IASBABA

[IASBABA'S 60 DAYS PLAN – (S&T COMPILATION)]

Born with the vision of "Enabling a person located at the most remote destination a chance at cracking AIR 1 in IAS".

Q.1) Consider the following about applications of biotechnology

1. Therapeutics and Diagnostics
2. Genetically modified crops for agriculture and processed food
3. Bioremediation and waste treatment
4. Energy production

Choose the correct answers using the codes given below.

a) 1 and 3 only
b) 1, 2, 3 and 4
c) 2, 3 and 4 only
d) 1, 3 and 4 only

Q.1) Solution (b)

The applications of biotechnology include therapeutics, diagnostics, genetically modified crops for agriculture, processed food, bioremediation, waste treatment, and energy production.

Do you know?

- If a person is born with a hereditary disease, can a corrective therapy be taken for such a disease? Gene therapy is an attempt to do this. Gene therapy is a collection of methods that allows correction of a gene defect that has been diagnosed in a child/embryo.

Think

- Smart agriculture
- Precision farming.

Q.2) Consider the following statement about induced pluripotent stem cells (iPSC).

1. They are derived from embryonic stem cells.
2. The tissues derived from these iPSC can avoid rejection by the immune system.

Which of the statements given above is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) None of the above

Q.2) Solution (b)

Induced pluripotent stem cells (iPSC) produced by genetically manipulating human skin cells to produce embryonic-like stem cells that are capable of forming any cell types of the body.

Tissues derived from iPSCs will be a nearly identical match to the cell donor and thus probably avoid rejection by the immune system.

Do you know?

- Researchers in Hyderabad based LV Prasad Eye Institute (LVPEI) have successfully grown miniature eye-like organs that closely resemble the developing eyes of an early-stage embryo. These were produced using induced pluripotent stem cells (iPSC).

Think

- National Guidelines for Stem Cell Research 2017

Q.3) Recently Biotechnology Innovation Organization (BIO) was in news. Consider the following statements about it?

1. BIO is the world's largest trade association representing biotechnology companies only.
2. BIO members are involved in the research and development of innovative healthcare, agricultural, industrial and environmental biotechnology products.
3. The BIO International Convention 2017 was hosted by India.

Choose the correct answers using the codes given below.

a) 1 and 3 only
b) 2 only
c) 2 and 3 only
d) All the above

Q.3) Solution (b)

Biotechnology Innovation Organization (BIO)

BIO is the world's largest trade association representing biotechnology companies, academic institutions, state biotechnology centers and related organizations across the United States and in more than 30 other nations.

BIO members are involved in the research and development of innovative healthcare, agricultural, industrial and environmental biotechnology products.

The Biotechnology Innovation Organization (BIO) BIO 2017 was held in San Diego, USA in June, 2017.

Do you know?

India Biotech Handbook 2017, showcasing the strengths of India's fast growing $ 42 bn bio-economy was released in **BIO International Convention 2017.**

Think

- Biotechnology Industry Research Assistance Council.

Q.4) Consider the following statements about Bird Flu.

1. It is caused by the both viruses and bacteria.
2. India has declared itself free from Bird Flu.
3. Bird Flu can be a reason to restrict imports via sanitary and phytosanitary measures.

Choose the correct answers using the codes given below.

a) 1 and 3 only
b) 3 only
c) 2 and 3 only
d) All the above

Q.4) Solution (c)

Avian influenza—known informally as **avian flu** or **bird flu** is a variety of influenza caused by viruses adapted to birds.

India has declared itself free from Bird Flu (highly pathogenic Avian Influenza - H5N1 and H5N8) and notified it to the World Organization for Animal Health.

The Agreement on the Application of Sanitary and Phytosanitary Measures is one of the final documents approved at the conclusion of the Uruguay Round of the Multilateral Trade Negotiations. It applies to all sanitary (relating to animals) and phytosanitary (relating to plants) (SPS) measures that may have a direct or indirect impact on international trade.

Sanitary and phytosanitary (SPS) measures are measures to protect humans, animals, and plants from diseases, pests, or contaminants.

Based on this principle countries can restrict or ban the import of poultry from countries where Bird Flu is prevalent.

Do you know?

- Approximately 20% of the protein consumed in developing countries come from poultry. In the wake of the H5N1 pandemic, millions of poultry were killed.

Think

- Swine flu or H1N1
- Zika fever

Q.5) The term 'nosocomial infections' was in news refers to

a) Any chronic ailment that occurs because of work or occupation.
b) An infection that is acquired in a hospital or other health care facility.
c) An infection that is acquired due to indoor air pollution.
d) An infection that is acquired due to mercury contaminated water.

Q.5) Solution (b)

A hospital-acquired infection (HAI), also known as a nosocomial infection, is an infection that is acquired in a hospital or other health care facility. Such an infection can be acquired in hospital, nursing home, rehabilitation facility, outpatient clinic, or other clinical settings. Infection is spread to the susceptible patient in the clinical setting by various means. Health care staff can spread infection, in addition to contaminated equipment, bed linens, or air droplets.

It usually goes by unacknowledged unless an epidemic situation such as Gorakhpur tragedy happens.

Do you know?

- A study published by British Medical journal indicates that burden of healthcare associated infections in countries like India id high, with an estimated pooled prevalence of 15.5 per 100 patients, more than double the prevalence in Europe and the US.

Think

- Universal Health Cover or Modicare.

Q.6) The term 'Orphan Drug' was in news refers to

a) The drugs supplied by government to orphanages under its various schemes.
b) A biological product or medicine that is intended to treat diseases so rare that sponsors are reluctant to develop them under usual marketing conditions.
c) Any drug that is derived from endangered species of plants.
d) Drugs that are developed to treat a rare syndrome called parents phobia.

Q.6) Solution (b)

Orphan Drug- A biological product or medicine that is intended to treat diseases so rare that sponsors are reluctant to develop them under usual marketing conditions.

In 1983, the US government passed the Orphan Drugs Act to stimulate research in the treatment of diseases that have been largely ignored by the pharmaceutical industry. Similar laws have been enacted in Japan, Australia and the European Union. All these laws offer incentives such as shorter clinical trials, extended exclusivity, tax breaks and high rates of regulatory success. They have made it commercially attractive for pharmaceutical companies to invest in the research and development (R&D) required to find a cure for these diseases. India does not have a nationwide Orphan Drug policy.

In 2016 Karnataka became the first state to release a Rare Diseases and Orphan Drugs Policy. It recommended the implementation of preventive and carrier testing as a means of reducing morbidity and mortality. Given that over 80% of rare diseases have a genetic basis, it suggested the use genetic testing to accelerate the identification of the critical genes involved in rare diseases.

Do you know?

The court made many suggestions to the government. It pointed to the corporate social responsibility (CSR) provisions under the Companies Act, 2013 and confirmed that the act of sponsoring the treatment of rare diseases would qualify as a CSR activity.

Think

- Living Drugs
- Gene therapy.

Q.7) Choose the correct code which defines `Bioprospecting'

a) It is a technique of extracting metals from ores and other solid materials typically using prokaryotes or fungi.

b) It is the process of discovery and commercialization of new products based on biological resources.
c) It is the term used to refer to the use of bio-resources by multinational companies and other organizations without proper authorization from the countries and people concerned without compensatory payment.
d) It is a process of discovery of new biodiversity conservation methods.

Q.7) Solution (b)

Bioprospecting is the process of discovery and commercialization of new products based on biological resources. Despite indigenous knowledge being intuitively helpful, bioprospecting has only recently begun to incorporate such knowledge in focusing screening efforts for bioactive compounds.

Biopiracy is the term used to refer to the use of bio-resources by multinational companies and other organizations without proper authorization from the countries and people concerned without compensatory payment.

Biomining is a technique of extracting metals from ores and other solid materials typically using prokaryotes or fungi. These organisms secrete different organic compounds that chelate metals from the environment and bring it back to the cell where they are typically used to coordinate electrons.

Do you know?

The people of India in a variety of ways have used neem, since time immemorial. Indians have shared the knowledge of the properties of the neem with the entire world. Pirating this knowledge, the USDA and an American MNC W.R. Grace in the early 90s sought a patent (No. 0426257 B) from the European Patent Office (EPO) on the "method for controlling on plants by the aid of hydrophobic extracted neem oil." The patenting of the fungicidal properties of Neem was an example of biopiracy.

Think

- Biopiracy policy in India.

Q.8) Consider the following statements with regard to Human Genome Project (HGP):

1. Goal of the project was complete mapping and understanding of all the genes of human beings.

2. The potential benefits of HGP include providing new solutions to diseases like malaria, dengue and chikungunya.
3. A group of scientists from India recently proposed an ambitious project named as Human Genome Project-Write (HGP-Write) to create a genetic blueprint or synthetic human genome.

Which of the statements given above is/are correct?

a) 1 only
b) 1 and 2 only
c) 2 and 3 only
d) 1, 2 and 3

Q.8) Solution (b)

Human Genome Project (HGP)

The Human Genome Project (HGP) was a large, international and multi-institutional effort that took 13 years [1990-2003] and $2.7 billion to produce a blueprint of the sequence of genes and spaces between genes that make up a typical human genome.

Human Genome Project – Write (HGP – Write)

Fast forward to 2016 and another project, called the Human Genome Project–write (HGP-write), now underway to synthesise a human genome from scratch.

The original HGP was a "read" in that it used chemicals and instruments to decipher the genome for the first time. The new project, its proponents say, is to write or build an artificial human genome with sophisticated bioengineering tools.

A group of **scientists from United States** recently proposed an ambitious project named as Human Genome Project-Write (HGP-Write) to create a genetic blueprint or synthetic human genome.

The project envisions on the same scale as the Human Genome Project-Read (HGP-Read) which had sequenced human genome in 2003.

HGP-Write seeks to reduce the cost of engineering DNA segments synthetically in the laboratory.

The potential benefits of HGP-write to India include providing new solutions to diseases like malaria, dengue and chikungunya. The tools, techniques and technologies that are going to be developed through HGP-write will be universally applicable to all organisms, especially at

an earlier stage for organisms with smaller genomes (for example, viruses), towards building individual genes and genomes efficiently and in an inexpensive manner.

It also aims at improving the ability to chemically manufacture DNA, with one of the goals being to synthetically create an entire human genome.

Q.9) Consider the below statement with regard to human genome sequencing:

1. India is among the league of countries who have demonstrated the capability of mapping all the genes of a human.
2. The world's first human genome sequence was completed in 2003 by the International Human Genome Project, in which Indian scientists had also participated.

Which of the statements given above is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.9) Solution (a)

The human genome sequence of an Indian was mapped during 2009, putting the country in the league of then five others — United States, Britain, Canada, China and South Korea — who had demonstrated similar capabilities. This means the 3.1 billion base pairs describing every function of the body of an Indian are now available for further study and as an important diagnostic tool for predictive healthcare.

Devoting over two years on the background work, a team of young scientists from the Indian Institute of Genomics and Integrative Biology (IGIB) in New Delhi mapped the genome sequence of a man in his fifties from Jharkhand.

The world's first human genome sequence was completed in 2003 by the International Human Genome Project with scientists from the US, UK, France, Germany, Japan and China. Resource constraints hindered India's participation in that project.

Q.10) Which among the following are examples of biotechnology?

1. Cloning

2. Beer brewing
3. Penicillin
4. Gene therapy

Choose the correct answer:

a) 1 and 4 only
b) 1, 3 and 4
c) 2 and 4
d) 1, 2, 3 and 4

Q.10) Solution (d)

Biotechnology is the use of an organism, or a component of an organism or other biological system, to make a product or process for a specific use.

It can include both cutting-edge laboratory techniques and traditional agricultural and culinary techniques that have been practiced for hundreds of years.

Beer brewing: In beer brewing, tiny fungi (yeasts) are introduced into a solution of malted barley sugar, which they busily metabolize through a process called fermentation. The by-product of the fermentation is the alcohol that's found in beer. Here, we see an organism – the yeast – being used to make a product for human consumption.

Penicillin: The antibiotic penicillin is generated by certain molds. To make small amounts of penicillin for use in early clinical trials, researchers had to grow up to 500 liters of "mold juice" a week. Here, an organism (mold) was used to make a product for human use – in this case, an antibiotic to treat bacterial infections.

Gene therapy: Gene therapy is an emerging technique used to treat genetic disorders that are caused by a nonfunctional gene. It works by delivering the "missing" gene's DNA to the cells of the body.

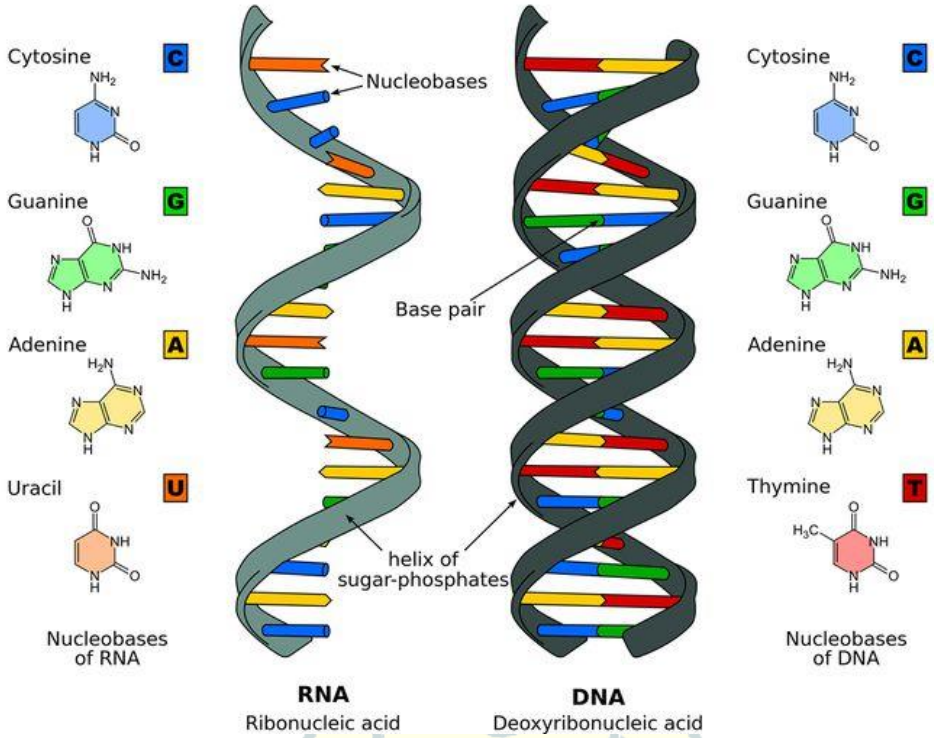
In gene therapy, biological components from different sources (a gene from humans, a plasmid originally from bacteria) are combined to make a new product.

Biotechnology has additional applications in areas such as food production and the remediation (cleanup) of environmental pollution.

Q.11) Which one among the following statements is not true with respect to DNA and RNA?

a) They both carry genetic information.
b) DNA is a double-stranded molecule while RNA is a single stranded molecule.
c) RNA is not stable under alkaline conditions while DNA is stable.
d) Compared with RNA, DNA is relatively resistant and less susceptible to UV damage.

Q.11) Solution (d)



DNA stands for deoxyribonucleic acid, while RNA is ribonucleic acid. Although DNA and RNA both carry genetic information, there are quite a few differences between them. This is a comparison of the differences between DNA versus RNA, including a quick summary and a detailed table of the differences.

Differences between DNA and RNA

1. DNA contains the sugar deoxyribose, while RNA contains the sugar ribose. The only difference between ribose and deoxyribose is that ribose has one more -OH group than deoxyribose, which has -H attached to the second (2') carbon in the ring.
2. DNA is a double-stranded molecule while RNA is a single stranded molecule.
3. DNA is stable under alkaline conditions while RNA is not stable.

4. DNA and RNA perform different functions in humans. DNA is responsible for storing and transferring genetic information while RNA directly codes for amino acids and as acts as a messenger between DNA and ribosomes to make proteins.
5. DNA and RNA base pairing is slightly different since DNA uses the bases adenine, thymine, cytosine, and guanine; RNA uses adenine, uracil, cytosine, and guanine. Uracil differs from thymine in that it lacks a methyl group on its ring.

Comparison of DNA and RNA

Comparison	**DNA**	**RNA**
Name	DeoxyriboNucleic Acid	RiboNucleic Acid
Function	Long-term storage of genetic information; transmission of genetic information to make other cells and new organisms.	Used to transfer the genetic code from the nucleus to the ribosomes to make proteins. RNA is used to transmit genetic information in some organisms and may have been the molecule used to store genetic blueprints in primitive organisms.
Structural Features	B-form double helix. DNA is a double-stranded molecule consisting of a long chain of nucleotides.	A-form helix. RNA usually is a single-strand helix consisting of shorter chains of nucleotides.
Composition of Bases and Sugars	deoxyribose sugar phosphate backbone adenine, guanine, cytosine, thymine bases	ribose sugar phosphate backbone adenine, guanine, cytosine, uracil bases
Propagation	DNA is self-replicating.	RNA is synthesized from DNA on an as-needed basis.
Base Pairing	AT (adenine-thymine) GC (guanine-cytosine)	AU (adenine-uracil) GC (guanine-cytosine)
Reactivity	The C-H bonds in DNA make it fairly stable, plus the body destroys enzymes that would attack DNA. The small grooves in the helix also serve as protection, providing minimal space for enzymes to attach.	The O-H bond in the ribose of RNA makes the molecule more reactive, compared with DNA. RNA is not stable under alkaline conditions, plus the large grooves in the molecule make it susceptible to enzyme attack. RNA is constantly produced, used, degraded, and recycled.
Ultraviolet Damage	DNA is susceptible to UV damage.	Compared with DNA, RNA is relatively resistant to UV damage.

Q.12) Which among the following biomaterials that can be potentially retrieved and stored?

1. Skin
2. Bones
3. Ligaments and tendons
4. Heart valves
5. Corneas

Choose the correct answer:

a) 3, 4 and 5
b) 2, 4 and 5
c) 1, 2, 3 and 5
d) 1, 2, 3, 4 and 5

Q.12) Solution (d)

Experts say a number of tissues can potentially be retrieved and stored for use. The Transplantation of Human Organs (Amendment) Act, 2011, includes the component of tissue donation and registration of tissue banks as well.

Biomaterials that can be potentially retrieved and stored –

Skin: It is used as a biological dressing, in cases of major burns. It helps prevent infections and does not need to be changed every day – it can be kept for a couple of weeks, giving the patient time to recover.

Bones: Bones from limbs can be stored and used to replace parts that are damaged or diseased. Bone grafts from banks act as scaffolds for support. They could be used in cases of trauma where there is bone loss, in sports injuries and in cancer cases where parts of the bone and joint cartilage die. The upper end of the shin bone, lower end of the thigh bone and the head of thigh bone can be retrieved for use.

Ligaments and tendons: These can be used in cases of sports injuries involving multiple ligaments. In some cases, it is difficult to use the patient's own. The Achilles tendon (ankle), the Peroneal tendon (leg to ankle), the Patellar tendon (front of the knee) and the Meniscus (a shock absorber between the thigh bone and leg bone) can be procured for storage.

Bone products: Bone powder is made by crushing bones, generally those that would otherwise be disposed of – such as those parts replaced during hip replacement surgeries.

These are used to treat various kinds of defects – in dentistry, skeletal and joint reconstruction procedures.

Amniotic membrane: This is the wall of the amniotic sac. When a baby is delivered, the sac ruptures. The sac can be used as a biological dressing for burns, bed sores, diabetic ulcers and skin reactions to radiation.

Heart valves: Heart valves can be retrieved and stored to be used in valve replacement procedures. The advantage with such valves is that the patient does not need blood thinners. They are also cheaper than artificial valves. However, they last about 15 years and another procedure may be subsequently required. Even in cases where the heart can't be used, the valve can be retrieved for storage. Usually, the aortic valve is procured.

Corneas: Corneal transplants are used in cases when the cornea becomes opaque – due to injuries, infections, birth defects or rarely after surgeries.

Q.13) Svalbard Global Seed Vault, recently celebrated the 10th anniversary of its official opening. Consider the following in regard to it:

1. It is a facility located on a remote island in the Arctic Ocean and it houses the world's largest collection of seeds.
2. The facility is located in Finland and the permafrost surrounding the facility will help maintain the low temperature of the seeds when the electricity supply fails.
3. A temperature of -18ºC is required for optimal storage of the seeds, which are stored and sealed in custom made three-ply foil packages.

Which of the statements given above are correct?

a) 1 and 2 only
b) 2 and 3 only
c) 1 and 3 only
d) 1, 2 and 3

Q.13) Solution (c)

Recently, Svalbard Global Seed Vault in Norway celebrated the 10th anniversary of its official opening. The Norwegian government has planned to spend about $13 million to upgrade the vault.

It is a facility located on a remote island in the Arctic Ocean and it houses the world's largest collection of seeds. The seeds can be of use in the event of a global catastrophe or when

some species is lost due to natural disasters. It is therefore also referred to as the doomsday vault.
The Seed Vault has the capacity to store 4.5 million varieties of crops. Each variety will contain on average 500 seeds, so a maximum of 2.5 billion seeds may be stored in the Vault.

Currently, the Vault holds more than 890,000 samples, originating from almost every country in the world. Ranging from unique varieties of major African and Asian food staples such as maize, rice, wheat, cowpea, and sorghum to European and South American varieties of eggplant, lettuce, barley, and potato. In fact, the Vault already holds the most diverse collection of food crop seeds in the world.

The focus of the Vault is to safeguard as much of the world's unique crop genetic material as possible.

A temperature of -18ºC is required for optimal storage of the seeds, which are stored and sealed in custom made three-ply foil packages. The packages are sealed inside boxes and stored on shelves inside the vault. The low temperature and moisture levels inside the Vault ensure low metabolic activity, keeping the seeds viable for long periods of time.

Do you know - Where is India's seed vault?

- At Chang La in the Himalayas, at a height of 17,300 feet, there is a storage facility with over 5,000 seed accessions. One accession consists of a set of seeds of one species collected from different locations or different populations.
- The vault is a joint venture of the National Bureau of Plant Genetic Resources (which comes under the Indian Council of Agricultural Research) and the Defence Institute of High Altitude Research (under Defence Research and Development Organisation)

Q.14) Ability of a living cell to express all of its genes to regenerate a whole new individual, is defined by the term –

a) Totipotency
b) Organogenesis
c) Hybridoma
d) Cybrids

Q.14) Solution (a)

Totipotency is the ability of a living cell to express all of its genes to regenerate a whole new individual. Totipotent cells from plants have been used in tissue-culture techniques to produce improved plant materials that are pathogen-free and disease-resistant. Totipotent

cells from animals are now being used to clone mammals, although ethical questions remain over whether cloning a human should be done.

In plant tissue culture, the process of initiation and development of organs is known as organogenesis. New organs such as shoots, roots or embryos can be induced to form on plant tissues lacking pre-existing meristems.

Think

- Know the difference between Hybrids and Cybrids.

Q.15) Which of the following reasons make Escherichia coli suitable for gene cloning?

1. The E. coli genome was the first to be completely sequenced
2. It grows slowly and gives a stable condition for observation
3. E. coli is naturally found in the intestinal tracts of humans and animals
4. E. Coli has no adverse impact on human health

Select the code from following:

a) 1 and 2
b) 1 and 3
c) 1,2 and 3
d) 2,3 and 4

Q.15) Solution (b)

Although E. coli is known to the general population for the infectious nature of one particular strain (0157:H7) few people are aware of how versatile and useful E. coli is to genetic research. The E. coli genome was the first to be completely sequenced (in 1997). E. coli is the well-understood bacterium in the world, and is an extremely important model organism in many fields of research, particularly molecular biology, genetics, and biochemistry. It is easy to grow under laboratory conditions, and research strains are very safe to work with. As with many bacteria, E. coli grows quickly, this allows many generations to be studied in a short time. In fact, under ideal conditions, E. coli cells can double in number after only 20 minutes.

Think

- Use of E. coli in biodegradable plastics

Q.16) What are cry1Ac and cry2Ab in context of bt crops?

a) They are proteins produced by a bacteria
b) They are viruses which affect bt cotton
c) They are names of bt cotton seeds
d) They are farm techniques which are used to produce bt cotton.

Q.16) Solution (a)

They are toxic proteins produced by a bacillus Thuringiensis. They are incorporated into crop plants which cause death of insects once they ingest the toxins.

In B. thuringiensis-transgenic (Bt) cotton, production of both Cry1Ac and Cry2Ab has been proposed to delay resistance of Heliothis virescens (tobacco budworm).

Think

- Allelopathy

Q.17) Consider the following statements regarding 'Luciferase'

1. It is an enzyme that gives fireflies their glow
2. It can be used for low light intensity indoor lighting
3. It can be used to transform trees into self-powered street lights

Which of the above statements are correct?

a) 1 only
b) 1 and 2
c) 2 and 3
d) All of the above

Q.17) Solution (d)

Luciferase

Luciferase is a generic term for the class of oxidative enzymes that produce bioluminescence, and is usually distinguished from a photoprotein.

Luciferases are widely used in biotechnology, for microscopy and as reporter genes, for many of the same applications as fluorescent proteins. However, unlike fluorescent

proteins, luciferases do not require an external light source, but do require addition of luciferin, the consumable substrate.

Luciferases can be produced in the lab through genetic engineering for a number of purposes. Luciferase genes can be synthesized and inserted into organisms or transfected into cells. Mice, silkworms, and potatoes are just a few of the organisms that have already been engineered to produce the protein.

In the luciferase reaction, light is emitted when luciferase acts on the appropriate luciferin substrate. Photon emission can be detected by light sensitive apparatus such as a luminometer or modified optical microscopes.

Think

- How is Luciferase different from Photoprotein?

Q.18) Consider the following statements:

1. Y chromosome controls only male sexual characters.
2. X chromosome controls only female sexual characters.
3. Mutation in mitochondrial DNA does not cause any genetic disorder because that DNA is not used in protein synthesis.

Which of the above statements are correct?

a) 1 only
b) 3 only
c) 1 and 2
d) All of the above

Q.18) Solution (a)

Only first statement is correct.

Second statement is wrong because X chromosome controls other characters also ex: colour blindess, Hemophilia etc. are due factors presents in X chromosome

Third statement is incorrect because Alzheimer's & Parkinson's disease are due mutation in mitochondrial DNA.

Think

- Chromosomal disease

- Down syndrome

Q.19) Which of the following have identical DNA fingerprints

1. Conjoint twins
2. Identical twins
3. Clones
4. Father & son

Select the code from following:

a) 3 only
b) 1 and 2
c) All of the above
d) None of the above

Q.19) Solution (b)

NOTE: Only twins can have identical DNAs

DNA fingerprinting

- DNA fingerprinting was invented in 1984 by Professor Sir Alec Jeffreys after he realised you could detect variations in human DNA, in the form of these minisatellites.
- DNA fingerprinting is a technique that simultaneously detects lots of minisatellites in the genome to produce a pattern unique to an individual. This is a DNA fingerprint.
- The probability of having two people with the same DNA fingerprint that are not identical twins is very small.
- Just like your actual fingerprint, your DNA fingerprint is something you are born with, it is unique to you.

DNA profiling

- Modern-day DNA profiling is also called STR analysis and relies on microsatellites rather than the minisatellites used in DNA fingerprinting.
- Microsatellites, or short tandem repeats (STRs), are the shorter relatives of minisatellites usually two to five base pairs long. Like minisatellites they are repeated many times throughout the human genome, for example 'TATATATATATA'.

Q.20) Consider the following statement regarding mitochondrial disease:

1. Mitochondrial disease can be cause by adverse effect of drug infection and other environmental causes.
2. Mitochondrial disease is the group of disease caused by dysfunctional nucleus.

Which of the given options are NOT correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.20) Solution (b)

Mitochondrial Disease

Mitochondrial diseases are a group of disorders caused by dysfunctional mitochondria. Mitochondria are found in every cell of the human body except red blood cells. Mitochondrial disorders may be caused by mutations (acquired or inherited), in mitochondrial DNA (mtDNA), or in nuclear genes that code for mitochondrial components. They may also be the result of acquired mitochondrial dysfunction due to adverse effects of drugs, infections, or other environmental causes.

Think

- Three parent baby

Q.21) Which of the following statements about Dr. Har Gobind Khorana is correct?

1. He was the first Indian-born Nobel Prize winner in Medicine
2. The award was given for discovering that the order of nucleotides in DNA determines which amino acids are built.
3. He is credited with making the first synthetic genes by cutting and pasting different bits of DNA together.

Select the code from following:

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All the above

Q.21) Solution (b)

Har Gobind Khorana was an Indian American biochemist who shared the 1968 Nobel Prize for Physiology or Medicine with Marshall W. Nirenberg and Robert W. Holley for research that showed the order of nucleotides in nucleic acids, which carry the genetic code of the cell and control the cell's synthesis of proteins.

Work on Electron Diffraction

In the 1950s, it was established that genetic information is transferred from DNA to RNA, to protein. One sequence of three nucleotides in DNA corresponds to a certain amino acid within a protein. How could this genetic code be cracked? After Marshall Nirenberg discovered the first piece of the puzzle, the remainder of the code was gradually revealed in the years that followed. Har Gobind Khorana made important contributions to this field by building different RNA chains with the help of enzymes. Using these enzymes, he was able to produce proteins. The amino acid sequences of these proteins then solved the rest of the puzzle.

Note: Ronald Ross was the first Indian-born Nobel Prize winner in Medicine who won the prize in 1902 for his work on transmission of malaria.

Think

- Indian Nobel Laureates

Q.22) (DRDO) has successfully test fired the anti-tank missile "Nag" recently. Consider the following statements.

1. Nag missile is a third generation "fire and forget" anti-tank missile
2. It can be launched from land, water and air-based platforms

Which of the above statements is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) None

Q.22) Solution (a)

The Defence Research and Development Organization (DRDO) has successfully test fired the anti-tank missile "Nag" in Rajasthan.

The Nag missile is a **third generation "fire and forget**" anti-tank missile and can be launched from land and air-based platforms (not for naval use).

It is equipped with highly advanced Imaging Infrared Radar (IRR) seeker and has integrated avionics technology in its arsenal.

It is one of the five missile systems developed by the Defence Research and Development Organization (DRDO) under **the integrated guided missile development programme (IGMDP).** The four other missiles developed under this programme include **Agni, Akash, Trishul and Prithvi.**

Do you know?

- NAMICA (Nag Missile Carrier) is a tank destroyer built for the army. It is equipped with a thermal imager for target acquisition.

THINK!

- HeliNA

Q.23) India began developing a multi-tiered Ballistic Missile Defense (BMD) system in 1999, after the end of the Kargil War in reaction to Pakistan's growing missile arsenal. Consider the following statements in this regard;

1. Prithvi Air Defense (PAD) / Pradyumna Ballistic Missile Interceptor destroyes missiles at endo-atmospheric altitudes.
2. Advanced Air Defense (AAD)/ Ashvin Advanced Defense interceptor missile exo atmosphere at altitudes.

Which of the above statements is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) None

Q.23) Solution (d)

India began developing a multi-tiered Ballistic Missile Defense (BMD) system in 1999, after the end of the Kargil War in reaction to Pakistan's growing missile arsenal.

A consortium of 40 Indian companies were involved in the development of the missile defense shield.

India's BMD shield is a **two-tiered defense system**

Prithvi Air Defense (PAD) / Pradyumna Ballistic Missile Interceptor destroying missiles at exo-atmospheric altitudes of 50–80 kilometers (31–50 miles).

Advanced Air Defense (AAD)/ Ashvin Advanced Defense interceptor missile endo-atmosphere at altitudes of 20-40 kilometers (12-24 miles).

Do you know?

- In addition to the indigenously developed BMD system, India has procured six regiments of Russian S-300 air defense systems and is negotiating for five regiments of more advanced S-400 systems with Russia.
- Swordfish is long-range tracking radar developed for the BMD system. It was derived from the Israeli Green Pine long range radar.

THINK!

- Cruise Missiles
- Swordfish Radar
- Long Range Tracking Radar (LRTR)

Q.24) BrahMos is the fastest supersonic cruise missile in the world. Consider the following statements regarding this:

1. The BrahMos is a medium-range scramjet supersonic cruise missile.
2. It can be launched from submarine, ships, aircraft, or land.
3. It is a joint venture between the DRDO of India and the Federal State Unitary Enterprise NPO Mashinostroyenia (NPOM) of Russia.

Choose the correct answer using the codes given below.

a) 1 and 3 only
b) 2 and 3 only
c) 3 only
d) All the above

Q.24) Solution (b)

The BrahMos is a medium-range **ramjet supersonic cruise missile** that can be launched from submarine, ships, aircraft, or land. It is the fastest supersonic cruise missile in the world.

It is a joint venture between the Russian Federation's NPO Mashinostroeyenia and India's Defence Research and Development Organisation (DRDO) who together have formed BrahMos Aerospace.

Do you know?

- A hypersonic version of the missile, BrahMos-II, is also presently under development with a speed of Mach 7-8 to boost aerial fast strike capability. It is expected to be ready for testing by 2020.

THINK!

- Missile Technology Control Regime(MTCR).
- Ramjet and Scramjet.

Q.25) The Kalvari class is a class of diesel-electric attack submarines based on the Scorpène class submarine being built for the Indian Navy. Consider the following statements.

1. The submarines are designed by French naval defence and energy company DCNS and are being manufactured by Mazagon Dock Limited in Mumbai.
2. It will also feature advanced Air-independent propulsion (AIP) systems.

Which of the above statements is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) None

Q.25) Solution (c)

The Kalvari class is a class of diesel-electric attack submarines based on the Scorpène class submarine being built for the Indian Navy. The submarines are designed by French naval defence and energy company DCNS and are being manufactured by Mazagon Dock Limited in Mumbai.

Which will also feature **advanced Air-independent propulsion (AIP)** systems to enable them to stay submerged for longer duration and substantially increase their operational range.

Do you know?

- The Project 75I-class submarine is a follow-on of the Project 75 Kalvari-class submarine for the Indian navy. Under this project, the Indian Navy intends to acquire 6 diesel-electric submarines.

THINK!

- Torpedoes.

Q.26) K-4 missile – intermediate-range submarine-launched ballistic missile (SLBM). Consider the following statements about it:

1. It is nuclear capable missile
2. It will arm the kalavari-class submarines.

Which of the above statements is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) None

Q.26) Solution (a)

K-4 missile – intermediate-range submarine-launched ballistic missile (SLBM).

Features

- It is nuclear capable missile.
- It is under development by Defence Research and Development Organisation (DRDO) of India.
- It will arm the Arihant-class submarines.
- It can carry a warhead weighing up to 2.2 tons.

Do you know?

- The K-4 was developed to overcome the difficulty of fitting in AGNI-III in equipping INS Arihant.

THINK!

- Frigates.

Q.27) Consider the following list of exercises of Indian Army.

Exercise name	Participating country
1. Yudh Abhyas	USA
2. Nomadic Elephant	Kazakhstan
3. Indra	Russia

4. Mitra Shakti	Sri Lanka

Which of the above pairs is/are correctly matched?

a) 1, 2 and 3 only
b) 2 only
c) 1, 3 and 4 only
d) None

Q.27) Solution (c)

Exercise Name	**Participating Country**
Khanjar	Kyrgyzstan
Surya Kiran	Nepal
Al Nagah-Ii	Oman
Bold Kurukshetra	Singapore
Nomadic Elephant	Mongolia
Maitree	Thailand
Surya Kiran	Nepal
Yudh Abhyas	United States
Mitra Shakti	Sri Lanka
Indra	Russia

Do you know?

- The Joint Indo-Russia Tri-Services Exercise INDRA. The name of the exercise INDRA has been derived from **IND**ia and **R**ussi**A.** INDRA exercises have been undertaken between respective Armies, Navies and Air Forces

THINK!

- Indian Airforce Exercises.

Q.28) Consider the following

1. INS Jalashwa is an amphibious transport dock currently in service with the Indian Navy.
2. Dhanush is a howitzer used by Indian Army.
3. Defence Acquisition Council (DAC) is the highest decision making body on procurement headed by Defence Secretary.

Which of the above statements is/are correct?

a) 1 and 2 only
b) 2 and 3 only
c) 2 only
d) 1, 2 and 3

Q.28) Solution (a)

INS Jalashwa is an amphibious transport dock currently in service with the Indian Navy. Formerly USS Trenton, she, along with six Sikorsky SH-3 Sea King helicopters were procured from the United States by India for a total of US$90 million in 2005.

She was commissioned on 22 June 2007. INS Jalashwa is the only Indian Naval ship to be acquired from the United States. She is based in Visakhapatnam under the Eastern Naval Command.

Dhanush

- The Dhanush is a 155 mm towed howitzer used by the Indian Army.

Defence Acquisition Council

- DAC – is the government's highest decision-making body on procurement.
- **DAC is chaired by Union Defence Minister.**
- To counter corruption and speed up decision-making in military procurements.

The decision flowing from the Defence Acquisition Council are to be implemented by the following 3 Boards –

- Defence Procurement Board headed by the Defence Secretary
- Defence Production Board headed by the Secretary (Defence Production)
- Defence Research & Development Board headed by the Secretary (Defence Research & Development)

Do you know?

- Shardul-class landing ships are large amphibious warfare vessels built at Garden Reach Shipbuilders and Engineers for the Indian Navy. They are an evolution of the Magar class amphibious landing ships. The class has an indigenous content of over 90% with state-of-the-art equipment.

THINK!

- HAL-Tejas.

Q.29) Which of the following statements regarding 'Navika Sagar Parikrama' are correct?

1. It is the world's first ever circumnavigation of globe by an All women crew.
2. The Voyage is undertaken by indigenously built sailing vessel INS Tarini.
3. The entire journey will have 10 stopovers before it reaches India.

Select the code from following:

a) 1 and 2
b) 2 only
c) 1 and 3
d) All of the above

Q.29) Solution (b)

Navika Sagar Parikrama

Navika Sagar Parikrama is the name of expedition for circumnavigation the globe on INSV Tarini by Indian Navy's Women Naval Officers. The six-member all-woman team will circumnavigate and manage the whole operation in this first ever global journey. The voyage is expected to be finished around March 2018 when the crew returns to Goa, with only 4 port calls in Fremantle Australia; Lyttelton, New Zealand; Port Stanley, Falklands; and Cape Town, South Africa.

Note: It is India's first all women circumnavigation Mission (not World's)

THINK!

Mark the locations on a map. They can be asked in a map based question.

Q.30) Consider the following statements regarding 'Sagar Kavach' security program:

1. It is a naval exercise between India and Sri Lanka.
2. A terror attack was simulated named 'Red Force' to check the effectiveness of Marine Policing.

Which of the above statements are correct?

a) 1 only
b) 2 only

c) Both 1 and 2
d) Neither 1 nor 2

Q.30) Solution (b)

The Governments of Odisha and West Bengal conducted joint security exercise named 'Sagar Kavach' to further tighten the existing coastal security mechanism along the 630 km long coastline.

Sagar Kavach security exercise is a realistic drill to check the efficacy of the security parameters and preparedness of various security forces like the Indian Navy, Marine police force, Indian Coast Guard (ICG), Forest Department, Fisheries and district administration

A simulated terror attack named 'red force' was organized at a random place along Odisha or West Bengal coast and check how effective our marine policing is.

https://timesofindia.indiatimes.com/india/odisha-wb-to-hold-first-ever-joint-coastal-security-exercise/articleshow/61595268.cms

Q.31) Which of the following has been named 'Fat boy'?

a) It was the name given to the nuclear bomb used in Japan by USA
b) It is the name given to India's GSLV Mk III.
c) It is the name given to NASA's quiet supersonic aircraft.
d) It is the name given to Agni V missile.

Q.31) Solution (b)

GSLV Mk III

GSLV Mk III is popularly known as 'Fat Boy'. It is one of the most heaviest satellite launch vehicles of the World and also one of the shortest.

It has the capacity to carry payload of 4 – 8 tonnes.

It has three stage engine with solid, liquid and cryogenic phase.

THINK!

- Cryogenic technology
- Scramjet

Q.32) Which of the following statements regarding 'Thermobaric bomb of increased power'?

1. It is known as the Father of all Bombs.
2. It used uses atmospheric oxygen for explosion and does not contain an oxidizer.
3. It is the most powerful non-nuclear bomb of the World.
4. It has been recently developed by USA

Select the code from below:

a) 1,2 and 3
b) 2,3 and 4
c) 1,3 and 4
d) All of the above

Q.32) Solution (a)

Father of All Bombs

Aviation Thermobaric Bomb of Increased Power nicknamed **"Father of All Bombs"** (**FOAB**) is a Russian-designed, bomber-delivered thermobaric weapon.

The bomb is reportedly similar to the US military's GBU-43/B Massive Ordnance Air Blast which is often unofficially called "Mother of All Bombs" derived from its official military acronym "MOAB". This weapon would therefore be the most powerful conventional (non-nuclear) weapon in the world.

Note: All thermobaric bombs use atmospheric oxygen.

THINK!

- Mother of All Bombs

Q.33) Which of the following statements are correct regarding the 'Mountain Strike Corps' of India?

1. It has been built as a quick reaction force and as well as counter offensive force against China along LAC.
2. Its headquarters are located at Panagarh in West Bengal.

Select the code from following:

a) 1 only
b) 2 only
c) Both 1 and 2

d) Neither 1 nor 2

Q.33) Solution (c)

Mountain strike corps

XVII Corps of Indian army is the first mountain strike corps of India which has been built as an quick reaction force and as well as counter offensive force against China along LAC. Its headquarters are located at Panagarh in West Bengal.

China, incidentally, has re-organized its 2.3-million PLA into five theatre commands to crank up its offensive capabilities as well as establish better command-and-control structures. Its western theatre command now handles the entire LAC with India instead of the earlier Chengdu Military Region in the east and the Lanzhou Military Region towards the north.

THINK!

- Paramilitary Forces
- ITBP

Q.34) Who is known as the Missile Women of India?

a) Tessy Thomas
b) Nandini Harinath
c) J Manjula
d) N Valarmathi

Q.34) Solution (a)

Tessy Thomas

- Born in 1963, an engineer and the Project Director for Agni-IV missile in Defence Research and Development Organisation, Tessy is is the first woman engineer to head a missile project in India. She is known as the 'Missile Woman' of India.

https://www.indiatimes.com/news/india/8-awesome-isro-scientists-who-happen-to-be-women-271697.html

Q.35) Consider the following statements regarding India's first unmanned Tank, MUNTRA:

1. It has been indigenously developed by DRDO.
2. It has three variants for surveillance, mine detection and reconnaissance in areas with nuclear or bio threat.

Select the code from following:

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.35) Solution (c)

Muntra

Defence Research and Development Organisation (DRDO) has developed an unmanned, remotely operated tank which has three variants - surveillance, mine detection and reconnaissance in areas with nuclear and bio threats. It is called Muntra.

Muntra-S is the country's first tracked unmanned ground vehicle developed for unmanned surveillance missions while Muntra-M is for detecting mines and Muntra-N is for operation in areas where there is a nuclear radiation or bio weapon risk.

The vehicle has been tested and validated at Mahajan field firing range in Rajasthan under dusty desert conditions where temperatures touched 52 C. Army comfortably tele-operated the vehicle. It has surveillance radar, an integrated camera along with laser range finder which can be used to spy on ground target 15km away - may be a crawling men or heavy vehicles.

THINK!

- AI Weapons
- Ban on killer robots

Q.36) Which among the following is/are surface-to-surface missiles?

1. Prithvi II
2. Agni II
3. K-15 Missile
4. Shaurya Missile

Choose correct answer:

a) 2 only
b) 2 and 4 only
c) 1, 2 and 3
d) 1, 2 and 4

Q.36) Solution (d)

Agni II

- Agni-II (fire), is a nuclear-capable, **surface-to-surface** strategic ballistic missile.
- The Agni (missile) family is envisaged to be the mainstay of the Indian missile-based strategic nuclear deterrence.
- It is a two stage surface-to-surface missile, equipped with an advanced high accuracy navigation system and guided by a novel state-of-the-art command and control system.
- The Agni-II missile is developed by Advanced Systems Laboratory (ASL) and integrated by the Bharat Dynamics Limited (BDL), Hyderabad.

Prithvi II

- Prithvi-II is India's first developed indigenously and inducted indigenous **surface-to-surface** strategic missile.
- It is first missile to be indigenously developed by DRDO under India's prestigious Integrated Guided Missile Development Program (IGMDP).

K-15

- K-15 (K-15 Sagarika missile) is an **underwater missile** developed by Defence Research and Development Organisation (DRDO)
- It is a nuclear-capable submarine launched ballistic missile with a range of 700 kilometres. It belongs to the K Missile family. It is being developed f... for use with Indian Navy nucleur-powered Arihant class submarime.

Shaurya missile

- The Shaurya missile is a canister launched hypersonic boost-glide **surface-to-surface** tactical missile developed by the Indian Defence Research and Development Organisation (DRDO) for use by the Indian Armed Forces.

Q.37) Which among the following activities are part of Indian Navy's 'Constabulary Role'?

1. anti-poaching operations
2. anti-smuggling operations
3. anti-piracy operations
4. to deter any military adventurism against the country
5. coastal surveillance

Choose the correct answer:

a) 4 and 5 only
b) 3, 4 and 5

c) 1, 2, 3 and 5
d) 1, 2, 3, 4 and 5

Q.37) Solution (c)

Indian Navy undertakes the following roles - military, diplomatic, constabulary and benign.

The primary military objective of the IN is to deter any military adventurism against the country, including intervention in India's affairs and subversive strategies against the national interests and the ability to inflict a crushing defeat on the adversary in the event of hostilities.

However, as part of its 'Constabulary Role', the IN is involved in operations like anti-poaching, anti-smuggling, coastal surveillance and anti-piracy.

Q.38) Consider the following about Scorpene-class submarines and identify the *incorrect* statement:

a) The submarines are built with the French technology at the Mazagaon Dock Ltd in Mumbai.
b) The Scorpene-class submarines are a class of diesel-electric attack submarines jointly developed by the French Direction des Constructions Navales (DCN) and the Spanish company Navantia, and now by DCNS.
c) All the six submarines under this class will be equipped with the Air Independent Propulsion (AIP) system, which will enable them to stay underwater for longer duration.
d) None of the above

Q.38) Solution (c)

The Scorpène-class submarines are a class of diesel-electric attack submarines jointly developed by the French Direction des Constructions Navales (DCN) and the Spanish company Navantia, and now by DCNS. It features diesel propulsion and an additional air-independent propulsion (AIP).

In 2005, India chose the Scorpène design; purchasing six submarines. Under a technology transfer agreement, the state-owned Mazagon Docks in Mumbai will manufacture the submarines.

India plans to incorporate the DRDO-developed air independent propulsion (AIP) system onto the last two submarines being built and also to equip the P75I submarines, of which the DCNS is participating in the tender process.

In other words, in 2005 the Indian Navy ordered six Scorpène-class: all the Indian boats will be built in India, at Mazagon Dock and elsewhere, and only the last two are to be fitted with an Indian Air Independent Propulsion (AIP) system. Hence, statement (c) is incorrect.

Q.39) Consider the following statements in regard to India's Ballistic Missile Defence (BMD) system:

1. India plans to deploy a two tiered BMD system to protect important cities from external threats.
2. BMD system can intercept incoming missiles both at exo-atmopshere and endo-atmosphere altitudes
3. Exo-atmopshere is altitudes between 47 and 80 km and endo-atmosphere is below 40 km altitude.

Choose the appropriate code:

a) 1 only
b) 1 and 2 only
c) None of the above
d) All the above

Q.39) Solution (d)

Self-explanatory – All the given statements are correct.

India plans to deploy a two tiered BMD system to protect important cities from external threats.

- BMD system can intercept incoming missiles both at exo-atmopshere and endo-atmosphere altitudes
- Exo-atmopshere is altitudes between 47 and 80 km and endo-atmosphere is below 40 km altitude.

India's BMD shield is a two-tiered defense system, with –

- Prithvi Air Defense (PAD) / Pradyumna Ballistic Missile Interceptor destroying missiles at exo-atmospheric altitudes of 50–80 kilometers (31–50 miles).
- Advanced Air Defense (AAD)/ Ashvin Advanced Defense interceptor missile at endo-atmosphere altitudes of 20-40 kilometers (12-24 miles).

Q.40) Consider the following pairs and choose the correctly matched pair/s from below options:

Missile deal : : Associated country

1. Spike anti-tank guided missile : : India-US
2. S-400 Triumf long-range surface-to-air missile systems : : India-Russia
3. Javelin anti-tank guided missile : : India-Israel

Choose appropriate code from options below:

a) 1 only
b) 2 only
c) 1 and 2 only
d) 2 and 3 only

Q.40) Solution (b)

Correct pairs are:

1. Spike anti-tank guided missile : : India-Israel
2. S-400 Triumf long-range surface-to-air missile systems : : India-Russia
3. Javelin anti-tank guided missile : : India-US

India will purchase Spike antitank guided missiles from Israel through the so-called government to government route.

"Spike is a battle-proven missile which has much longer range and comparatively light in weight when compared to locally made Nag missile.

India and Russia signed an intergovernmental agreement on the sale of the S-400 systems during a bilateral summit in October 2016 in Goa, India, in the presence of Russian President Vladimir Putin and Indian Prime Minister Narendra Modi.

India plans to procure Israeli Spike, American Javelin and Indigenous MPATGM Anti-Tank missile for Indian Army.

Q.41) 'Ajeya Warrior' is a joint army training exercise between India and -

a) Nepal
b) UK
c) US
d) Russia

Q.41) Solution (b)

Exercise Ajeya Warrior-2017, a fourteen days training exercise between the Indian Army and the British Army, was concluded during December 2017 at the Mahajan Field Firing Ranges in Rajasthan.

It was third joint military exercise between India and UK. The first exercise was conducted in 2013 at Belgaum, Karnataka and second exercise was held in 2015 in UK.

Q.42) Which of the following is/are correctly matched?

	Festival	State
1.	Kambala	Maharashtra
2.	Jalikattu	Tamil Nadu
3.	Aanaval Pidi	Kerala

Select the correct code:

a) 2 Only
b) 1 and 2
c) 2 and 3
d) 1, 2 and 3

Q.42) Solution (c)

Kambala – Karnataka

Jalikattu – Tamil Nadu

Aanaval Pidi (Catching elephant's tail) – Kerala

Kambala is an annual buffalo race which is a tradition in the Karnataka's Dakshina Kannada and Udupi districts' farming community. This area is called Tulunadu (Land of Tulu Language).

A pair of buffaloes are tied to the plough and one person anchors it, beating the buffaloes with a stick to run faster. There are two parallel muddy tracks, on which two competing pairs of buffaloes run. Fastest team wins.

Read More:

- http://timesofindia.indiatimes.com/india/all-you-need-to-know-about-kambala/listshow/56774237.cms
- http://www.ndtv.com/india-news/what-is-jallikattu-1650547

Source: http://www.thehindu.com/news/national/karnataka/centre-clears-kambala-bill/article18788687.ece

Q.43) HySIS (Hyperspectral Imaging Satellite) is being developed by

a) NASA
b) European Space Agency
c) The China National Space Administration
d) ISRO

Q.43) Solution (d)

ISRO plans to launch HySIS (Hyperspectral Imaging Satellite) – a earth observation satellite, using a critical chip it has developed called **"optical imaging detector array".**

Hyperspectral imaging, or imaging spectroscopy**, combines the power of digital imaging and spectroscopy.**

For each pixel in an image, a hyperspectral camera acquires the light intensity (radiance) for **a large number of contiguous spectral bands.**

Every pixel in the image thus contains a continuous **spectrum in the visible and near infra-red** regions and can be used to characterize the objects in the scene with great precision and detail.

Hyperspectral images provide **much more detailed information about the scene than a normal color camera**, which only acquires three different spectral channels corresponding to the visual primary colors red, green and blue.

Hence, hyperspectral imaging leads to a vastly improved ability to classify the objects in the scene based on their spectral properties.

Do you know?

- Hyperspectral or hyspex imaging is said to be an Earth Observation trend that is being experimented globally. Adding a new dimension to plain-vanilla optical imagers, it can be used for a range of activities from monitoring the environment,

crops, looking for oil and minerals all the way up to military surveillance — all of which need images that show a high level of differentiation of the object or scene.

THINK!

- 'CATSCAN'

(Source: http://www.thehindu.com/sci-tech/science/isro-to-develop-full-fledged-earth-observation-satellite/article19458651.ece)

https://www.isro.gov.in/isro-develops-optical-imaging-detector-array-hyperspectral-imaging-applications

Q.44) Consider the following pairs.

Name	Definition
1. Meteor	(astronomy) any of the small solid extraterrestrial bodies that enters Earth's atmosphere.
2. Meteorite	A small body moving in the solar system before it enters Earth's atmosphere.
3. Meteoroid	A piece of stone or metallic object that remains from a meteor and has landed on the surface of the Earth.

Which of the above pairs is/are correctly matched?

a) 1 only
b) 1 and 2 only
c) 3 only
d) All the above

Q.44) Solution (a)

Meteor

Definition: Any of the small solid extraterrestrial bodies that enters Earth's atmosphere

Meteorite

Definition: A piece of stone or metallic object that remains from a meteor and has landed on the surface of the Earth.

Meteoroid

Definition: A small body moving in the solar system before it enters Earth's atmosphere

Do you know?

- **Perseid shower** is the dust of **Comet Swift Tuttle** which passes through earth every year.

THINK!

- Asteroids

Q.45) Which of the following is true about spacecraft OSIRIS-Rex?

a) (OSIRIS-REx) is NASA's first unmanned asteroid sampling mission.
b) (OSIRIS-REx) is NASA's first manned asteroid sampling mission.
c) (OSIRIS-REx) is NASA's first unmanned meteoroid sampling mission.
d) None of the above.

Q.45) Solution (a)

Recently, spacecraft OSIRIS-REx passed by earth to reach **Asteroid Bennu** using Earth's gravity.

About OSIRIS-Rex

Spectral Interpretation, Resource Identification, Security-Regolith Explorer (OSIRIS-REx) is **NASA's first unmanned asteroid sampling mission** which was launched in September 2016.

Asteroid Bennu orbits around the Sun however its orbit is more tilted as compared to Earth's and it crosses Earth's orbit only twice a year. Therefore OSIRIS-REx will have to make adjustments in its path to intersect with Asteroid

Do you know?

- Cassini mission to Saturn is ending its journey. It will dive towards the Saturn and burn up in its atmosphere.
- Cassini is an ambitious space missions launched through collaboration between NASA, ESA and the Italian space agency, Agenzia Spaziale Italiana.

THINK!

- Mangalayana (MOM).

Q.46) Balloon Borne measurement campaigns of Asian Tropopause Aerosol Layer (BATAL) is a collaborative programme of?

a) NASA-European Space Agency
b) ISRO-China Space Administration
c) ISRO-DRDO

d) NASA-ISRO

Q.46) Solution (d)

Atmospheric aerosol and clouds play important role in weather and climate. A recent discovery of high altitude (~ 16km) Aerosol layer occurring during monsoon in the south Asian region using CALIPSO (Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation) has started puzzling the atmospheric scientists.

Very little is known on the composition and the formation mechanisms of this intense aerosol layer.

This layer is of concern since it could play an important role on the climate and weather. To understand this enigmatic layer, balloon borne experiments along with ground based observations are being conducted under a **ISRO-NASA collaborative program** – "Balloon Borne measurement campaigns of Asian Tropopause Aerosol Layer (BATAL)".

Q.47) India is set to launch its first solar mission Aditya-L1 in 2019. Consider the following statements about it.

1. Aditya L1 is to be the first satellite to study the magnetic field of the sun's corona.
2. The Aditya L1 will be placed in a halo orbit around a vantage point in space known as L1 Lagrange point.
3. The Aditya L1 is expected to help study that why the photosphere, the deeper layer of the sun is at much lower temperature than the corona.

Which of the above statements is/are correct?

a) 1 and 3 only
b) 1 only
c) 2 and 3 only
d) All the above

Q.47) Solution (d)

The Aditya L1 will be placed in a **halo orbit around a vantage point** in space known as L1 Lagrange point. The point L1 has the major advantage of viewing the **sun without any occultation/ eclipses.**

The mission will carry seven payloads including the main payload the **Visible Emission Line Coronagraph (VLEC).**

Aditya L1 is to be the **first satellite to study the magnetic field** of the sun's corona.

The Aditya L1 is expected to help study that why the photosphere, the deeper layer of the sun is at much lower temperature than the corona.

It will also **study aspects that affect space weather**, the origin of solar wind ions, their reaction to coronal mass ejections, the distribution of these in the heliosphere- the space around the sun that extends up to Pluto.

Do you know?

- **Lagrange Point:** It is the point where the combined gravitational force of two large bodies is equal to the centrifugal force that is felt by a third body which is relatively smaller

THINK!

- Solar and Heliospheric Observatory (SOHO).

(Source: http://www.thehindu.com/sci-tech/science/here-comes-the-sun-watcher-indias-aditya-l1/article20942099.ece)

Q.48) Which of the following best describes the NASA'S SOFIA Mission?

a) It is a satellite launched to study the atmosphere of the Saturn.
b) It is the Lander and Rover sent to the Titan.
c) It is the world's largest airborne astronomical observatory.
d) None of the above.

Q.48) Solution (c)

It is an **aircraft (Boeing 747SP jetliner) modified to carry a 100-inch diameter telescope**. It is a **joint project** of NASA and the German Aerospace Centre, DLR.

It is the world's largest airborne astronomical observatory and is in fourth year of operation now. Its 2.5 diameter telescope allows astronomers to access the visible, infrared and sub millimeter spectrum. It has the ability to produce a higher resolution image, three times higher in quality than those captured by other observatories.

Do you know?

SOFIA studies many different kinds of astronomical objects and phenomena, but some of the most interesting are:

- Star birth and death
- Formation of new solar systems
- Identification of complex molecules in space

- Planets, comets and asteroids in our solar system
- Nebulae and dust in galaxies (or, Ecosystems of galaxies)
- Black holes at the center of galaxies

THINK!

- Star-Planet Activity Research CubeSat (SPARCS).

(Source: https://www.nasa.gov/mission_pages/SOFIA/overview/index.html)

Q.49) Consider the following pairs.

Phenomenon	Description
1. Blue moon	Occurs when the full moon is at the closest point of its orbit to the Earth, which is also called the perigee.
2. Blood moon	The moon turns into red color during the height of the eclipse as some light does reach it even though the moon is in the shadow of the Earth.
3. Super moon	When two full moons appear in the same calendar month, the second is termed a super moon

Which of the above pairs is/are matched correctly?

a) 1 and 3 only
b) 2 only
c) 2 and 3 only
d) All the above

Q.49) Solution (b)

Blue Moon: When two full moons appear in the same calendar month, the second is termed a "blue moon".

Super Moon: Occurs when the full moon is at the closest point of its orbit to the Earth, which is also called the perigee. The moon appears 30% brighter and 14% bigger than the apogee full moon.

Blood Moon: The moon turns into red color during the height of the eclipse as some light does reach it even though the moon is in the shadow of the Earth. Fine particles in the atmosphere scatter (Rayleigh scattering) the blue component of solar spectrum, & what reaches us is the longer wavelength red light.

Do you know?

- On January 31, 2018, a rare Blue Moon event was experienced on large parts of the globe. It was a rare moment as blue moon, a super moon and a total lunar eclipse fell on same day after more than 150 years.

THINK!

- Lunar eclipse.

(Source: http://www.thehindu.com/sci-tech/science/rare-super-blood-blue-moon-visible-on-jan-31/article22544956.ece)

Q.50) "Innovation in Science Pursuit for Inspired Research (INSPIRE)" is an innovative programme sponsored and managed by the Department of Science & Technology. Which of the following programs are included in INSPIRE Scheme?

1. Scheme for early Attraction of Talents for Science (SEATS)
2. Scholarship for Higher Education (SHE)
3. Assured Opportunity for Research Careers (AORC)

Select the code from below:

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

Q.50) Solution (d)

INSPIRE Scheme

INSPIRE is an innovative programme developed by the the Department of Science & Technology to attract talent to the excitement and study of science at an early age, and to help the country build the required critical resource pool for strengthening and expanding the S&T system and R&D base. It is a programme with long term foresight.

INSPIRE has three components:

i. Scheme for Early Attraction of Talent (SEATS)

ii. Scholarship for Higher Education (SHE)

iii. Assured Opportunity for Research Careers (AORC)

http://www.inspire-dst.gov.in/inspire.html

Q.51) An umbrella scheme KIRAN was launched by Ministry of Science and Technology. Which of the following statements are correct regarding the scheme?

1. The aim is to increase the women researchers in India.
2. Provide Research grants particularly to those female researchers and technologists who had to take a break in career owing to household reasons.
3. To provide 50% quota to women in premier Science institutes for research.

Select the code from following:

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

Q.51) Solution (a)

KIRAN Scheme

The Union Ministry of Science & Technology has launched KIRAN (Knowledge, Involvement, Research, Advancement through Nurturing) for women scientists.

Objectives

- To increase the number of women researchers in India.
- Provide Research grants particularly to those female researchers and technologists who had to take a break in career owing to household reasons.
- Bring about, as far as achievable, gender parity in the field of science and technology.

The scholarships will be provided under three categories

- For those women linked in research work in basic or applied sciences with any central or state level organization or university.
- For those women scientists involved in research and application of innovative solutions for several social problems.
- For those researchers who are self-employed

Q.52) The Traditional Knowledge Digital Library (TKDL) is an Indian digital knowledge repository of the traditional knowledge. It has been created by

a) MeitY

b) Council of Scientific and Industrial Research
c) IISER Pune
d) National Council of Science Museums

Q.52) Solution (b)

Traditional Knowledge Digital Library (TKDL)

The Traditional Knowledge Digital Library (TKDL) is an Indian digital knowledge repository of the traditional knowledge, especially about medicinal plants and formulations used in Indian systems of medicine. Set up in 2001, as a collaboration between the Council of Scientific and Industrial Research (CSIR) and the MINISTRY OF AYUSH the objective of the library is to protect the ancient and traditional knowledge of the country from exploitation through biopiracy and unethical patents, by documenting it electronically and classifying it as per international patent classification systems. Apart from that, the non-patent database servers to foster modern research based on traditional knowledge, as it simplifies access to this vast knowledge of remedies or practices.

Think

- Biopiracy
- Cartagena Convention

Q.53) Which of the following programs come under Ministry of Earth Sciences?

1. Atmosphere and Climate Research – Modelling, Observing Systems and Services (ACROSS)
2. Ocean Services, Technology, Observations, Resources, Modelling and Science (OSTORMS)
3. Polar and Cryosphere Research (PACER)
4. Seismology and Geosciences (SAGE)

Select the code from following:

a) 1 and 2
b) 3 and 4
c) 1,3 and 4
d) All of the above

Q.53) Solution (d)

The mandate of the Ministry of Earth Sciences (MoES) is to provide services for weather, climate, ocean and coastal state, hydrology, seismology and natural hazards; to explore marine living and non-living resources in a sustainable way and to explore the three polar-regions (Arctic, Antarctic and Himalayas). To achieve this mandate, the research & development and operational activities of MoES are carried out under the following five major programs:

1. Atmosphere and Climate Research – Modelling, Observing Systems and Services **(ACROSS)**

2. Ocean Services, Technology, Observations, Resources, Modelling and Science **(OSTORMS)**

3. Polar and Cryosphere Research **(PACER)**

4. Seismology and Geosciences **(SAGE)**

5. Research, Education, Outreach and Training **(REACHOUT)**

The above schemes are central sector schemes. They are for the entire country and not specific to any State/UT.

For details of the above programs go through the following link:

www.moes.gov.in/writereaddata/files/LS_S_186_15032017.pdf

Q.54) Which of the following is the objective of Nidhi – Prayas initiative of department of Science and technology?

a) To promote young and aspiring innovators and startups
b) To provide global standard education in schools
c) To remove gender inequality in scientific education
d) None of the above

Q.54) Solution (a)

Objectives of NIDHI-PRAYAS:

• To enable translation of an innovative idea to a prototype.

• To provide a platform for faster experimentation and modify approaches in the idea to market journey.

• To generate innovative solutions relevant to the local and global problems.

• To attract a large number of youth who demonstrates problem solving zeal and abilities

• To work on their new technology/knowledge/innovation based startups.

• To enhance the pipeline in terms of quality and quantity of innovative startups to the incubators.

• To build a vibrant innovation ecosystem, by establishing a network between innovators, academia, mentors and incubators.

Q.55) National Center for Antarctic and Ocean Research has established a high altitude research station called Himansh. Where is it located?

a) Himachal Pradesh
b) Antarctica
c) Jammu and Kashmir
d) Sikkim

Q.55) Solution (a)

Himansh

National Centre for Antarctic and Ocean Research (NCAOR), Goa, under the Ministry of Earth Sciences has established a high altitude research station in Himalaya called HIMANSH (literally meaning, a slice of ice), situated above 13,500 ft (> 4000 m) at a remote region in Spiti, Himachal Pradesh.

The station houses many instruments to quantify the glacier melting and its relation to changing climate. Some of the instruments that are available at this research facility include, Automatic Weather Stations for weather monitoring, water level recorder for quantifying the glacier melt, ground penetrating radar to know the thickness of glaciers, geodetic GPS systems to study the glacier movements, snow fork for studying snow thickness, steam drill, snow corer, temperature profilers, as well as various glaciological tools. Further, the researchers would be using this as a base for undertaking surveys using Terrestrial Laser Scanners (TLS) and Unmanned Aerial Vehicles (UAV) that would digitize the glacier motion and snow cover variations with exceptional precision.

Q.56) Which of the following statements is correct regarding 'Cryonics'?

a) It is a process of deep freezing gases into liquid state to be used as fuel.
b) It is a process of preserving a body by deep freezing it.
c) It is a process of burning a body with cold fire.
d) It is a process of making a substance superconductingly.

Q.56) Solution (b)

Cryonics

Cryonics is the low-temperature preservation (usually at −196°C) of people who cannot be sustained by contemporary medicine, with the hope that resuscitation and restoration to full health may be possible in the far future. Cryopreservation of humans is not reversible with present technology; cryonicists hope that medical advances will someday allow cryopreserved people to be revived.

Cryonics is regarded with skepticism within the mainstream scientific community and is not part of normal medical practice. It is not known if it will ever be possible to revive a cryopreserved human being. Cryonics depends on beliefs that the cryonics patient has not experienced information-theoretic death. Such views are at the speculative edge of medicine.

Cryonics procedures can only begin after legal death, and cryonics "patients" are considered legally dead. Cryonics procedures ideally begin within minutes of legal death, and use cryoprotectants to prevent ice formation during cryopreservation.

Q.57) The human brain is made of neurons and glial cells. What is the role of the latter?

a) To convey messages from the neurons to different parts of the body
b) To conduct electrical impulses
c) To support neurons and insulate them from each other
d) They create neurons when neurons die

Q.57) Solution (c)

The brain is made up of two broad cell types, **nerve cells or neurons** and **glia**, which are **non-nerve cells** that make up more than half the volume of the brain.

Neurobiologists have tended to focus on the former because these are the cells that form networks that process information.

However, given the preponderance of glia in the brain's cellular make-up, the researchers hypothesised that they could play a fundamental part in brain development.

Recently, researchers found that the **coordination of nerve-cell development is achieved through a population of glia**, which are non-nerve cells.

They found that glia, a collection of non-neuronal cells that had long been regarded as passive support cells, in fact are **vital to nerve cell development in the brain**.

For more information: http://www.thehindu.com/sci-tech/science/new-source-for-brains-growth-found/article19610992.ece

The four main functions of glial cells are:

- to surround neurons and hold them in place,
- to supply nutrients and oxygen to neurons,
- to insulate one neuron from another, and
- to destroy and remove the carcasses of dead neurons (clean up).

Do you know?

Unlike neurons, **glial cells do not conduct electrical impulses**. The glial cells surround neurons and provide support for and insulation between them. Glial cells are the most abundant cell types in the central nervous system. Types of glial cells include oligodendrocytes, astrocytes, ependymal cells, Schwann cells, microglia, and satellite cells.

Q.58) There is a fall in boiling points of water and other liquids at hills, because –

a) of high pressure at mountainous regions, the liquid experiences less downward force pushing down on it from above.
b) Boiling point of water changes with altitude because atmospheric pressure changes with altitude.
c) Boiling point of water changes with altitude because of temperature inversion.
d) At mountainous regions, water molecules have tough time escaping off the surface when the air pressure above them is less.

Q.58) Solution (b)

In mountainous regions, the air pressure is a little lower than what it is at sea or normal ground level.

Any liquid boils at that temperature at which its vapour pressure equals that of the atmospheric pressure. At the ground level, water boils at 100 degrees C at normal

atmospheric pressure. At very high altitudes, the atmosphere thins and the pressure will be less, so that water boils at a temperature below 100 degrees C.

This makes it difficult to cook in open pans in hilly regions, and we have to use a pressure cooker. In the pressure cooker the pressure inside the container will be 2-3 times higher than at ground level. Hence water will boil at around 120 degrees C, and the materials get cooked completely. Thus one can observe a fall in boiling points of water and other liquids at hills due to the fall in the atmospheric pressure.

Q.59) Aeons, eras, periods, epochs, and ages denote different segments on the geological timescale. Which global body is responsible for setting these time standards to express Earth's history?

a) The International Commission on Stratigraphy
b) The International Society of Ankylography
c) The International Union of Balneography
d) The International Commission on Zoological Nomenclature

Q.59) Solution (a)

The International Commission on Stratigraphy is the largest and oldest constituent scientific body in the International Union of Geological Sciences (IUGS). Its primary objective is to precisely define global units (systems, series, and stages) of the International Chronostratigraphic Chart that, in turn, are the basis for the units (periods, epochs, and age) of the International Geologic Time Scale; thus setting global standards for the fundamental scale for expressing the history of the Earth.

Q.60) This telescope is said to be 100 times more powerful than the Hubble Space Telescope, and is expected to find the first galaxies formed in the early universe. Name the telescope.

a) Planck Observatory
b) James Webb Space Telescope
c) Herschel Space Observatory
d) Galileo Telescope

Q.60) Solution (b)

The National Aeronautics and Space Administration (NASA) of the United States has successfully completed building the largest space telescope, called James Webb Space Telescope — one that is 100 times powerful than the Hubble Space Telescope and may find the first galaxies that were formed in the early universe.

The James Webb Space Telescope will be the successor of NASA's 26-year-old Hubble.

Q.61) Lucy may well be one of the world's most famous fossil. Which species does she belong to?

a) Australopithecus afarensis
b) Homo habilis
c) Homo heidelbergensis
d) Denisovan Neanderthal

Q.61) Solution (a)

Lucy, world's most famous fossil hominid, is the best-known specimen of the species Australopithecus afarensis, and her partial skeleton, found in 1974, revealed that she and her kin could walk upright.

'Lucy' is a collection of fossilised bones that once made up the skeleton of a hominid from the Australopithecus afarensis species. She lived in Ethiopia 3.2 million years ago.

First discovered in 1974, the discovery was remarkably 'complete' - 40 per cent of her skeleton was found intact, rather than just a handful of incomplete and damaged fossils that usually make up remains of a similar age.

One of the most important things about Lucy is the way she walked. By studying her bones, in particular the structure of her knee and spine curvature, scientists were able to discover that she spent most of her time walking on two legs - a striking human-like trait.

Q.62) A cave in Burzahama region in Kashmir depicts a scene which has recently been interpreted as an astronomical event of significance. What is this event?

a) The earliest known record of a total solar eclipse
b) The earliest known depiction of a binary star
c) The earliest known record of a supernova explosion
d) The earliest known record of a god particle

Q.62) Solution (c)

The oldest of the human observations are scattered through various Palaeolithic epochs. These observations are seen in the form of the cave paintings at various sites in France and Spain and include the phases of moon leading to ephemeris, bright stars and basic constellations.

In India, a stone carving is excavated from a site in the Kashmir region, where permanent settlements are dated to a period around 3000 - 1500 BC. The stone slab shows two bright objects in the sky with a hunting scene in the foreground. These have been assumed to be a depiction of a double star system, first record of a supernova.

Q.63) In a first, researchers have estimated that along with sea level rise, the sea floor is also sinking. What might be the cause of the latter?

a) Weight of additional meltwater is pressing down on the seafloor
b) Inner core of the Earth is shrinking
c) Collision of tectonic plates
d) Reduces seafloor spreading

Q.63) Solution (a)

In recent decades, melting ice sheets and glaciers driven by climate change are swelling Earth's oceans. And along with all that water comes an unexpected consequence — the weight of the additional liquid is pressing down on the seafloor, causing it to sink.

Refer: https://www.livescience.com/61328-ocean-bottom-is-sinking.html

So much extra water is being added to the world's oceans from melting glaciers that the ocean floor is sinking underneath the increasing weight.

Over the past 20 years, ocean basins have sunk an average of 0.004 inches per year. This means that the ocean is 0.08 inches deeper than it was two decades ago. While this small fragment of an inch may not seem much, oceans cover 70 percent of our planet, making the problem bigger than it seems at first glance.

Q.64) Which of the following departments are related to Nano-science and nanotechnology in India?

1. Department of Science and Technology (DST)

2. Department of Biotechnology (DBT)
3. Department of Electronics and Information Technology (DeITy)
4. Department of Industrial Policy and Promotion (DIPP)

Select the correct answer using the codes given below.

a) 1 and 2 only
b) 1, 2 and 3 only
c) 1 and 3 only
d) All the above

Q.64) Solution (d)

Department of Science and Technology (DST): DST is the nodal agency in the Indian nanotechnology innovation system. It has since 1980s launched may programmes/schemes to foster R&D on miniature-scale and on Nano-scale.

Department of Biotechnology (DBT): The DBT is basically active in the area of nano biotechnology R&D. In the period around 2007, the Department of Biotechnology (DBT) initiated a programme on Nano biotechnology.

Department of Electronics and Information Technology (DeITy): The DeITy has established Centre for Materials for Electronics Technology (C-MET) at Pune, Hyderabad and Trissur. These centres are involved in nanotechnology R&D activities, particularly in nanomaterials.

Department of Industrial Policy and Promotion (DIPP): DIPP established a Nano Manufacturing Technology Centre (NMTC) and Academy of Excellence for Advanced Manufacturing Technology (AEAMT) at the Central Manufacturing Technology Institute (CMTI) in Bangalore.

Do you know?

- Mission on Nano Science and Technology (Nano Mission) was launched by the **Department of Science and Technology** (DST) to foster, promote and develop all aspects of nanoscience and nanotechnology which have the potential to benefit the country.

THINK!

- Draft Guidelines for Safe Handling of Nanomaterials.

Q.65) Consider the following statements about Carbon Nano Tubes.

1. Carbon nanotubes (CNTs) are an isotope of carbon.
2. Carbon Nanotubes are also known as Carbon fibers.

3. CNT metal matrix composites have excellent electrical properties and are used as reinforcement to metals in order to enhance their electrical properties.

Which of the above statements is/are correct?

a) 1, 2 and 3
b) 1 and 3 only
c) 2 and 3 only
d) 3 only

Q.65) Solution (d)

Carbon nanotubes (CNTs) are an allotrope of carbon- they are cylindrical hollow fibers, comprised of a single sheet of pure graphite (a hexagonal lattice of carbon), having a diameter of 0.7 to 50 nanometers with lengths generally in the range of 10's of microns.

Being a hollow tube comprised entirely of carbon, they are also extremely light weight. They have novel properties that make them potentially useful in a wide variety of applications in nanotechnology, electronics, optics and other fields of materials science.

Carbon fibers are fibers about 5–10 micrometers in diameter and composed mostly of carbon atoms. Some important properties of carbon fiber are- high stiffness, high tensile strength, low weight, high chemical resistance, high temperature tolerance and low thermal expansion. These make them very popular in aerospace, civil engineering, military and sports.

Stiffness and strength of materials used in load bearing applications is key as they reduce the mass and dimensions of the materials.

CNTs are dispersed homogenously through the metal, with strong interfacial adhesion between the CNTs and the metallic matrix.

CNT metal matrix composites have excellent electrical properties and are used as reinforcement to metals in order to enhance their electrical properties.

Carbon nanotubes have extremely high thermal conductivity that allows metal matrix carbon nanotubes to be used for thermal management.

Do you know?

- CNTs exhibit dimensional and chemical compatibility with biomolecules, such as DNA and proteins. CNTs enable fluorescent and photoacoustic imaging, as well as localized heating using near-infrared radiation.

THINK!

- Potential applications of carbon nanotubes.

Q.66) Environment nanotechnology involves use of nanoscale material for addressing environmental concerns. Consider the following statements.

1. NanoCO_2 harvester which can suck CO_2 from the atmosphere and convert it into methanol can be used as vehicular fuel.
2. The magnetically charged nanoparticles have been proved potent to remove heavy metals and dyes from the water bodies.
3. Due to nanoparticles' ability of long persistence, they may raise concerns such as bio-magnification.

Which of the above statements is/are correct?

a) 1 and 2 only
b) 1 and 3 only
c) 1 only
d) 1, 2 and 3

Q.66) Solution (d)

Environment nanotechnology involves use of nanoscale material for addressing environmental concerns such as bioremediation, water purification, product recycling and recovery, solid waste management.

These nanomaterials have unique properties such as chemical reactivity, electronic properties and antimicrobial activity. Therefore, they hold potential to address issues such as combating Climate Change and reduction of pollution.

Areas where Environment nanotechnology can be used

- **Combating Carbon Emission,** the researchers have developed nanoCO_2 harvester which can suck CO_2 from the atmosphere and convert it into methanol which can further be used as vehicular fuel. The NanoCO_2 Harvester can capture more CO_2 than usual and is more efficient fuel converter.
- **Cleaning Water** The magnetically charged nanoparticles have been proved potent in researches to have effectively carried on adsorption process to remove heavy metals and dyes from the water bodies and they do not readily degrade. They can also be used to clean the underground water contaminated with toxic materials such as arsenic, lead, chromium and mercury. They can also be used to clean up oil spills by using Nanosponges.
- **Accelerating Biodegradation (Solid Waste Management)** The method of converting the organic waste into organic manures and fertilizers can also be quickened through use of Nanoparticles. Thus, they can reduce the time consumed in solid waste

management and increases the production of biogas. According to researchers, Iron oxide particles which are non-toxic can be used for the same.

Challenges

- The Nanoparticles being small in size **have tendency to clump up** which make them inactive with prolonged use.
- Synthesizing useful nanoparticles is also challenging as production of a consistent size is tough. **The viability of Nanoparticles such as nanosponge** still remains a laboratory success and hasn't been tested on large-scale.
- The usage of Nanoparticles also raises health concerns as due to their small size they can be easily transported inside human as well as animal bodies.
- **Due to their ability of long persistence, they may raise concerns such as bio-magnification as well.**

Do you know?

- **Nanosponges are Nano sized particles designed to look like red blood cell and protect the body.** Nanoparticles have been used for unknown preventative measures, such as silverware and wound care products. Silverware contains small silver nanoparticles which contain an antimicrobial agent.
- Nanosponges are introduced to the body by injection and take the form of a red blood cell so that the bacteria or venom attacks it. Once it is attacked, it is trapped within the scaffolding of the nanosponge. After the nanosponge is full of toxins and cannot trap anymore it moves to the liver to filter out the toxins.

THINK!

- Graphene

Q.67) Big data is a term that describes the large volume of data – both structured and unstructured beyond the ability of commonly used software tools to capture, curate, manage, and process data within a tolerable elapsed time. Which of the following are applications of Big data?

1. Better understanding and targeting customers by companies.
2. Tracking and analyzing the supply chain delivery routes.
3. Used in healthcare to find new cures for cancer.
4. Security and law and order management.

Select the correct answer using the codes given below.

a) 1 and 2 only
b) 1, 2 and 4 only
c) 1, 3 and 4 only
d) All the above

Q.67) Solution (d)

Applications of Big Data

- Companies use big data to **better understand and target customers by bringing together data from their own transactions** as well as social media data and even weather predictions.
- Businesses optimize their processes **by tracking and analyzing their supply chain delivery routes and combine that data with live traffic updates.** Others use machine data to optimize the service cycles of their equipment's and predict potential faults.
- **Big Data is used in healthcare to find new cures for cancer**, to optimize treatment and even predict diseases before any physical symptoms appear.
- **Big Data is used to analyze and improve the performance of individuals (at sports, at home or work**) where data from sensors in equipment and wearable devices can be combined with video analytics to get insights that traditionally were impossible to see.
- **Police forces and security agencies use big data to prevent cyber-attacks**, detect credit card fraud, foil terrorism and even predict criminal activity.
- **Big Data is used to improve our homes, cities** and countries by optimizing the heating or lighting in our homes, the traffic flow in our cities, or the energy grid across the country.

Do you know?

- **Big Data Management Policy, 2016.** It was launched by CAG (Comptroller and Auditor General). It paved the wave for Data Analytics Centre (first of its kind in the country).

THINK!

- Big Data in India's governance policy.

Q.68) 5G is a wireless communication technology and the next generation mobile networks technology after 4G LTE networks. Consider the following regarding this:

1. 5G will help aid incorporate Artificial Intelligence in our lives.
2. It will create the ecosystem for Internet of Things (IoT).

Which of the above statements is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) None

Q.68) Solution (c)

5G is a wireless communication technology. It is the next generation mobile networks technology after 4G LTE networks. **The final standard for 5G will be set up by the International Telecommunications Union (ITU).**

Advantages of 5G

- As per the OECD (Organization for Economic Cooperation and Development) Committee on Digital Economic Policy, 5G technologies rollout will help in increasing GDP, creating employment and digitizing the economy.
- The 5G technology will offer far greater upload and download speed available today. This will help cloud systems to stream software updates, music, and navigation data to driverless cars. In other words, **it will help aid incorporate Artificial Intelligence in our lives.**
- It will enable Smart devices to exchange data seamlessly providing the **ecosystem for Internet of Things (IoT).**

Do you know?

- The Internet of Things (IoT) is the network of **physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators, and connectivity** which enables these objects to connect and exchange data. Each thing is uniquely identifiable through its embedded computing system but is able to inter-operate within the existing Internet infrastructure.

THINK!

- Applications of IoT.

Q.69) The term "digiceuticals" often in news refers to.

a) The use of digital technology for the preparation of medicines.
b) Software that can improve a person's health as much as a drug can.
c) The diseases and syndromes caused due to the overuse of digital tools.
d) Use of digital technology for drug delivery into the patient body.

Q.69) Solution (b)

What if an app could replace a pill? That's the big question behind an emerging trend known as "digital therapeutics." **The idea: software that can improve a person's health as much as a drug can, but without the same cost and side-effects.**

Digital therapeutics, or "digiceuticals," as some call them, have become a Holy Grail in some quarters of Silicon Valley, where investors see the chance to deliver medicine **through your smartphone.**

Do you know?

- Some digiceuticals will work better alongside conventional drugs, rather than on their own—opening up possibilities for alliances between tech and pharma firms. **Voluntis, a startup, develops companion software for specific medications or medical devices.** These programs can monitor side-effects, help manage symptoms and connect patients with doctors and nurses.

THINK!

- Telemedicine

(Source: http://healblock.com/category/digiceuticals/)

Q.70) Which of the following are the India's indigenous robots.

1. Mitra
2. Brabo
3. Shakti
4. Spurti

Select the correct answer using the codes given below.

a) 1 and 3 only
b) 1 and 2 only
c) 1, 3 and 4 only
d) All the above

Q.70) Solution (b)

Mitra has been developed by a Bangalore-based startup Invento Robotics that was set up in October 2015. Mitra has been completely designed and developed in India. The idea behind the robot was to provide customised and contextual information to people.

TAL Manufacturing Systems, **a wholly owned subsidiary of Tata Motors**, which is all set to launch **Tata Brabo** – India's first indigenous industrial-articulated robot.

Tata Brabo – the potential game changer for MSMEs

TAL Manufacturing Systems has rightly identified a vast and untapped niche for mini-industrial robots that seeks to improve manufacturing and assembly efficiency at the floor level, with special focus to meet the needs of the MSME industry in India.

Tata Brabo is geared to handle payloads of 2-kilogram, 5 kilograms and 10 kilogram and will find application in electronics, automotive, pharmaceutical, food processing, logistics, packaging, and several other industries.

Do you know?

- India's labour force faces tough competition from robots. About 20–30 percent of employers in India anticipate a decrease in headcount due to automation taking over low-skill, monotonous jobs. **At Infosys, for example, some 11,000 workers have already lost their jobs to automation, and 3,000 Wipro employees faced the same fat after the company deployed Holmes,** its AI project. These instances leave no doubt that IT industry jobs will downsize, losing 6.4 lakh jobs by 2021, according to HfS Research estimates.

THINK!

- STRIVE (Skill Strengthening for Industrial Value Enhancement).
- SANKALP (Skills Acquisition and Knowledge Awareness for Livelihood Promotion)

Sources

https://www.mapsofindia.com/my-india/business/tata-brabo-indias-first-indigenous-industrial-articulated-robot

https://www.hindustantimes.com/tech/mitra-the-made-in-india-robot-that-stole-the-show-at-ges-hyderabad/story-XLYgp5UnSP3ACv7kMWOC1H.html

http://www.digitalpolicy.org/human-side-indias-robot-economy/

Q.71) Airbus has developed CIMON(Crew Interactive Mobile Companion). Which of the following statements are correct regarding it?

1. It is a 3 – D printed Artificial Intelligence System.
2. It is made up of plastic and metal.
3. It will join the crew aboard the International Space Station (ISS) to assist Astronauts.

Select the code from following:

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

Q.71) Solution (d)

CIMON (Crew Interactive MObile CompanioN)

- It is a 3D-printed artificial intelligence system, described by its creators as a "flying brain".

- It is made up of plastic and metal, created using 3D printing
- It is being developed by Airbus, an aeronautics company based in Netherlands
- It will be the first AI-based mission and flight assistance system
- It will join the crew aboard the International Space Station (ISS) to assist astronauts.
- It is designed to support astronauts in performing routine work

http://www.thehindu.com/todays-paper/tp-in-school/ai-reaches-for-the-skies/article22954336.ece

Q.72) Which of the following statements are correct regarding Distributed Denial of Service (DDoS) attacks?

1. It is a malware which creates a botnet (network of bots) and use that to ping a server at the same time.
2. It corrupts all the files linked with a server and deletes them from the device.
3. It overburdens a server and leads to its crashing.

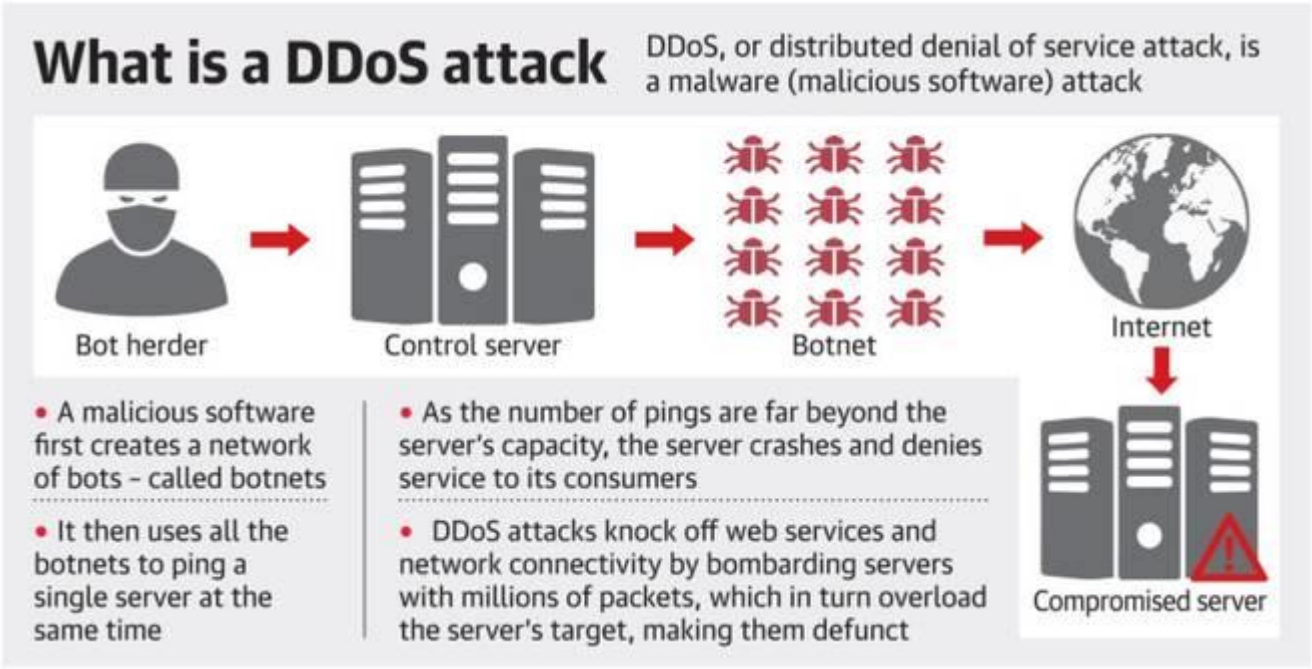
Select the code from following:

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

Q.72) Solution (c)

Distributed Denial of Service (DDoS) attacks

- A DDoS (Distributed Denial of Service) attack is an illegal large-scale cyber campaign where a big number of devices are used to create traffic to a certain server.
- If the number of devices involved is big enough, the overwhelming traffic would be more than what the targeted server is capable of handling.
- Malware first creates a network of bots — called a botnet — and then uses the botnet to ping a single server at the same time.
- In such a case, the server would get overburdened which would lead to crashes.
- After a successful DDoS attack, the customers of the service that had its servers targeted would not be able to use/access the said service due to the server crash triggered by the DDoS attacks.



Do You Know?

- Reaper is a highly evolved malware capable of not only hacking devices like WiFi routers and security cameras, but also able to hide its own presence in the bot — a device taken over by a malware.

Think

- Mirai
- Ransomware
- Saposhi

Q.73) Which of the following correctly defines KeRanger?

a) It is an Artificial Intelligence software for automatic car driving
b) It is a ransomware which targets Mac Operating system.
c) It is a device that can generate electromagnetic radiations from radiowave frequency to gamma ray frequency.
d) None of the above

Q.73) Solution (b)

KeRanger

KeRanger (also known as OSX.KeRanger.A) is a ransomware trojan horse targeting computers running macOS. Discovered on March 4, 2016, by Palo Alto Networks, it affected more than 7,000 Mac users.

KeRanger is remotely executed on the victim's computer from a flaw in Transmission, a popular BitTorrent client. It is hidden in the .dmg file under General.rtf. The .rtf is actually a Mach-O format executable file packed with UPX 3.91. When users click these infected apps, their bundle executable Transmission.app/Content/MacOS/Transmission will copy this General.rtf file to ~/Library/kernel_service and execute this "kernel_service" before any user interface appearing. It encrypts the files with RSA and RSA public key cryptography, with the key for decryption only stored on the attacker's servers. The malware then creates a file, called "readme_to_decrypt.txt", in every folder. When the instructions are opened, it gives the victim directions on how to decrypt the files, usually demanding a payment of one bitcoin.

Q.74) Which of the following statements are correct regarding 'Cryptojackng'?

a) It refers to the use of encrypted code to highjack a network.
b) It refers to use of malware to hack the official sites and data of Banks.
c) It is the secret use of a computer device to mine cryptocurrency.
d) It is a software which decrypts an encrypted data.

Q.74) Solution (c)

Cryptojacking

- Cryptojacking is defined as the secret use of your computing device to mine cryptocurrency.
- Cryptojacking used to be confined to the victim unknowingly installing a program that secretly mines cryptocurrency
- Attackers employ malware to force an entry into the computers of remote users, and then using their hardware to mine for coins.
- This form of distributed computing can be profitable since it eliminates the cost burden of owning a mining rig with hundreds of processors.
- Cryptojackers usually target popular websites which draw audiences numbering in the millions every day.

Q.75) Consider the following statements regarding 'WiMAX':

1. It stands for Worldwide Interoperability for Microwave Access.

2. It is a wireless industry coalition dedicated to the advancement of IEEE 802.16 standards for broadband wireless access (BWA) networks.
3. WiMAX can provide at-home or mobile Internet access across whole cities or countries.

Which of the above statements are correct?

a) 1 only
b) 2 and 3
c) 1 and 3
d) All of the above

Q.75) Solution (d)

Worldwide Interoperability for Microwave Access

- It is a wireless industry coalition dedicated to the advancement of IEEE 802.16 standards for broadband wireless access (BWA) networks.
- WiMAX can provide at-home or mobile Internet access across whole cities or countries. In many cases this has resulted in competition in markets which typically only had access through an existing incumbent DSL (or similar) operator.
- Additionally, given the relatively low costs associated with the deployment of a WiMAX network (in comparison with 3G, HSDPA, xDSL, HFC or FTTx), it is now economically viable to provide last-mile broadband Internet access in remote locations.
- WiMAX is competing with the 3rd Generation Partnership Project (3GPP)'s Long-Term Evolution (LTE) in the 4G market.

Do You Know?

- IEEE 802.16 is a series of wireless broadband standards written by the Institute of Electrical and Electronics Engineers (IEEE).
- The IEEE Standards Board established a working group in 1999 to develop standards for broadband for wireless metropolitan area networks.
- The Workgroup is a unit of the IEEE 802 local area network and metropolitan area network standards committee.

Think

HSPA HSDPA HSUPA HSPA+ LTE (E-UTRA)

Q.76) 'Aadhar Pay' is a cashless method of payment. Which of the following statements are correct regarding this method?

a) A customer has to mention his Aadhar number only to the merchant to make the automatic payment from his bank account.
b) A customer has to swipe one common debit card connected to multiple bank accounts.
c) Customers will have to put their finger impression on a device to shop and withdraw cash instead of swiping credit or debit cards.
d) It is a mobile wallet connected to Aadhar card that can be used to make payment without any extra service charges.

Q.76) Solution (c)

Aadhar Pay

- Aadhaar Pay' — a payment system where customers put their finger impression on a device to shop and withdraw cash instead of swiping credit or debit cards.
- a unique solution that enables merchants across the country to facilitate cashless purchases for customers with just their thumb and Aadhaar number.
- No hassles of multiple apps, card swipes, remembering passwords, downloading e-wallets or even carrying a phone for cashless payments.

As a Customer:

All you need is your Aadhaar linked bank account & your thumb.

As a Merchant:

- All you need is your own Android smartphone with a reliable internet connection, a current account with Aadhar pay enabled Bank (to where the money will be collected) & the Aadhaar Pay app.
- You get immediate credit into your Aadhaar linked bank account.

Think

- Cyber crime
- Privacy issues
- Aadhar

Q.77) Consider the following statements regarding 'Cyber Surakshit Bharat' Initiative:

1. It has been launched by Ministry of Home Affairs with National e – Governance Division and Industry Partners.
2. Cyber Surakshit Bharat will be operated on the three principles of Awareness, Education and Enablement.
3. Cyber Surakshit Bharat is a public-private partnership and will leverage the expertise of the IT industry in cybersecurity.

Which of the above statements are correct?

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

Q.77) Solution (d)

Cyber Surakshit Bharat

- Ministry of Electronics and Information Technology (MeitY), announced the Cyber Surakshit Bharat initiative in association with National e-Governance Division (NeGD) and industry partners
- An aim of the initiative is to spread awareness about cybercrime and building capacity for safety measures for Chief Information Security Officers (CISOs) and frontline IT staff across all government departments.
- Cyber Surakshit Bharat will be operated on the three principles of Awareness, Education and Enablement.
- It will include an awareness program on the importance of cybersecurity; a series of workshops on best practices and enablement of the officials with cybersecurity health tool kits to manage and mitigate cyber threats.
- Cyber Surakshit Bharat is the first public-private partnership of its kind and will leverage the expertise of the IT industry in cybersecurity.

Think

- Cert-In & NIC

Q.78) RADAR and SONAR are both detection systems that can be used to identify objects and their position when they are not visible or at a distance. Consider the following differences between Radar and Sonar:

1. Radar detection relies on electromagnetic waves whereas Sonar detection relies on mechanical waves.
2. Radar uses high frequency radio waves and microwaves for communication whereas sonar uses high frequency sound waves.
3. Absorption of radio waves by sea water is very high, however water molecules and ions cannot absorb mechanical waves much.

Which of the statements given above is/are correct?

a) 3 only
b) 1 and 3 only
c) 1 and 2 only
d) 1, 2 and 3

Q.78) Solution (d)

RADAR and SONAR are both detection systems that can be used to identify objects and their position when they are not visible or at a distance. They are similar in that they both detect the reflection of a transmitted signal. This makes them easily confused with one another. They also both also serve as acronyms for a much longer description, with RADAR being short for Radio Detection and Ranging and SONAR for Sound Navigation and Ranging.

The primary differences between radar and sonar is going to be the type of signal that they both use for detection.

Radar detection relies on radio waves, which are part of the electromagnetic spectrum. Sonar uses sound waves, which are mechanical waves.

Radar uses high frequency radio waves and microwaves for communication whereas sonar uses high frequency sound waves.

Energy loss of any wave in a medium arises from two important factors namely, scattering and absorption by the particles (atoms or molecules) present in the medium.

In air, radar system sends radio waves and upon reflection from the target, the reflected radio waves will be received. Since density of air is less, the absorption of radio waves by air molecules is very less. But the absorption of radio waves by sea water is very high especially at high frequencies. This is because water molecules and electrically charged ions effectively absorb radio waves. For example, sea water can absorb almost 99 per cent of high frequency radio waves within one metre length. Typically, submarines are inside the sea by several kilometers which makes it very difficult to communicate to them through radio waves. Even if one can try to communicate by low frequency (longer wavelength) radio waves, then the length of the antenna would be of the order of few thousand kilometres,

which is practically not possible. Also, usage of low frequency radio waves results in slower data transfer.

However being mechanical waves, sound waves can propagate few hundreds of kilometers and water molecules and ions cannot absorb much. For example, 10 kHz radio wave can propagate only 6m inside sea whereas for the same frequency a sound wave can travel 38 km. However, the absorption of sound waves in air is very high when compared to radio waves. For example, the intensity of sound waves is 3,000 times reduced when compared with sea water. Hence usage of sound waves in air is limited only to short distances.

Q.79) What does haptic communication mean?

a) Communication through hearing
b) Communication through touch
c) Communication through smell
d) None of the above

Q.79) Solution (b)

Haptic communication is a technology that transmits the sensation of touch over the Internet, had been developed by engineers in the Virtual Reality Laboratories at the University at Buffalo (UB).

The breakthrough lead to creation of haptic technologies that convey the sense of touch and taught users how to master skills and activities — such as surgery, sculpture, playing the drums or even golf — that require precise application of 'touch' and movement.

Q.80) Emma Wren Gibson set a new record in November 2017, simply by being born. What was unusual about her birth?

a) She was the first test-tube baby.
b) She was the first product of human cloning.
c) She was the first baby delivered using a human embryo frozen for the longest period.
d) She was the first baby to be born in space.

Q.80) Solution (c)

An American woman gave birth to a healthy baby girl from an embryo that was frozen a quarter century ago, in what hospital officials say may be a world record.

The baby, named Emma Wren Gibson, was born November 25, according to the National Embryo Donation Center (NEDC) in Knoxville, Tennessee, which revealed the birth announcement this week.

The embryo was conceived by another couple and frozen on October 14, 1992 and Tina Gibson, the woman who just gave birth to the baby was born in 1991. By some measures, this would make the embryo only about a year younger than her mother.

Q.81) January 1, 2018 marked 124 years since the birth of this scientist who lent his name to a whole class of elementary particles. Name the scientist.

a) Satyendranath Bose
b) Jagadish Chandra Bose
c) Subhash Chandra Bose
d) Albert Einsten

Q.81) Solution (a)

January 1, 2018 – 125th birthday of the famous physicist Satyendra Nath Bose, who was born this day in 1894.

Bose's name was very much in the news when CERN discovered the Higgs boson a few years back.

The word "boson" in "Higgs boson" had been coined from Bose's surname. The Higgs boson is not the only particle, however, to enjoy this honour, and there is in fact a whole class of elementary particles that share a group name – boson.

Q.82) Consider the below statements:

1. Electron, proton and photon are part of matter particles.
2. Neutron and neutrino on the other hand, is a quantum, or tiny bundle, of the electromagnetic field.
3. One fundamental difference between matter particles and field quanta is that while one can squeeze in as many field quanta into a small volume, one cannot do so with matter.

Which of the statements given above is/are correct?

a) 3 only
b) 1 and 3 only
c) 1 and 2 only
d) 1, 2 and 3

Q.82) Solution (a)

All the particles - such as electron, proton, neutron and neutrino (except the photon) - are part of matter particles.

The photon, on the other hand, is a quantum, or tiny bundle, of the electromagnetic field.

The relation between matter particles and field quanta is simple — Matter particles interact with each other by exchanging the appropriate field quanta.

One fundamental difference between matter particles and field quanta is that while you can squeeze in as many field quanta into a small volume, you cannot do so with matter.

To see this, just try sitting close to another person – there is a limit to how close you can get. This is because the electrons, protons etc in our bodies resist being stacked on top of each other. The same is not the case with field quanta, which can be as closely packed as needed.

Matter particles such as electrons, protons etc obey what is known as the Fermi-Dirac statistics and hence are known as 'Fermions'. Field quanta, for instance, obey what is called Bose-Einstein Statistics and are collectively called 'Bosons'.

Q.83) With the boom of the bitcoin – a variety of cryptocurrency – the blockchain technology has come into prominence. What does this technology promise to do, even though it is still in its infancy?

a) Help facilitate secure, online transactions in a decentralized way
b) Keep out malware
c) Connect servers with common reasons for existence, remotely
d) All of the above

Q.83) Solution (a)

Blockchain is the backbone technology on which bitcoins run. Simply put, it is a digital public ledger that records every transaction. Once a transaction is entered in the blockchain, it cannot be erased or modified. Blockchain removes the need for using a trusted third party such as a bank to make a transaction by directly connecting the customers and suppliers.

Each transaction is recorded to the ledger after verification by the network participants, mainly a chain of computers, called nodes.

While the origin of the technology is not clear, it is widely believed that a person or group of people by the pseudonym Satoshi Nakamoto, who invented bitcoins, released the technology to support cryptocurrency.

Bitcoin is just one of the applications for the technology, whose use is being tested across industries. It is witnessing a lot of traction within India, in sectors such as banking and insurance. In most of these industries, players are coming together to form a consortium to realise the benefits of blockchain at an industry level.

For example, in India, there is a consortium 'BankChain' which has about 27 banks from India (including State Bank of India or SBI and ICICI) and the Middle East as its members. The consortium is exploring using usage of Blockchain technology to make business safer, faster and cheaper.

The Institute for Development and Research in Banking Technology (IDRBT), an arm of the Reserve Bank of India (RBI), is developing a model platform for blockchain technology.

Blockchain is expected to improve the efficiency of a transaction by eliminating the middlemen, while also reducing the cost of all transactions. It is also likely to increase transparency. and bring down fraud as every transaction would be recorded and distributed on a public ledger.

Q.84) Indian scientists had developed an eco-friendly nanotechnology for water-softening applications that could be used in civic water treatment plants for generating potable water. What is the name of the naturally occurring substance with which these scientists developed eco-friendly nanotechnology for water purification?

a) Resin
b) Chitosan
c) Carcinogens
d) Anticarcinogens

Q.84) Solution (b)

The team from Institute of Advance Study in Science & Technology (IASST) in Assam's Guwahati, had crafted a biopolymer using a naturally occurring substance, called chitosan (obtained from the hard outer skeleton of shellfish, including crab, lobster, and shrimp) as a backbone for the carbon nanoparticles to sit on.

Q.85) Fission reactors can be divided roughly into two classes, depending on the energy of the neutrons that sustain the fission chain reaction: thermal reactors and fast neutron reactors. Consider the following statements.

1. Thermal reactors (the most common type of nuclear reactor) use slowed or thermal neutrons to keep up the fission of their fuel.
2. Fast neutron reactors use fast neutrons to cause fission in their fuel.
3. Breeder reactors operate with thermal neutrons.

Which of the above statements is/are correct?

a) 1 and 2 only
b) 2 and 3 only
c) 3 only
d) All the above

Q.85) Solution (a)

Thermal reactors (the most common type of nuclear reactor) **use slowed or thermal neutrons to keep up the fission of their fuel.** These contain neutron moderator materials that slow neutrons. The moderator is often also the coolant, usually water under high pressure.

Fast neutron reactors use fast neutrons to cause fission in their fuel. They do not have a neutron moderator and use less-moderating coolants.

Boiling water reactors (BWR), Pressurized water reactors (PWR) and Heavy water reactors (HWR) operate **with thermal neutrons** [moderators used].

Breeder reactors operate with **fast neutrons [moderators are not required].**

Do you know?

- The light-water reactor (LWR) is a type of thermal-neutron reactor that uses NORMAL WATER, as opposed to heavy water, as both its coolant and neutron moderator.

THINK!

- Pressurized Water reactor
- Boiling water reactor

Q.86) Consider the following statements.

1. The Nuclear Fuel Complex manufactures fuel assemblies for pressurized heavy water reactors only.
2. Heavy Water Board not only produces heavy water but also undertakes the task of boron enrichment.

Which of the above statements is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) None

Q.86) Solution (b)

The Nuclear Fuel Complex at Hyderabad manufactures fuel assemblies for **pressurized heavy water reactors, boiling water reactors and fast breeder reactor.**

The Heavy Water Board has contributed successfully to the first stage of Nuclear Power Programme by producing heavy water for all Pressurized Heavy Water Reactors in a cost-effective manner enabling the department to provide nuclear power at an affordable cost to common man.

In consonance with the material input required for second stage of NPP based on FBRs, HWB, with its decades of experience of handling isotope separation process, took up development, demonstration and deployment of indigenous technologies for production of enriched boron. HWB has now acquired comprehensive capability in this area achieving enrichment levels beyond 95 per cent in multiple chemical forms. **To support the second stage of NPP, HWB has successfully delivered the entire quantity of enriched boron for the 1st core of PFBR.**

Do you know?

- Sodium is another important input for FBRs, used as coolant in the reactor. Networking with the Indian R&D organizations, HWB has developed indigenous and safer closed electrolytic cell technology for production of nuclear grade sodium. Successively larger size cells are tested with the ultimate intent of an industrial scale set up.

THINK!

- Nuclear Power Generation Programme

Q.87) Consider the following statements about The Indian Nuclear Power Programme.

1. In the first stage of the programme, natural uranium fueled pressurized heavy water reactors (PHWR) produce electricity while generating plutonium-239 as by-product.
2. The Stage II Fast Breeder Reactors are designed to "breed" more fuel than they consume.
3. The Stage III reactor or an Advanced nuclear power system involves a self-sustaining series of thorium-232-uranium-233 fueled reactors.

Which of the above statements is/are correct?

a) 1 and 2 only
b) 2 and 3 only
c) 3 only
d) All the above

Q.87) Solution (d)

In the first stage of the programme, natural uranium fuelled pressurised heavy water reactors (PHWR) produce electricity while **generating plutonium-239 as by-product.**

In the second stage, fast breeder reactors (FBRs) would use a mixed oxide (MOX) fuel made from plutonium-239, recovered by reprocessing spent fuel from the first stage, and natural uranium. In FBRs, plutonium-239 undergoes fission to produce energy, while the uranium-238 present in the mixed oxide fuel transmutes to additional plutonium-239. **Thus, the Stage II FBRs are designed to "breed" more fuel than they consume.** Once the inventory of plutonium-239 is built up thorium can be introduced as a blanket material in the reactor and transmuted to uranium-233 for use in the third stage.

A Stage III reactor or an Advanced nuclear power system involves a self-sustaining series of thorium-232-uranium-233 fuelled reactors. This would be a thermal breeder reactor, which in principle can be refueled – after its initial fuel charge – using only naturally occurring thorium. According to the three-stage programme, Indian nuclear energy could grow to about 10 GW through PHWRs fueled by domestic uranium, and the growth above that would have to come from FBRs till about 50GW. **The third stage is to be deployed only after this capacity has been achieved.**

Do you know?

- **Doubling time** refers to the time required to extract as output, double the amount of fissile fuel, which was fed as input into the breeder reactors. This metric is critical for understanding the time durations that are unavoidable while transitioning from the second stage to the third stage of Bhabha's plan, because building up a sufficiently large fissile stock is essential to the large deployment of the third stage.

THINK!

- Advanced Heavy Water Reactor.

Q.88) Consider the following statements about applications of Nuclear science in agriculture.

1. Nitrogen-15 is used to assess soil quality.
2. Carbon-13 is used to know about how efficiently the crops use the nutrients.

Which of the above statements is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) None

Q.88) Solution (d)

To confirm the effectiveness of the integrated crop-livestock approach, scientists use nuclear techniques involving the nitrogen-15 and carbon-13 isotopes. Nitrogen-15 and carbon-13 are stable isotopes, and scientists are able to track these isotopes to measure, for example, how efficiently crops consume nitrogen.

Scientists do this by introducing samples of nitrogen-15 into the soil around the crops. Over several months they observe how much nitrogen-15 is absorbed by the plants. **This provides crucial information about how efficiently the crops use the nutrients.**

Similarly, scientists add samples of carbon-13 to the soil to assess soil quality. As nutrients are recycled in the soil, organic carbon content goes up. Scientists can measure the changes in organic carbon content by tracking the carbon-13.

Do you know?

- Stereotactic surgery or stereotaxy is a minimally invasive form of surgical intervention which makes use of a three-dimensional coordinate system to locate small targets inside the body and to perform on them some action such as ablation, biopsy, lesion, injection, stimulation, implantation, radiosurgery (SRS), etc.
- A robot based frameless stereotactic system is developed at BARC for performing neurosurgery which has accuracy and patient comfort level comparable to frame-based system.

THINK!

- Applications of Nuclear Science in Medicine.

(Source https://www.iaea.org/newscenter/news/integrated-farming-finds-success-in-india-with-help-of-nuclear-science)

Q.89) Consider the following statements.

1. Moderators slow down neutrons.
2. Moderators are composed of chemical elements such as boron, silver, indium and cadmium.
3. Control Rods absorb neutrons.

Which of the above statements is/are correct?

a) 1 and 2 only
b) 1 and 3 only
c) 3 only
d) All the above

Q.89) Solution (b)

A neutron moderator is a medium that reduces the speed of fast neutrons, thereby turning them into thermal neutrons capable of sustaining a nuclear chain reaction.

Commonly-used moderators include regular (light) water (in 74.8% of the world's reactors), solid graphite (20% of reactors), heavy water (5% of reactors).

The power output of the reactor is adjusted by controlling how many neutrons are able to create more fission. Control rods that are made of a neutron poison are used to absorb neutrons.

Control rods are composed of chemical elements such as boron, silver, indium and cadmium.

Do you know?

- A critical mass is the smallest amount of fissile material needed for a sustained nuclear chain reaction.

THINK!

- Neutron poison

Q.90) Which of the following are the types of energy that can be harnessed from sea/ocean?

1. Tidal energy
2. Marine current power
3. Ocean thermal energy
4. Osmotic power

Which of the above statements is/are correct?

a) 1, 2 and 3 only
b) 1 and 2 only
c) 1 and 3 only
d) All the above

Q.90) Solution (d)

Tidal Power. Quantitatively different from wave power, tidal generation makes use of moving masses of water as a whole. Although the technology is known, this form of renewable energy is not yet in widespread use due to relatively high cost and limited places with sufficiently strong tides, but experts believe it has the potential to be one of the most useful forms of sea-based renewable power, especially now the next generation of technology is coming through.

Marine current power. This form of renewable energy comes from harnessing of the kinetic energy of marine currents that can be found covering large swathes of the oceans, the Gulf Stream that keeps the UK warmer than Siberia is one such current. Marine current power is not widely in use at the moment but has great potential for the future, since marine currents are more reliable and regular than wind and solar energy.

Ocean thermal energy. Known as OTEC for short, this form of renewable energy exploits the difference between the cold water of the deep sea, and the warmer shallows to power a heat engine and produce electricity. Such temperature differentials, which increase the efficiency of a heat engine the greater they are, are at their best in the tropical oceans, with OTEC possessing the potential to offer energy levels up to 100 times greater than forms of energy generation like wave or tidal power. They can also operate continuously and are not dependent on the weather.

Osmotic power. This is the most controversial of all the forms of sea-based renewable energy options. It works due to the difference in salt levels between sea and river water, using osmosis to create energy, according to laboratory tests which are now being converted to practical use in the Netherlands and Norway. However, there are serious concerns over the environmental impact of discharging large quantities of brackish fresh water into the sea, and vice versa. Osmotic power may well be renewable, but it sure isn't green!

Do you know?

- **Wave power.** Perhaps the best known of all forms of renewable energy from the sea, wave power involves harnessing the energy created by the ocean's surface waves to generate electricity, desalinate water or pump it into reservoirs.
- The machines used to exploit wave power are known as **wave energy converters (WECs),** which can be placed on the seashore itself, just off the shore and further out to sea. Once the wave energy has been captured at source, the power generated needs to be transferred to its point of use or connected to the national grid with power lines.

THINK!

- Geothermal energy.

Q.91) Which of the following best describes 'Uranium enrichment'?

a) Increasing the concentration of U-235 isotope in the fuel.
b) Increasing the concentration of U-238 isotope in the fuel
c) Increasing the concentration of thorium in the fuel.
d) All the above

Q.91) Solution (a)

The nuclear fuel used in a nuclear reactor needs to have a higher concentration of the U-235 isotope than that which exists in natural uranium ore. **U-235 when concentrated (or "enriched") is fissionable in light-water reactors (the most common reactor design in the USA).**

Do you know?

- When uranium is mined, it consists of approximately 99.3% uranium-238 (U238), 0.7% uranium-235 (U235), and < 0.01% uranium-234 (U234).

THINK!

- Energy from Bio-resources.

Q.92) In recent times, there is a rise in the exploration works of the shale gas. Which of the following statements are correct regarding 'Shale Gas'?

1. It is predominantly Methane trapped in Shale rock formations.
2. The source of formation of shale gas is somewhere else and it travels through the permeable shale rocks and gets trapped in the pores.

3. Hydraulic Fracturing is the technique used for extraction of Shale gas.

Which of the above statements are correct?

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

Q.92) Solution (c)

Shale Gas

Shale gas refers to natural gas that is trapped within shale formations. Shales are fine-grained sedimentary rocks that can be rich sources of petroleum and natural gas.

Over the past decade, the combination of horizontal drilling and hydraulic fracturing has allowed access to large volumes of shale gas that were previously uneconomical to produce.

Hydraulic Fracturing

Hydraulic fracturing (commonly called "fracking" or "hydrofracking") is a technique in which water, chemicals, and sand are pumped into the well to unlock the hydrocarbons trapped in shale formations by opening cracks (fractures) in the rock and allowing natural gas to flow from the shale into the well. When used in conjunction with horizontal drilling, hydraulic fracturing enables gas producers to extract shale gas at reasonable cost. Without these techniques, natural gas does not flow to the well rapidly, and commercial quantities cannot be produced from shale.

Shale Gas vs. Conventional Gas

Conventional gas reservoirs are created when natural gas migrates toward the Earth's surface from an organic-rich source formation into highly permeable reservoir rock, where it is trapped by an overlying layer of impermeable rock. In contrast, shale gas resources form within the organic-rich shale source rock. The low permeability of the shale greatly inhibits the gas from migrating to more permeable reservoir rocks. Without horizontal drilling and hydraulic fracturing, shale gas production would not be economically feasible because the natural gas would not flow from the formation at high enough rates to justify the cost of drilling.

Q.93) Consider the following statements regarding hydrogen fuel cells:

1. It is a clean energy device which converts chemical energy into electrical energy.

2. The byproduct of hydrogen fuel cell is Carbon dioxide.

Which of the above statements is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.93) Solution (a)

Hydrogen Fuel cells

A fuel cell combines hydrogen and oxygen to produce electricity, heat, and water. Fuel cells are often compared to batteries. Both convert the energy produced by a chemical reaction into usable electric power. However, the fuel cell will produce electricity as long as fuel (hydrogen) is supplied, never losing its charge.

Hydrogen is high in energy, yet an engine that burns pure hydrogen produces almost no pollution. NASA has used liquid hydrogen since the 1970s to propel the space shuttle and other rockets into orbit. Hydrogen fuel cells power the shuttle's electrical systems, producing a clean byproduct - pure water, which the crew drinks.

Fuel cells are a promising technology for use as a source of heat and electricity for buildings, and as an electrical power source for electric motors propelling vehicles. Fuel cells operate best on pure hydrogen. But fuels like natural gas, methanol, or even gasoline can be reformed to produce the hydrogen required for fuel cells.

Think

- Extraction of Hydrogen
- Reforming

Q.94) Lithium air battery is set to revolutionalise the feasibility and efficiency of electric vehicles. Which of the following statements are correct regarding Lithium air battery?

1. It produces much more energy as compared to Lithium ion battery.
2. In this process, Lithium reacts with oxygen to produce energy.
3. One exhausted, lithium air battery cannot be recharged.

Select the code from following:

a) 1 and 2
b) 2 and 3
c) 1 and 3

d) All of the above

Q.94) Solution (a)

Lithium Air batteries

Li-O2 batteries have great potential, providing up to five times more energy than the lithium-ion batteries. It may even be possible to have a rechargeable battery of up to 1,000 watt-hours per kilogram, and all it will need is oxygen. Such a battery could be used to fuel electric automobiles and store the electricity generated by solar panels and wind turbines.

Li-O2 batteries consist of a lithium metal anode whose atoms supply the electrons for the electric circuit when it is being used. The residual Li+ ions then migrate across an electrolyte to the cathode where the incoming electrons from the circuit attach to oxygen (O2) from the atmosphere, forming peroxide ions, O22–. The overall chemical process is:

$2Li + O_2 \rightarrow Li_2O_2$.

When the battery is recharged, the reverse reaction occurs. Lithium metal atoms and O2 are regenerated, with the oxygen being retained in a closed system or supplied anew in an open system. Although the chemistry seems simple, there are hurdles to be overcome.

One obvious problem with lithium-air batteries is lithium itself. This is a reactive metal and yet it needs to be in contact with an electrolyte with which it must not react. Nor must its ions react with the peroxide ions that are formed.

The cathode, too, has its problems. There has to be easy diffusion of oxygen from the air into this so it has to be porous and yet not allow H2O and CO2 to gain access as these will react to form lithium hydroxide (LiOH) and lithium carbonate (Li2CO3), both of which will not regenerate the lithium when the battery is recharged. An oxygen-differentiating polymer membrane is therefore needed to prevent these atmospheric gases gaining access.

Q.95) China has built the first solar powered Highway in the World. Which of the following statements regarding the Highway are correct?

1. It is a 1 km long road built in Jinan.
2. It is made of three layers with transparent concrete on the top, photovoltaic panel in the middle and insulation on the bottom.
3. The electricity generated will be used to power street lights and snow melting system on the road.

Select the code from following:

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

Q.95) Solution (d)

Photovoltaic Highway

In Jinan, the capital of the northeastern Shandong province, China has built the world's first photovoltaic highway.

Extending for 1 km (0.6 miles), the stretch is made of three layers: transparent concrete on the top, photovoltaic panels in the middle, and insulation on the bottom. The area covered comes out to 5,875 square meters (63,200 sq ft).

China is billing the project as the world's first photovoltaic highway. In late 2016, a village in France opened what it claimed was the world's first solar-panel road, running for about the same length as China's new stretch though covering about half the area. In 2014, the Netherlands built a bike path embedded with solar panels.

The expressway could handle 10 times more pressure than the normal asphalt variety and in a year generate 1 million kWH of electricity, which will be used to power street lights and a snow-melting system on the road. It's also designed to supply power to charging stations for electric vehicles, should those be added in the future.

Q.96) Which of the following statements correctly defines cold fusion?

a) It is fusion of two molten metals at room temperature.
b) It refers to a nuclear fusion reaction taking place at cryogenic temperatures.
c) It refers to nuclear fusion reaction taking place at room temperature.
d) It refers to nuclear fusion reaction in the stars.

Q.96) Solution (c)

Cold Fusion

Cold fusion is a hypothesized type of nuclear reaction that would occur at, or near, room temperature. This is compared with the "hot" fusion which takes place naturally within stars, under immense pressure and at temperatures of millions of degrees, and

distinguished from muon-catalyzed fusion. There is currently no accepted theoretical model that would allow cold fusion to occur.

Think

- Difference between Fusion and Fission

Q.97) Which of the following statements are correct regarding different generations of bio – fuels?

1. First-generation biofuels are those which are made from feedstocks that can also be consumed as human food.
2. Second-generation fuels are produced from sustainable feedstock but these feedstocks are *not* normally used for human consumption.
3. Third generation fuels are obtained from algae.

Which of the above statements are correct?

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

Q.97) Solution (d)

Biofuels are broken down into generations, so here we talk about the three main categories under which biofuels fall: First-, second-, and third-generation biofuels.

First Generation Biofuels

first-generation biofuels are those which are made from feedstocks that can also be consumed as human food. Whether it is sugar, starch, or vegetable oil, all of them are also human food products which makes them a first-generation fuel. The feedstocks that typically top this list for first-generation fuels include food crops like corn, sugarcane, sugar beet, wheat and sorghum.

Since they are easily extracted using conventional technology, they are also known as "conventional biofuels."

Most common first-generation biofuels include:

- Biodiesel - extraction of vegetable oils, with or without esterification, from the seeds of plants like soybean, rape (canola) and sunflower

- Ethanol - fermentation of simple sugars from sugar crops (sugarcane) or starch crops (corn, wheat)
- Biogas - anaerobic fermentation of organic waste and crop residues as energy crops

As with any industry, certain concerns (in this case related to cost and inefficiency) arose out of first-generation biofuel production. This evolution naturally led to second-generation biofuels.

Second Generation Biofuels

Like first-generation fuels, second-generation fuels are also produced from sustainable feedstock but, in this case, these feedstocks are *not* normally used for human consumption. That is, no second-generation feedstock is also a food crop, though certain food crops *may become* second-generation fuels if and when they're no longer useful for consumption.

Second-generation non-food feedstocks include woody crops and agricultural residues or waste, which are a little more difficult to extract. For this reason, advanced conversion technologies are needed in the process, which is also why second-generation biofuels are known as "advanced biofuels."

Second-generation technologies cover a wider range of biomass resources, from agriculture to forestry and waste materials. One well-known second-generation technology is called **lignocellulosic processing,** which uses forest materials.

The plus side of second-generation biofuels is the increased efficiency that uses the vast majority of the biomass feedstock which avoids the waste seen in first-generation bioful production.

Third Generation Biofuels

And now we come to the latest phase in the biofuels story: Third-generation. The key word in third-generation fuels is **algae.**

Algae's use in biofuel production was formerly relegated to second generation, but there exist some key differences that have warranted its own separate category. These are, mainly:

- Impressive diversity: Algae can produce such fuels as biodiesel, butanol, gasoline (petrol), ethanol, and even jet fuel!
- Higher yields: Algae is capable of producing much more than its other feedstock counterparts, and with lower resource inputs. By some estimates, algae can produce *10-fold* what even the best conventional feedstocks can generate.

The capital and operating costs of third-generation production are the highest. This sub-sector requires additional research and development to reach the point of being a sustainable method of consistent biofuel production on a commercial scale, but the potential is highly promising.

Q.98) A new concept of Space Based Solar Power (SBSP) is an idea under consideration to generate clean energy. Which of the following statements is/are correct regarding SBSP?

1. It is the concept of collecting solar power in outer space and distributing it to Earth.
2. Solar collectors will collect the light in space and beam it back to earth as microwaves.

Select the code from following:

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.98) Solution (c)

Space-based solar power (SBSP)

Space-based solar power (SBSP) is the concept of collecting solar power in outer space and distributing it to Earth. Potential advantages of collecting solar energy in space include a higher collection rate and a longer collection period due to the lack of a diffusing atmosphere, and the possibility of placing a solar collector in an orbiting location where there is no night. A considerable fraction of incoming solar energy (55–60%) is lost on its way through the Earth's atmosphere by the effects of reflection and absorption.

Space-based solar power systems convert sunlight to microwaves outside the atmosphere, avoiding these losses and the downtime due to the Earth's rotation, but at great cost due to the expense of launching material into orbit. SBSP is considered a form of sustainable or green energy, renewable energy, and is occasionally considered among climate engineering proposals. It is attractive to those seeking large-scale solutions to anthropogenic climate change or fossil fuel depletion (such as peak oil).

Think

- Suntower concept

Q.99) Recently, an India-UK Joint Team won the Newton-Bhabha Fund for a project on –

a) Groundwater Arsenic Research in Ganga River Basin.

b) Tapping huge atomic mineral deposits in Kerala and to meet the energy needs of the country.
c) Mining precious metals trapped in magma on the seabed of the Indian Ocean.
d) Neutrino project in Theni district in Tamil Nadu.

Q.99) Solution (a)

An **India-UK Joint Team** won the Newton-Bhabha Fund for a project on **Groundwater Arsenic Research in Ganga River Basin**.

The Department of Science and Technology has undertaken the project with the Natural Environment Research Council, UK, to find solutions to the water challenges faced in the pervasively arsenic-affected Ganga River Basin.

Do you know?

The **Newton Bhabha Fund**, provided by the **British Council**, aims to bring together the UK and Indian scientific research and innovation sectors to find joint solutions to the challenges facing India in economic development and social welfare.

THINK!

- About Newton Bhabha Fund
- Why Arsenic Contamination is a high-profile problem in the Ganges Delta?

Q.100) Consider the below statements about neutrinos and identify the incorrect statement:

a) Neutrino is a tiny elementary particle, but it is not part of the atom.
b) Neutrino has a very tiny mass, no charge and spin half.
c) Natural neutrinos are harmful as they generate radiation and can cause diseases.
d) Neutrinos come from the sun (solar neutrinos) and other stars, cosmic rays that come from beyond the solar system, and from the Big Bang from which our Universe originated.

Q.100) Solution (c)

What are neutrinos?

Proton, neutron, and electron are tiny particles that make up atoms. The neutrino is also a **tiny elementary particle**, but it is **not part of the atom**. Such particles are also found to exist in nature. Neutrino has a **very tiny mass**, **no charge** and **spin half**. It interacts very weakly

with other matter particles. So weakly that every second trillions of neutrinos fall on us and pass through our bodies unnoticed.

Neutrinos come from the sun (solar neutrinos) and other stars, cosmic rays that come from beyond the solar system, and from the Big Bang from which our Universe originated. They can also be produced in the lab.

Neutrinos come in three types or "flavours" – **electron neutrino**, **tau neutrino** and **muon neutrino.**

They can change from one flavor to another as they travel. This process is called **neutrino oscillation** and is an unusual quantum phenomenon.

Do you know?

- Neutrino oscillation was established by **Sudbury Neutrino Observatory, Canada**, and **Super-Kamiokande experiment in Japan**. They studied Solar neutrinos, atmospheric neutrinos and man-made neutrinos.
- The India-based Neutrino Observatory (INO) will study atmospheric neutrinos only. Solar neutrinos have much lower energy than the detector can detect.
- Natural neutrinos are **harmless**, everyone knows millions of neutrinos pass through us every moment. But artificially produced "collimated" beams of neutrinos generate radiation and can cause diseases.
- Here, "collimated" simply means the beams of neutrinos travel in parallel lines. And all that is called radiation, in scientific usage, is not harmful. Even visible light is a form of radiation.

Source: http://www.thehindu.com/sci-tech/science/what-are-neutrinos-and-how-are-they-detected/article23546887.ece

https://www.thehindubusinessline.com/news/science/all-you-want-to-know-about-the-neutrino-controversy/article23554745.ece

THINK!

- How are neutrinos detected? What's special about locating the INO in the South?
- Why study neutrinos?

Q.101) Recently, scientists have observed a new class of quantum matter created at low temperatures, in which a very large atom contains other ordinary atoms in the space between the nucleus and the electrons. The new state of matter is termed as –

a) Bose Fermion
b) Higgs Boson

c) Rydberg polarons
d) Telluride

Q.101) Solution (c)

Scientists have observed a new class of quantum matter at the very smallest scales in one of the coldest environments ever made. This discovery could pave the way for new technologies including innovations in superconductivity and other cutting-edge fields.

The researchers examined the behavior of matter on the atomic and subatomic scales - known as "quantum matter" - where a large number of particles interact with each other.

This latest discovery reveals a new state of quantum matter called a "**Rydberg polaron**," a relatively giant particle containing many atoms that behaves in some ways like a single massive particle.

Do you know?

About Rydberg polaron

It is an exotic state of matter, created at low temperatures, in which a very large atom contains other ordinary atoms in the space between the nucleus and the electrons.

For the formation of this atom, scientists had to combine two fields of atomic physics: Bose-Einstein condensates and Rydberg atoms.

- Rydberg atoms are formed by exciting a single atom into a high-energy state, in which the electron is very far from the nucleus.
- Bose-Einstein condensates are a state of matter that is produced at temperatures close to absolute zero.

What will be the use of these Rydberg polarons?

A particularly interesting implication is for cosmology. Our universe is believed to be filled with a mysterious 'dark matter' which exerts a gravitational force on other matter.

Some theories of dark matter postulate that it is a cosmic Bose Einstein Condensate, perhaps composed of an as-yet-unknown type of particle. If we are indeed living in an invisible all pervading Bose Einstein Condensate, this experiment can suggest ways to detect it.

Source: http://www.thehindu.com/sci-tech/science/a-new-state-of-matter-created/article22967209.ece

Q.102) Consider the following statements about Noble Gases and identify the incorrect statement:

a) All of the elements in Group Zero are noble gases.
b) The list includes helium, neon (Ne), argon (Ar), krypton (Kr), xenon (Xe), and radon (Rn).
c) They are called noble gases because they are so majestic that, in general, they don't react with anything.
d) Among all noble gases, Neon is the most reactive and xenon is very unreactive.

Q.102) Solution (d)

Noble Gases

The noble gases (historically also the inert gases) make up a group of chemical elements with similar properties; under standard conditions, they are all odorless, colorless, monatomic gases with very low chemical reactivity. The six noble gases that occur naturally are helium (He), neon (Ne), argon (Ar), krypton (Kr), xenon (Xe), and the radioactive radon (Rn).

They traditionally have been labeled Group 0 in the periodic table because for decades after their discovery it was believed that they could not bond to other atoms; that is, that their atoms could not combine with those of other elements to form chemical compounds.

Do you know?

Scientists have actually split the noble gases up into two groups, with krypton, xenon, and radon considered to be relatively reactive, and argon, neon, and helium considered to be very unreactive.

Actually noble gases are least reactive but among all, Xenon is the most reactive and Neon is least reactive.

THINK!

- Oganesson (Og)
- What causes noble gases to be unreactive?

Q.103) Match List I with List II and select the correct answer using the code given below the Lists:

List I	***List II***
Neutrino Observatory experiment names	***Countries***

1. Daya Bay Reactor	A) China
2. Hyper- Kamiokande	B) Japan
3. NOvA	C) US
4. JUNO	D) India

Choose the correct match from below options:

1-2-3-4

a) A-B-C-D
b) C-A-D-B
c) C-B-A-D
d) A-B-C-A

Q.103) Solution (d)

1st Chinese Neutrino Experiment: Daya Bay Reactor Neutrino Experiment (DBRNE)

2nd Chinese Neutrino Experiment: JUNO (Jiangmen Underground Neutrino Observatory)

Hyper- Kamiokande in Japan

NOvA in the U.S.

India's Neutrino Experiment - INO (Indian Neutrino Observatory) - located in Theni, TN (Near Bodhi Hills)

Do you know?

Who else has a neutrino facility?

- Underground: SNO, Canada, Kamioka in Japan and Gran Sasso, Italy.
- Underwater: Amundsen-Scott South Pole Station, Antarctica. Antares - under Mediterranean sea off coast of Toulon, France.

Q.104) Consider the following statements with regard to Atomic Energy Regulatory Board (AERB)

1. AERB is engaged in the development of nuclear power technology, applications of radiation technologies in the fields of agriculture, medicine, industry, and basic research.

2. The safety standards formulated by AERB are at par with those recommended by the international organisations such as the International Atomic Energy Agency (IAEA) and the International Commission on Radiological Protection (ICRP).

Which of the statements given above is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.104) Solution (b)

Department of Atomic Energy (not AERB), established in 1954 is engaged in the development of nuclear power technology, applications of radiation technologies in the fields of agriculture, medicine, industry, and basic research.

Do you know?

Atomic Energy Regulatory Board (AERB) is an independent body, the Atomic Energy Regulatory Board (AERB) monitors safety.

The safety standards formulated by AERB are at par with those recommended by the international organisations such as the International Atomic Energy Agency (IAEA) and the International Commission on Radiological Protection (ICRP).

THINK!

- Functions of AERB

Q.105) Nikolaus Otto was famous for his 1876 discovery of –

a) Nuclear fission
b) Modern internal combustion engine
c) Protactinium
d) Bijov, the most powerful laser in the world

Q.105) Solution (b)

OTTO was born on June 10, 1832 at Holzhausen, Germany. He was the son of a farmer and received meagre education. He left school when he was 16, to work in a merchant's office. Later he shifted to Cologne and became greatly interested in the **gas engine** pioneered by the Belgian, **Jean Lenoir** (1822-1900). This self- taught technologist brought to a successful

conclusion two centuries of experiment **to harness the energy resulting from an explosion in a closed cylinder**.

The principle employed was that of the double-acting steam engine. Instead of steam, gas and air were successively admitted at each end of the cylinder. This enabled induction, explosion and expansion to alternate with exhaustion on either side of the piston. Lenoir's engine patented in 1860 met the need of small industrialists and sold in hundreds. But it had defects of lack of compression and in complete expansion, which limited the range from 1/2 to 3 HP.

To overcome the above defects, Otto built in 1861 a small experimental engine. In 1864, he entered into a collaboration with Eugen Langen to form a company. He received valuable help from a former classmate Franz Reuleaux.

At the Paris Exhibition of 1867, the firm's product a vertical gas engine won a gold medal amongst 14 other gas engines displayed. A new factory, the Gasmotorenfabrik, was built in 1869 at Dentz near Cologne. Otto concentrated on the production side, leaving Langen to develop the engineering side. Gottlieb Daimler (1834-1900) and Wilhelm Maybach (1847-1929) joined the team.

Otto came out in 1876 with the patent for his **four-stroke engine**. This was in validated in 1886 as his competitors brought to notice the obscure pamphlet of Alphonse Bean de Rochas (1815- 1893), where the principle of the four-stroke cycle had already been enunciated.

Otto introduced in 1877 a horizontal engine, the operation of which was similar to Beau's cycle. However, Otto's much more efficient and relatively quiet engine - called the `silent Otto' - was well received and more than 30,000 engines were sold in the first ten years of manufacture. Otto died on January 26, 1891 at Cologne.

The Otto cycle

In the first stroke of the piston, the explosive mixture is drawn into the cylinder. It is compressed on the return stroke. Then ignition is effected and the burning mixture drives the piston during the third stroke. Finally, on the fourth stroke, the burnt gases are expelled out of the cylinder. The cycle is repeated.

The superiority of Otto's new engine over other types was soon recognised. Electric ignition was employed in the beginning; this was substituted by ignition by means of a flame drawn into the cylinder at the correct moment. A later innovation was the hot- tube method, in which a small tube of platinum (or other non- combustible mater) was inserted in the cylinder its outer being closed. The tube was kept at a bright red heat by an external gas flame, and upon compression a portion of the charge was forced into the tube and then

ignited. The invention of the free-float carburettor by Wilhelm Maybach allowed petrol to be used as a fuel instead of gas.

Q.106) What type of mirrors are used in torches, search-lights and vehicle headlights?

a) Convex mirrors
b) Plane mirrors
c) Concave mirrors
d) Both (a) and (c)

Q.106) Solution (c)

The concave mirror is a converging mirror, so that it is used for many purposes, It is used as a **torch to reflect the light**, It is used in the aircraft landing at the airports to guide the aero planes, It is used in **shaving to get an enlarged and erect image of the face .**

The concave mirror is used in **front lights of cars to reflect the light,** It is used in marine lighthouses that are found at the marine ports and at the airports to guide the ships and it is used in the solar ovens.

The **concave mirror is used in the solar ovens and the solar furnaces to collect a large amount of solar energy** in the focus of the mirror for cooking food, heating water, recharging power backups or melting metals respectively.

Concave mirrors are used in **satellite dishes**, they are used in telescopes, Dentist and ENT doctors use them to obtain a larger image than the original of the teeth, ear or skin etc.

Do you know?

- The convex mirror is used as side-view mirror on the passenger's side of a car because it forms an erect and smaller image for the way behind the car.
- The convex mirror is suitable for convenient shop and big supermarket and any other corner where need anti-thief, it is used in the turning off the road and parking.

THINK!

- Applications of convex and concave lenses

Q.107) Which of the following are the medical applications of ultrasound?

1. Echocardiography
2. Ultrasonography
3. Lithotripsy

4. SONAR

Select the correct answer using the codes given below

a) 1, 2 and 3 only
b) 1, 2 and 4 only
c) 2, 3 and 4 only
d) All the above

Q.107) Solution (a)

Sound waves with frequencies higher than the upper audible limit of human hearing are called ultrasound. The limit varies from person to person but is approximately 20,000 hertz. The physical properties of ultrasound are similar to the normal audible sound.

Applications.

Echocardiography: In the process of electrocardiography, the ultrasonic waves are used to form an image of the heart using reflection and detection of these waves from various parts.

Ultrasonography: Medical ultrasound is a diagnostic imaging technique based on ultrasound. It is used for the imaging of internal body structures such as muscles, joints and internal organs. Ultrasonic images are known as sonograms. In this process, pulses of ultrasound are sent to the tissue using a probe. The sound echoes off the tissue, where different tissues reflect sound varying in degrees. These echoes are recorded and displayed an image.

Lithotripsy: Ultrasonic waves are used to break stones in the kidney. High-energy sound waves are passed through the body without injuring it and break the stone into small pieces. These small pieces move through the urinary tract and out of the body more easily than a large stone.

SONAR: SONAR, sound navigation and ranging is a technique in which sound waves are used to navigate, detect and communicate under the surface of the water.

Do you know?

- **Echolocation is** the process where sound waves and echoes are used to determine objects in space. Echolocation **is used by bats to navigate and find their food** in the dark. Bats send out sound waves from their mouth and nose, which then hit the objects in their vicinity producing echoes, which are then received by the bats. The nature of the echo helps them determine the size, the shape and the distance of the object.

THINK!

- Doppler effect

Q.108) Which of the following phenomenon are must for rainbow formation?

1. Reflection
2. Refraction
3. Dispersion
4. Polarization

Select the correct answer using the codes given below

a) 1, 2 and 3 only
b) 2 and 4 only
c) 2, 3 and 4 only
d) All the above

Q.108) Solution (a)

A rainbow is a meteorological phenomenon that is **caused by reflection, refraction and dispersion of light in water droplets** resulting in a **spectrum of light appearing in the sky.** It takes the form of a multicolored circular arc. Rainbows caused by sunlight always appear in the section of sky directly opposite the sun.

In a primary rainbow, the arc shows red on the outer part and violet on the inner side. This rainbow is caused by light being refracted when entering a droplet of water, then reflected inside on the back of the droplet and refracted again when leaving it.

Do you know?

- Rainbows can be caused by many forms of airborne water. These include not only rain, but also mist, spray, and airborne dew.

THINK!

- Monochrome rainbow

Q.109) Consider the following statements.

1. Metal detector works on the principle of electromagnetic induction.
2. Transformer works on the principle of mutual induction.

Which of the above statements is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2

d) None

Q.109) Solution (c)

The operation of metal detectors is based upon the principles of electromagnetic induction. Metal detectors contain one or more inductor coils that are used to interact with metallic elements on the ground.

A transformer operates on the principals of "electromagnetic induction", in the form of Mutual Induction. Mutual induction is the process by which a coil of wire magnetically induces a voltage into another coil located in close proximity to it. Then we can say that transformers work in the "magnetic domain", and transformers get their name from the fact that they "transform" one voltage or current level into another.

Do you know?

- A **cover meter is an instrument** to locate rebars and measure the exact concrete cover. Rebar detectors are less sophisticated devices that can only locate metallic objects below the surface. Due to the cost-effective design, the pulse-induction method is one of the most commonly used solutions.
- The pulse-induction method is based on electromagnetic pulse induction technology to detect rebars.

THINK!

- MRI

Q.110) Which of the following are the applications of polaroid?

1. Polaroids are widely used as polarizing sun glasses.
2. Polaroid films are used to produce three-dimensional moving pictures.
3. In calculators and watches, letters and numbers are formed by liquid crystal display(LCD) through polarization of light.
4. Polarization is also used to study size and shape of molecules.

Select the correct answer using the codes given below

a) 1, 2 and 3 only
b) 2 and 4 only
c) 2, 3 and 4 only
d) All the above

Q.110) Solution (d)

Applications of polaroid.

- Polaroids are widely used as polarizing sun glasses.
- Polaroid films are used to produce three-dimensional moving pictures.
- In calculators and watches, letters and numbers are formed by liquid crystal display(LCD) through polarization of light.
- Polarization is also used to study size and shape of molecules.
- Polaroids are used in the laboratory to produce and analyses plane polarized light.
- They are used to eliminate the head light glare in motor cars.
- They are used to improve color contrasts in old oil paintings.
- They are used as glass windows in trains and aero planes to control the intensity of light. In aero plane one polaroid is fixed outside the window while the other is fitted inside which can be rotated. The intensity of light can be adjusted by rotating the inner polaroid.
- Aerial pictures may be taken from slightly different angles and when viewed through
- polaroid's give a better perception of depth.

Do you know?

- A polarizing filter or polarising filter is often placed in front of the camera lens in photography in order to darken skies, manage reflections, or suppress glare from the surface of lakes or the sea. Since reflections (and sky-light) tend to be at least partially linearly-polarized, a linear polarizer can be used to change the balance of the light in the photograph.

THINK!

- LASER
- MASER

Q.111) When ant bites irritation/itching starts, which of the following substance will you rub on the place of bite to reduce irritation?

a) Common salt
b) Lemon
c) Baking soda
d) Chili powder

Q.111) Solution (c)

The sting of an ant contains formic acid. When an ant bites, it injects the acidic liquid into the skin. **It causes irritation and burning effect on the skin**. To relieve, skin should be rubbed by **moist baking soda or calamine which are basic in nature.**

Do you know?

- An antacid tablet is taken when one suffers from acidity, Because An antacid tablet consists of a base like Milk of Magnesia (magnesium hydroxide). It neutralises the effect of excessive hydrochloric acid released during indigestion.

THINK!

- Wound healing property of turmeric.

Q.112) We see lightning much before we hear its thunder because

a) As a natural phenomenon, thunder occurs after lightning.
b) Intensity of light waves is more than sound waves.
c) Wavelengths of light waves is more than sound waves.
d) All the above

Q.112) Solution (a)

Inside a cumulonimbus cloud, a constant churning goes on because of convectional currents. Updrafts and downdrafts leads to generation of large amount of static charge which falls on the ground as lightning. Once lightning occurs, the temperature for a fraction of second increases to thousands of degrees because of which a temporary vacuum is created. The surrounding air in order to fill this vacuum crashes in which causes a thunder.

Hence we can see lightning first and then thunder.

Do you know?

- At the sunrise and sunset, the sun appears flattered. This apparent flattering of sun's disc is due to the atmospheric refraction.

THINK!

- Optical fiber

Q.113) Piezoelectric Effect is the ability of certain materials to generate an electric charge in response to applied mechanical stress. Which of the following materials show this effect?

a) Quarts
b) Mica
c) Limestone
d) Diamond

Q.113) Solution (a)

Piezoelectric Effect

Piezoelectric Effect is the ability of certain materials to generate an electric charge in response to applied mechanical stress.

When piezoelectric material is placed under mechanical stress, a shifting of the positive and negative charge centers in the material takes place, which then results in an external electrical field. When reversed, an outer electrical field either stretches or compresses the piezoelectric material.

The piezoelectric effect is very useful within many applications that involve the production and detection of sound, generation of high voltages, electronic frequency generation, microbalances, and ultra fine focusing of optical assemblies. It is also the basis of a number of scientific instrumental techniques with atomic resolution, such as scanning probe microscopes (STM, AFM, etc). The piezoelectric effect also has its use in more mundane applications as well, such as acting as the ignition source for cigarette lighters.

Quartz crystals were the first material to be commercially used for piezoelectric effect.

Q.114) Process of endoscopy is used to see the internal organs. Which of the following phenomenon is responsible for working of endoscopy?

a) Reflection
b) Total Internal reflection
c) Scattering
d) Diffraction

Q.114) Solution (b)

Endoscopy

An endoscope is a bit like a bendy telescope a physician can use for seeing inside one of the body's cavities. Unlike a telescope, which is a very rigid tube, the part of an endoscope that enters a person's body is relatively flexible. It consists of two or three main optical cables, each of which comprises up to 50,000 separate optical fibers (made from optical-quality glass or plastic). One or two of the cables carry light down into the patient's body; another one carries reflected light (the image of the patient's body) back up to the physician's eyepiece (or into a camera, which can display it on a TV monitor).

The light travels through endoscope with the help of Total internal reflection.

Q.115) Which of the following phenomenon are studied under 'Fulminology'?

a) Seismic waves
b) Volcanoes
c) Lightning
d) Rainbows

Q.115) Solution (c)

Fulminology

The study or science of lightning is called **fulminology**, and someone who studies lightning is referred to as a fulminologist.

Q.116) Which of the following statements correctly explains the term 'Black Ice'?

a) It is the name given to frozen petroleum.
b) Solid Carbon dioxide
c) It is a thin layer of transparent ice formed on the road.
d) It is the name given to icebergs on which soot and black carbon has settled.

Q.116) Solution (c)

Black Ice

The most basic definition of black ice is a thin coat of highly transparent ice. The reason it is transparent is because it blends in with road pavements since it is so thin, making it nearly impossible to see. It's called black ice since it looks black, like the color of the road pavement it forms on.

If the temperature rises above freezing or the sun comes out during the day, any snow on the ground will slowly melt and cause road surfaces to become wet. If it rains, that could also lead to wet roadways with some puddles.

If the temperature then drops below freezing while the ground is still wet, black ice will likely form on paved surfaces due to the refreezing.

Black ice can also form if moisture in the air condenses and forms dew or fog, and then the temperature drops below freezing.

Since black ice is highly transparent, it is unlikely you'll be able to see it while driving down the road. Roadways become very slippery when black ice forms, leading to hazardous driving conditions and an increased risk of car accidents.

Think

- Dry ice

Q.117) Parsec is a unit of measurement used to measure distance in Space. One Parsec is equal to

a) 5 light years
b) 3.261 light years
c) 7.48 light years
d) 11.2 light years

Q.117) Solution (b)

Parsec

The parsec (symbol: pc) is a unit of length used to measure large distances to astronomical objects outside the Solar System. One parsec is equal to about 3.26 light-years (30 trillion km or 19 trillion miles) in length. The nearest star, Proxima Centauri, is about 1.3 parsecs (4.2 light-years) from the Sun.[2] Most of the stars visible to the unaided eye in the night sky are within 500 parsecs of the Sun.

Q.118) Almost everyone has switched to DTH connections from the archaic cable connections. Which part of the DTH satellite dish converts the radio wave signals to electrical signals?

a) Modem
b) Parabolic dish
c) Orthomode tranceducer (OMT)
d) Low Noise Block Convertor (LMB)

Q.118) Solution (d)

Low Noise Block Convertor (LMB)

A low-noise block downconverter (LNB) is the receiving device mounted on satellite dishes used for satellite TV reception, which collects the radio waves from the dish and converts

them to a signal which is sent through a cable to the receiver inside the building. Also called a low-noise block, low-noise converter (LNC), or even low-noise downconverter (LND), the device is sometimes inaccurately called a low-noise amplifier (LNA).

Q.119) After your selection if you would want to boil water in your academy, in which of the following academies, the water will boil at the lowest temperature?

a) LABSNAA, Mussoorie
b) National Police Academy, Hyderabad
c) National Academy of Direct Taxes, Nagpur
d) Water will boil at the same temperature everywhere

Q.119) Solution (a)

Water boils at a lower temperature at higher altitudes. This is because atmospheric pressure is low. Since Mussoorie is at the highest altitude in the given options, that will be the correct answer.

Q.120) The "Lodestone" has a historical significance as being humans' first encounter with a new phenomenon. What mineral is closest to this material?

a) Limonite
b) Hematite
c) Magnetite
d) Siderite

Q.120) Solution (c)

A lodestone is a naturally magnetized piece of the mineral magnetite. They are naturally occurring magnets, which can attract iron.

The property of magnetism was first discovered in antiquity through lodestones. Pieces of lodestone, suspended so they could turn, were the first magnetic compasses, and their importance to early navigation is indicated by the name lodestone, which in Middle English means 'course stone' or 'leading stone', from the now-obsolete meaning of lode as 'journey, way'.

Do you know?

Lodestone is one of only a very few minerals that is found naturally magnetized.

The process by which lodestone is created has long been an open question in geology. Only a small amount of the magnetite on the Earth is found magnetized as lodestone.

Q.121) Recently a discovery of what was named 'Ata' after its location in the Atacama desert of Chile led to the suspicion that it may be an 'Alien' from outer space. What was this in fact?

a) A flying saucer-like object
b) A six-inch fossil skeleton
c) A hitherto unknown animal species
d) A five-feet reptile

Q.121) Solution (b)

Ata is the common name given to the 6-inch (15 cm) long skeletal remains of a human fetus found in 2003 in a deserted Chilean town in the Atacama Desert, hence the abbreviated name Ata.

Its unusual alien-like features – an elongated skull ending in a point and enlarged eye sockets – prompted many to treat it as evidence of extraterrestrial life.

However, recent study which used whole genome sequencing has shown that Ata is a female of human origin, likely of Chilean descent.

Whole DNA (genome) analysis of the remains determined that it was a female human fetus that had 64 unusual mutations in 7 genes linked to the skeletal system.

Source: http://www.thehindu.com/sci-tech/science/bizarre-alien-skeleton-was-of-human-foetus-study/article23344011.ece

Q.122) Which of these discoveries is a landmark evidence of Big Bang theory?

a) Quasars
b) The first exoplanet 51 Pegasi b
c) Cosmic Microwave Background Radiation
d) Supernova

Q.122) Solution (c)

The cosmic microwave background (CMB) is electromagnetic radiation as a remnant from an early stage of the universe in Big Bang cosmology. In older literature, the CMB is also variously known as cosmic microwave background radiation (CMBR) or "relic radiation".

The CMB is a faint cosmic background radiation filling all space that is an important source of data on the early universe because it is the oldest electromagnetic radiation in the universe, dating to the epoch of recombination. With a traditional optical telescope, the space between stars and galaxies (the background) is completely dark. However, a sufficiently sensitive radio telescope shows a faint background noise, or glow, almost isotropic, that is not associated with any star, galaxy, or other object. This glow is strongest in the microwave region of the radio spectrum.

The accidental discovery of the CMB in 1964 by American radio astronomers Arno Penzias and Robert Wilson was the culmination of work initiated in the 1940s, and earned the discoverers the 1978 Nobel Prize in Physics.

Do you know?

- After the Big Bang, the universe was filled with different types of radiation. The microwave background radiation (MBR) is one of the earliest radiations and we can find it scattered everywhere in the universe.
- The discovery of CMBR is landmark evidence of the Big Bang origin of the universe.

Source: http://www.thehindu.com/education/catching-the-cosmic-rays/article22643466.ece

Q.123) Invisible to the naked eye, prokaryotes such as archaea and bacteria form a huge section of the living world. What is the characteristic of these microbes?

a) They have a well-defined membrane-bound nucleus.
b) They are found only in water bodies.
c) They contain membrane-bound organelles.
d) They have no well-defined membrane-bound nucleus.

Q.123) Solution (d)

The distinction between prokaryotes and eukaryotes is considered to be the most important distinction among groups of organisms. Eukaryotic cells contain membrane-bound organelles, such as the nucleus, while prokaryotic cells do not. Differences in cellular structure of prokaryotes and eukaryotes include the presence of mitochondria and chloroplasts, the cell wall, and the structure of chromosomal DNA.

Prokaryotes were the only form of life on Earth for millions of years until more complicated eukaryotic cells came into being through the process of evolution.

THINK!

- Know the differences between prokaryotes and eukaryotes

Q.124) What is solar geoengineering?

a) Study on how to reduce the glare from the sun to curb climate change
b) Study of the sun's surface
c) Study of the relationship between Earth and Sun
d) All of the above

Q.124) Solution (a)

Solar geo-engineering or Solar radiation management (SRM) projects are a type of climate engineering which seek to reflect sunlight and thus reduce global warming.

Proposed methods include increasing the planetary albedo, for example using stratospheric sulfate aerosols. Restorative methods have been proposed regarding the protection of natural heat reflectors like sea ice, snow and glaciers with engineering projects. Their principal advantages as an approach to climate engineering is the speed with which they can be deployed and become fully active, their potential low financial cost, and the reversibility of their direct climatic effects.

Solar radiation management projects could serve as a temporary response while levels of greenhouse gases can be brought under control by mitigation and greenhouse gas removal techniques. They would not reduce greenhouse gas concentrations in the atmosphere, and

thus do not address problems such as ocean acidification caused by excess carbon dioxide (CO_2).

Do you know?

- In the last decade, solar geo-engineering has rapidly garnered attention as a plausible method to counteract global warming.
- So-called solar radiation management works by preventing some of the sun's rays from hitting the planet's surface, forcing them instead back up into space.

Source: http://www.thehindu.com/sci-tech/science/developing-nations-to-study-ways-to-dim-sunshine-slow-warming/article23433930.ece

Q.125) We all know WiFi. Now, what is SoFi?

a) Robotic fish, built with a generic fish design
b) The first robot declared a citizen by Saudi Arabia
c) Next generation WiFi
d) Social Finance, online personal finance company

Q.125) Solution (a)

SoFi is a robotic fish, built with a generic fish design. A remote-controlled robot that swims quietly through coral reefs and schools of fish and uses a fisheye lens to capture high-resolution photos and video with a camera built into its nose.

SoFi can swim forward, move up and down, turn and change speeds, propelling itself by wiggling its tail side to side like a real fish, a motion created by pumping water with a small motor into two balloon-like tail chambers. SoFi, built with a generic fish design, is white, weighs less than 1.6 kg and is about 47 cm long.

Do you know?

- SoFi's "soft artificial muscle" tail is made of silicone elastomer, a type of rubber. Its nose houses the electronic elements. It has two side fins for maneuvering.
- SoFi - abbreviates the word Soft Fish
- SoFi is operated using a waterproofed Super Nintendo controller by a diver who can be almost 70 feet away.
- The robot can be used as a marine biology instrument and also to measure pollution in coastal waters, to create maps, to do inspection, to monitor and track.

Source: http://www.thehindu.com/sci-tech/science/new-robot-fish-from-mit-to-study-ocean-life/article23319825.ece

Q.126) Recently, a 3D conic device called 'Artificial Transpiration' that can increase solar-thermal conversion was developed by –

a) France
b) Faroe Islands
c) China
d) USA

Q.126) Solution (c)

Chinese scientists have developed a new device of 3D hollow-cone structure that can greatly increase the solar-thermal conversion efficiency.

The device, named 'Artificial Transpiration' by Zhu Jia and his team from the Nanjing University, is inspired by the transpiration process of trees.

Do you know?

It has a special 1D water path within it, which can reduce the energy loss in conduction, China's state-run Xinhua news agency quoted the article as saying.

The cone structure, based on a graphene film, can collect more sunlight throughout the day when compared with a flat device, as about 10 per cent to 50 per cent of sunlight is diffusive. Thus it performs even better in the real world than in the laboratory.

As a result, the device can enhance the solar-thermal conversion rate to 85 per cent, which is much higher than the 40 per cent rate of common devices, it said.

Many sectors have refrained from using solar power because of its low conversion rate caused by losses in radiation, convection and conduction. The device will open new possibilities in utilisation of solar energy.

Zhu's team first applied this structure to solar waste-water treatment, and the test showed that it could not only retrieve clean water but also recycle heavy metals such as copper and cadmium.

In the future, the structure can be further optimised to have a longer life and recycle more heavy metals.

Source: http://www.thehindu.com/sci-tech/technology/china-develops-3d-conic-device-to-increase-solar-thermal-conversion/article23555120.ece

Q.127) Consider the following statements with regard to Aqua Regia.

1. It is a mixture of nitric acid and hydrochloric acid.
2. It is also known as royal water.
3. It is used to separate gold and silver.

Which of the above statements is/are correct?

a) 1 only
b) 2 only
c) 1, 2 and 3 only
d) 2 and 3 only

Q.127) Solution (c)

Aqua Regia ("royal water" or "king's water") is a mixture of **nitric acid and hydrochloric acid,** optimally in a molar ratio of 1:3. Aqua Regia is a yellow-orange fuming liquid, so named by alchemists because **it can dissolve the noble metals gold and platinum, though not all metals. It is used to separate gold and silver.**

Do you know?

- Pickles are always stored in glass jar because acid present in them reacts with the metal of metallic pot.

THINK!

- Oil of vitriol

Q.128) Which of the following are artificial sweeteners?

1. Saccharin
2. Aspartame
3. Alitame
4. Sucralose

Select the correct answer using the codes given below.

a) 1 and 2 only
b) 2 and 3 only
c) 2, 3 and 4 only
d) All the above

Q.128) Solution (d)

A sugar substitute is a food additive that provides a sweet taste like that of sugar while containing significantly less food energy. Some sugar substitutes are produced by nature, and others produced synthetically.

The world's most commonly used artificial sweetener, **sucralose is a chlorinated sugar** that is about 600 times as sweet as sugar. It is produced from sucrose when three chlorine atoms replace three hydroxyl groups.

Aspartame is an odorless, white crystalline powder that is derived from the two amino acids aspartic acid and phenylalanine. It is about 200 times as sweet as sugar and can be used as a tabletop sweetener or in frozen desserts, gelatins, beverages, and chewing gum.

Saccharin was the first artificial sweetener and was originally synthesized in 1879 by Remsen and Fehlberg. Its sweet taste was discovered by accident. It had been created in an experiment with toluene derivatives. A process for the creation of saccharin from phthalic anhydride was developed in 1950, and, currently, saccharin is created by this process as well as the original process by which it was discovered.

Alitame is an aspartic acid-containing dipeptide sweetener. It was developed by Pfizer in the early 1980s and currently marketed in some countries under the brand name Aclame. Most dipeptides are not sweet, but the unexpected discovery of aspartame in 1965 led to a search for similar compounds that shared its sweetness. Alitame is one such second-generation dipeptide sweetener. Neotame, developed by the owners of the NutraSweet brand, is another.

Do you know?

- An antioxidant is a molecule that inhibits the oxidation of other molecules. Oxidation is a chemical reaction that can produce free radicals, leading to chain reactions that may damage cells.

THINK!

- Sources of antioxidants

Q.129) Consider the following pairs.

Thermoplastic	Uses
1. Polythene	Bottles
2. Teflon	Containers and pipes that come in contact with reactive chemicals.
3. Polyvinyl chloride	coats, jackets and upholstery

Which of the above pairs is/are correctly matched?

a) 1 and 2 only
b) 2 and 3 only
c) 1, 2 and 3
d) 2 only

Q.129) Solution (c)

Polyethylene

Polyethylene (or polyethene, polythene, PE) is a family of materials categorized according to their density and molecular structure. For example, ultra-high molecular weight polyethylene (UHMWPE) is tough and resistant to chemicals, and it is used to manufacture moving machine parts, bearings, gears, artificial joints and some bulletproof vests. High-density polyethylene (HDPE) is used to make milk jugs, margarine tubs and water pipes. Medium-density polyethylene (MDPE) is used for packaging film, sacks and gas pipes and fittings. Low-density polyethylene (LDPE) is soft and flexible and is used in the manufacture of **squeeze bottles, sacks and sheets.**

Polyvinyl chloride (PVC) is a tough, lightweight material that is resistant to acids and bases. Much of it is used by the construction industry, such as for vinyl siding, drainpipes, gutters and roofing sheets**. It is also converted to flexible forms with the addition of plasticizers, thereby making it useful for items such as hoses, tubing, electrical insulation, coats, jackets and upholstery.** Flexible PVC is also used in inflatable products, such as water beds and pool toys.

Teflon is the brand name given by DuPont Corp. for a polymer called polytetrafluoroethylene (PTFE), which belongs to a class of thermoplastics known as fluoropolymers. It is famous as a coating for non-stick cookware**. Being chemically inert, it is used in making containers and pipes that come in contact with reactive chemicals**. It is also used as a lubricant to reduce wear from friction between sliding parts, such as gears, bearings and bushings.

Do you know?

- Polystyrene is manufactured in various forms that have differing applications. Extruded polystyrene (PS) is used in the manufacture **of disposable cutlery, CD and DVD cases, plastic models of cars and boats, and smoke detector housings.**

THINK!

- Bakelite
- Melamine

Q.130) Which of the following are synthetic fibers?

1. Rayon
2. Nylon
3. Polyester
4. Acrylic

Select the correct answer using the codes given below.

a) 1 and 2 only
b) 2 and 3 only
c) 2, 3 and 4 only
d) All the above

Q.130) Solution (d)

Types of Synthetic fibers-

- Rayon
- Nylon
- Polyester
- Acrylic are some synthetic fibers.

Rayon: Rayon is made from wood (artificial silk) pulp, a naturally- occurring, cellulose- based raw material. Rayon is moisture- absorbent and comfortable to wear.

Uses:

- Home furnishings such as bedspreads, bed sheets, blankets, curtains, tablecloth, carpets etc. are made from rayon fiber, as it has a silky lustre.
- It is strong fiber, it is used in automobile tyre cords.
- It is used to make apparel such are suits, jackets, slacks etc.

Nylon was the first synthetic fiber to be made entirely from chemicals. Basic raw materials for the production of nylon are coal, petroleum oil, water and air. Nylon fiber is very strong and elastic. It is light and wrinkle- resistant. It is easy to wash and absorbs very little water.

Uses:

- Garments such as saris are made from nylon. Since it is wear resistant, garments made from it last for a long time.
- Being very strong, nylon fiber is used to make ropes, tents, fishing nets and parachutes.
- It is also used to make toothbrushes, combs, zip fasteners and machine parts.

Polyester: Polyester is a polymer of many ester units. Polyester is manufactured from petroleum Polyester fibers are extremely strong, very durable, resistant to most chemicals and do not get wrinkled easily. Polyester does not absorb water, so it dries quickly. PET (Polyethylene terephthalate), the commonly used polyester, is made from two monomers by condensation polymerization.

Uses:

- Polyester is used to make pants, shirts, suits and bed sheets either by itself or as a blend.
- Its water- resistant property makes it ideal for garments & jackets that are to be used in wet or damp environments.

Acrylic: Acrylic is a light weight soft and warm synthetic fabric which has a wool like feel. It does not shrink is wrinkle- resistant and cheaper than wool. It can also be dyed very well in a variety of color.

Uses:

- Strong & warm, acrylic fiber is often used for making sweaters and tracksuits and as linings for boots and gloves as well as in furnishing fabrics and carpets.
- It is used in craft yarns, boat sails and vehicle covers.

Do you know?

- Glass wool is an insulating material made from fibres of glass arranged using a binder into a texture similar to wool.

THINK!

- Glass fiber.

Q.131) Consider the following pairs.

Drugs	Uses
1. Antipyretics	These drugs kill another organism and check the growth (spread) of virus and bacteria.
2. Antiseptics	This is specially used to prevent blood to be polluted and in cleaning wounds
3. Antibiotics	They are used as body pain reliever and in the form of medicine of fever etc

Which of the above pairs is/are correctly matched?

a) 1 and 2 only
b) 2 and 3 only
c) 1, 2 and 3

d) 2 only

Q.131) Solution (d)

Antiseptics: Antiseptic drugs are helpful in killing micro organism (virus and bacteria) and in preventing its spread. **This is specially used to prevent blood to be polluted and in cleaning wounds by suitable antiseptics.** There are three antiseptic substances which are today frequently used in making antiseptics as suggested by Semmelwies, Lister and Koch. Some antiseptic drugs which are commonly used are Iodine, Hypochlorous acid, Ethyl alcohol, phenols Hexachlorophene, Formaldehydes, Hydrogen peroxide, Acriflavine etc.

Antipyretics: Antipyretics are used as body pain reliever and in the form of medicine of fever etc. Some important antipyretic drugs are- Asprin, Crocin, Phenacitin, Pyromidin etc.

Antibiotics: Antibiotic drugs are prepared by microorganism; moulds, fungi etc and these **drugs kill another organism and check the growth (spread) of virus and bacteria**. The firstly Alexander Flemming invented the drug Penicillin (antibiotic) in 1929 which is used a destroyer of virus, bacteria and fungi. Some more important antibiotics which are used frequently are- Tetracycline, Cephalosporin, Streptomycin, Gentamycin, Rifamycin, Chloromycitin etc.

Do you know?

- **Sulpha Drugs:** These drugs are mainly composed from sulphur and nitrogen and such drugs are sharply effective against certain organisms. Some sulpha drugs are used specially for animals. The first sulpha drug was sulphanilamide invented and formed in 1908. Some important sulpha drugs are- Sulphanilamide, Sulphadigine, Sulpha pyridine, Sulphathiogol etc.

THINK!

- Anesthesia

Q.132) After white washing, within two or three days a shiny finish appears on walls. With reference to this, which of the following statements is correct?

a) The solution used for white washing reacts slowly with oxygen to give a shiny finish.
b) Formation of Calcium carbonate ($CaCO_3$) gives a shiny finish to the walls.
c) Precipitation of Aluminum oxide on the surface of the walls.
d) None of the above

Q.132) Solution (b)

A solution of slaked lime (Ca(OH)2) is used for white washing walls. Calcium hydroxide reacts slowly with the carbon dioxide in air to form a thin layer of calcium carbonate on the walls. Calcium carbonate (CaCO3) is formed after two to three days of white washing and gives a shiny finish to the walls. The chemical formula for marble is also CaCO3.

Do you know?

- Calcium carbonate contains vitamin D which is essential for human body. Calcium carbonate is used as a dietary calcium supplement. Calcium carbonate makes bones and teeth strong and healthy. It can be used for disease like heart burn, high potassium osteoporosis, over active thyroid and so on.

THINK!

- Potash Alum

Q.133) The term 'Rancidity' refers to:

a) Decrease in pH of soil after acid rain.
b) Oxidation of unsaturated fat present in food products causing unpleasant odor or flavor.
c) Conversion of basic solution into acidic due to addition of hydrogen ions.
d) The process of formation of photochemical smog.

Q.133) Solution (b)

Rancidity is a condition produced by aerial oxidation of unsaturated fat present in foods and other products marked by unpleasant odor or flavor.

When a fatty substance is exposed to air, its unsaturated components are converted into hydroperoxides, which break down into volatile aldehydes, esters, alcohols, ketones, and hydrocarbons, some of which have disagreeable odors.

Butter becomes rancid by the foregoing process and by hydrolysis, which liberates volatile and malodorous acids, particularly butyric acid.

To prevent it antioxidants are added to foods containing fats and oil. Keeping food in air tight containers help to slow down the process.

Do you know?

- Similar to rancidification, oxidative degradation also occurs in other hydrocarbons, such as lubricating oils, fuels, and mechanical cutting fluids.

THINK!

- Fermentation

Q.134) Which of the following statements are correct regarding Parker Solar Probe of NASA?

1. It is a robotic spacecraft to probe the outer corona of the sun.
2. It will stay at Lagrange Point 1 to study the sun's atmosphere.
3. It is the first ever mission to be named after a living person.

Select the code from following:

a) 1 only
b) 2 and 3
c) 1 and 2
d) 1 and 3

Q.134) Solution (d)

Parker Solar Probe

Parker Solar Probe (previously Solar Probe, Solar Probe Plus, or Solar Probe+) is a planned NASA robotic spacecraft to probe the outer corona of the Sun. It will approach to within 8.86 solar radii (6.2 million kilometers or 3.85 million miles) from the 'surface' (photosphere) of the Sun.

The project was announced in the fiscal 2009 budget year. Johns Hopkins University Applied Physics Laboratory designed and built the spacecraft, which was originally scheduled to launch in 2015.The launch date has since been rescheduled to the summer of 2018. This was the first time a NASA spacecraft was named after a living person, honoring physicist Eugene Parker.

Think

- Aditya L1
- Solar Flair

Q.135) Which of the following statements correctly explains 'DigiShala'?

a) It is a digital wallet developed by Ministry of Communication to promote digital payments in rural areas.
b) These are temporary schools developed in rural India to facilitate digital payments and create awareness regarding the same.

c) It is a free Doordarshan DTH channel, launched to educate and inform the people about the various modes of digital payments.
d) It is a program of Miety to create awareness about digital India in schools.

Q.135) Solution (c)

DigiShala

DigiShala, a free Doordarshan DTH channel is launched to educate and inform the people about the various modes of digital payments. DigiShala will be available through GSAT15 (DD Direct DTH), 93.5 degree East, Receive frequency: 11590 Mhz

The channel will help people understand the use of unified payments interface (UPI), USSD, aadhaar-enabled payments system, electronic wallets, debit and credit cards.

A website was also launched which will serve as a repository of knowledge regarding digital payments.

Both the channel and website were launched as a part of the '**Digi Dhan Abhiyan'**, a campaign conceptualized by the IT ministry to enable every citizen, small trader and merchant to adopt digital payments in their everyday financial transactions.

Significance: DigiShala will enable and empower every citizen of the country, especially farmers, students, Dalits and women in rural areas to learn the usefulness and benefits of digital payment in our everyday life to adopt the same on a mass scale

The provision of digital literacy to semi-urban and rural sector of the economy has become the major focus area for the government

Think

Swayam and Swayam Prabha

Q.136) Which of the following statements are correct regarding 'AmbuSens'?

1. It is a wireless technology developed to monitor condition of those patients who are ferried in Ambulances.
2. It is an app developed by researchers in IIT Kharagpur to locate the nearest ambulance in case of emergency.
3. The AmbuSens system includes both hardware and software.

Select the code from following:

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

Q.136) Solution (c)

AmbuSens

Indian Institute of Technology, Kharagpur has developed a wireless technology called 'AmbuSens' for remote monitoring of condition of those patients who are ferried in ambulances.

The AmbuSens system includes both hardware and software. The ambulance and the hospitals will have laptops or tablets with internet connection to continuously monitor the health condition of the patients in real-time.

The patients will be fitted with wireless body sensors. The technology will monitor the parameters like ECG, heart-rate, temperature and blood-pressure and can ensure remote monitoring of the patient's condition even before they reach the hospital.

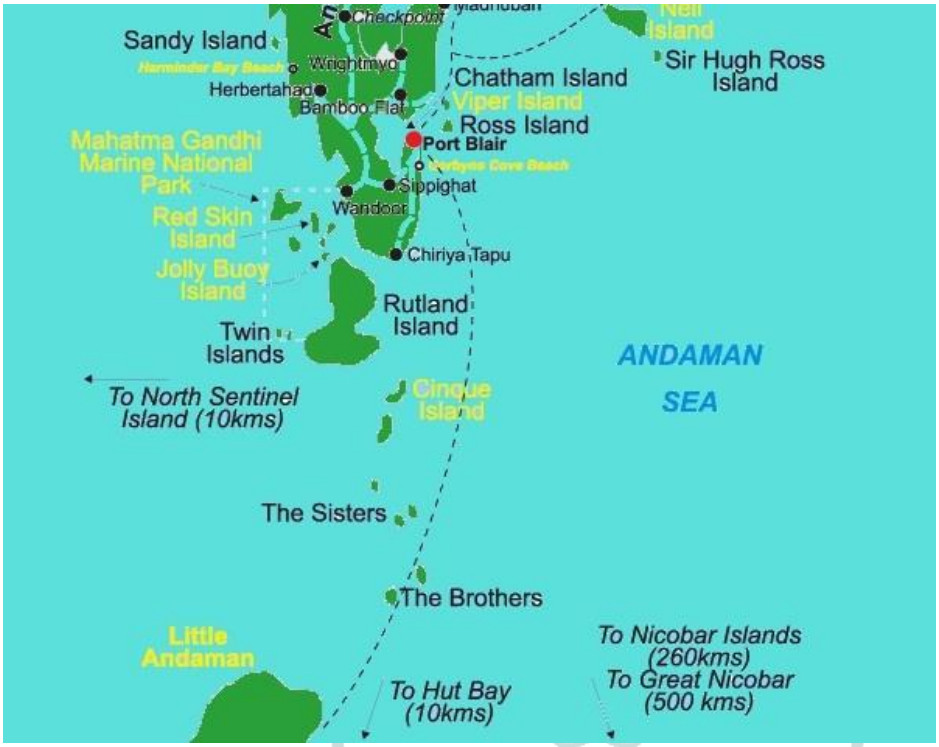
Q.137) The National Board of Wildlife has approved Rutland Island to be the site for the country's long-range missile test facility. Where is Rutland Island Located?

a) Andaman and Nicobar Islands
b) Odisha Coast
c) Goa Coast
d) Lakshadweep

Q.137) Solution (a)

The National Board of Wildlife has approved Rutland Island in South Andaman to be the site for the country's long-range missile test facility. DRDO has been seeking the approval for the test facility since 2012. Taking into account the strategic importance of the project for country's defence, the Standing Committee of the National Board of Wildlife has approved the project.

The island is located at an ideal distance from the mainland where tests are typically launched from. The test facility is vital for DRDO's plans to have a comprehensive testing facility in order to identify and track long-range missile tests. DRDO also requires a land-based test area to accurately track its long range missiles. The Rutland Island is ideally located due to its distance from mainland.



Think

- Chandipur
- Wheeler Island

Q.138) The World's first hybrid 'Aeroboat' has been developed by a joint venture of India and Russia. Which of the following statements regarding aeroboat are correct?

1. The aeroboat is capable of travelling on land, water, snow and sand.
2. Aeroboats are much faster and robust when compared to hovercrafts.
3. It is capable of take off without runway and can fly in all weather conditions.

Select the code from following:

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

Q.138) Solution (a)

Aeroboat

The world's first hybrid "aeroboat" capable of travelling on land, water, snow and sand has been built by an Indo-Russian joint venture. The aeroboat was unveiled in Moscow on Tuesday at a start-ups event organised by Russia's state-run Skolkovo Foundation.

All about the world's first hybrid aeroboat:

- The aeroboat is capable of travelling on land, water, snow and sand. It has been designed to access difficult terrain, such as flooded or marshy areas in which the regular boats cannot handle because of shallow water, patches of dry land or by marine vegetation
- The aeroboat can handle steep slopes and embankments without the requirement of marine infrastructure, such as jetties
- It will have room for 10 passengers and one crew member
- Aeroboats are much faster and robust when compared to hovercrafts. They are capable of moving at the speed of around 150 kmph or more on water, while hovercrafts can move at around 45-50 kmph or more
- Unlike hovercrafts, aeroboats are cheaper to maintain and fuel. The aeroboat "hybrid" engine is capable of running on either petrol or electricity, thus helping in reducing the carbon emissions and improve energy efficiency
- While hovercrafts work on static air cushion, aeroboats function on dynamic air-cushion. The dynamic air-cushion feature provides a lot of advantage to aeroboats in terms of speed and manoeuvrability
- The amphibious aeroboats can provide high-speed year-round navigation even in frozen surfaces
- In India, these aeroboats will be very helpful for disaster management authorities, especially during the monsoon season.

Q.139) Which of the following statements correctly explains the 'Internet of Birds'?

a) Internet connectivity is provided to users using a collar for common urban birds which will emit radio waves.

b) It is a mechanism to trace the movement of endangered birds using a electromagnetic collar.
c) It is the name given to a network created by mobile internet devices.
d) It is a platform to identify birds from Indian Sub continent with the help of Artificial Intelligence.

Q.139) Solution (d)

Internet of Birds

Accenture Labs in Bengaluru and the Bombay Natural History Society (BNHS) in Mumbai have developed an Internet of Things-based platform that identifies birds.

The cloud-based software uses Artificial Intelligence (machine learning and computer vision) to recognise species from digital photographs.

Q.140) Ministry of Science and Technology has launched 'VAJRA' scheme to connect the Indian academic and research and development (R&D) systems to the best of global science and scientists for a sustained international collaborative research. Which of the following statements are correct regarding VAJRA scheme?

1. Under this scheme, foreign researchers abroad of Indian origin or otherwise can collaborate with faculties in public funded Indian institutions.
2. The VAJRA faculty can reside in India for a minimum of 1 month and a maximum of 3 months a year.
3. VAJRA Faculty is provided US Dollars 15000 in the first month of residence and US Dollars 10000 in each of the subsequent month.

Select the code from following:

a) 1 only
b) 2 and 3
c) 1 and 3
d) All of the above

Q.140) Solution (d)

'Visiting Advanced Joint Research (VAJRA) Faculty Scheme'

The Science and Engineering Research Board (SERB), a Statutory body of the Department of Science and Technology (DST) has recently launched a 'Visiting Advanced Joint Research

(VAJRA) Faculty Scheme' to connect the Indian academic and research and development (R&D) systems to the best of global science and scientists for a sustained international collaborative research.

The scheme offers adjunct / visiting faculty assignments to overseas scientists, faculty members and R&D professionals including Non-resident Indians (NRI) and Overseas Citizen of India (OCI) to undertake high quality collaborative research in cutting edge areas of science and technology including interdisciplinary areas of priority such as energy, water, health, security, nutrition, materials and manufacturing, etc. with one or more Indian collaborators of public funded academic and research institutions of India.

The VAJRA Faculty should be an active researcher working in an overseas leading academic / research / industrial organization with significant accomplishments in R&D.

The initial Faculty assignment is given for a period of one year extendable to subsequent years based on the collaborative outcome and interest.

The residency period of VAJRA Faculty in the host institution would be for a minimum of 1 month and a maximum of 3 months every year. VAJRA Faculty is provided US Dollars 15000 in the first month of residence and US Dollars 10000 in each of the subsequent month. Presently, call for applications is made open for prospective researchers.

Q.141) With the boom of the bitcoin – a variety of cryptocurrency – the blockchain technology has come into prominence. What does this technology promise to do, even though it is still in its infancy?

a) Help facilitate secure, online transactions in a decentralized way
b) Keep out malware
c) Connect servers with common reasons for existence, remotely
d) Helps to remove inequality and promote inclusive development

Q.141) Solution (a)

What is blockchain?

Blockchain is the backbone technology on which bitcoins run. Simply put, it is a digital public ledger that records every transaction. Once a transaction is entered in the blockchain, it cannot be erased or modified.

Blockchain removes the need for using a trusted third party such as a bank to make a transaction by directly connecting the customers and suppliers. Each transaction is recorded

to the ledger after verification by the network participants, mainly a chain of computers, called nodes.

Blockchain today may be compared to what the Internet was in the early 1990s. While we have witnessed how the 'Internet of Information' has changed our society over the past two decades, we are now entering a phase where blockchain may do the same by ushering in a new paradigm comprising 'Internet of Trust' and 'Internet of Value', as per a Deloitte and Assocham study.

Do you know?

Bitcoin is just one of the applications for the technology, whose use is being tested across industries. It is witnessing a lot of traction within India, in sectors such as banking and insurance. In most of these industries, players are coming together to form a consortium to realise the benefits of blockchain at an industry level.

For example, in India, there is a consortium 'BankChain' which has about 27 banks from India (including State Bank of India or SBI and ICICI) and the Middle East as its members. The consortium is exploring using usage of Blockchain technology to make business safer, faster and cheaper.

The Institute for Development and Research in Banking Technology (IDRBT), an arm of the Reserve Bank of India (RBI), is developing a model platform for blockchain technology.

What are the benefits?

The benefits of using blockchain will vary from case to case.

The major uses of blockchain technology are focused on the decentralized data storage, data immutability, and distributed ownership features.

Blockchain is expected to improve the efficiency of a transaction by eliminating the middlemen, while also reducing the cost of all transactions. It is also likely to increase transparency. and bring down fraud as every transaction would be recorded and distributed on a public ledger.

What is happening in India?

A high-level committee, which consists of officials from the Ministries of Finance, Home Affairs and IT as well as SEBI, the RBI, SBI, and NITI Aayog, is currently deliberating on whether or not cryptocurrencies should be banned in India. However, the discussions till now are learnt to be in support of encouraging the use of blockchain technology.

Q.142) Water deep inside oceans doesn't freeze even when the temperature in the deep is extremely low. Why?

a) Difference in salinity
b) Warm ocean currents prevent freezing
c) Water deep inside the oceans is under very high pressure
d) Water deep inside the oceans is under low pressure

Q.142) Solution (c)

A liquid freezes when its body temperature falls below its freezing point and a solid melts when its body temperature rises above its melting point. Though the term, 'melting point,' means the temperature where the solid commences to melt and the term, 'freezing point,' means the temperature where the liquid commences to freeze, these two terms are numerically the same, for a given pure material. However, this value depends on the pressure whereat the change of state (phase) from liquid to solid or vice versa takes place. Handbooks tabulate data of melting points of various substances for a pressure of 1 atm.

There is a famous equation known in Thermodynamics as 'Clausius-Clapeyron Equation' after the nineteenth century European physicists, Rudolf Clausius and Paul Clapeyron that relates the temperatures of phase transformations (melting point is one among them) to the pressure, change of density (during the phase transformation) and the heat of such phase transformation (quantity of heat released or absorbed during the phase change).

According to this proven equation, the melting point of a solid increases when pressure is increased where the density of the solid is higher than that of its liquid. This is usually the case with many of the substances we see around. But the case of water is unusual; water has lower density in its solid state (ice form) than in its liquid state. That is why ice floats on water. For such anomalous substances, the 'Clasius-Clapeyron Equation' states that the melting point decreases with increased pressure. In other words, water can remain as liquid water without freezing (or ice can readily melt) even when the temperature is below 0 C if it is under higher pressure (than 1 atm).

The water deep inside the oceans is under the heavy weight of the water held above it and is, effectively, experiencing very high pressure. So the 'ice' that should have been as 'frozen ice' has its melting point reduced so much extremely low that it is 'already molten' as liquid water; or that water is 'yet to freeze.' This is also a reason why in certain glaciers, water is still in liquid form below the sheets of ice.

Put your palm on an ice block and press it. You will see ice melting under your palm though the temperature there is considerably lower than 0 C.

Q.143) Water has the property of gradual freezing and melting due to

a) High specific heat capacity
b) High latent heat of fusion
c) High latent heat of vaporisation
d) Low specific gravity

Q.143) Solution (b)

High latent heat of fusion

Latent heat is the heat per mass unit required for a phase change to occur.

The heat of fusion, also known as the latent heat of fusion, is a category of latent heat describing the energy for the phase change between a liquid and a solid to occur without a change in temperature.

Q.144) Communication satellites need to be placed in geosynchronous orbits to be tracked by an Earth station from a fixed place. How high should the geosynchronous orbit be?

a) About 360 km
b) About 3,600 km
c) About 36,000 km
d) Anywhere between 360 km to 3,600 km

Q.144) Solution (c)

A geostationary orbit, geostationary Earth orbit (often referred to as geosynchronous equatorial orbit) (GEO) is a circular geosynchronous orbit 35,786 km (22,236 mi) above Earth's equator and following the direction of Earth's rotation. An object in such an orbit appears motionless, at a fixed position in the sky, to ground observers.

Do you know?

Communications satellites and weather satellites are often placed in geostationary orbits, so that the satellite antennae (located on Earth) that communicate with them do not have to rotate to track them, but can be pointed permanently at the position in the sky where the satellites are located.

Using this characteristic, ocean color satellites with visible and near-infrared light sensors (e.g. GOCI) can also be operated in geostationary orbit in order to monitor sensitive changes of ocean environments.

Q.145) Bionics is an interdisciplinary branch of science which has found use in many applications. Consider the following statements regarding Bionics:

1. It refers to the application of principles of Biology to engineering.
2. Bioengineering is a sub branch of Bionics.
3. Biomedical Engineers have designed artificial ears and artificial retinas that can restore hearing and sight to the people using Bionics.

Which of the above statements are correct?

a) 1 only
b) 1 and 3
c) 2 and 3
d) All of the above

Q.145) Solution (b)

Bionics is not a specialized science. It refers to the use of principles of biology to engineering. Now it is used more to describe a method to engineer organs that can replace diseased or non- functional organs in human body.

Bionics is different from bioengineering (or Biotechnology), which is the use of living things to perform industrial tasks like use of microbes to remove waste etc.

Q.146) In-Virto Fertilization (IVF) technique is gaining popularity. Consider the following steps in Women's IVF process and arrange it in its correct order of occurrence

1. Collecting the eggs
2. Boosting the egg supply
3. Embryo transfer
4. Fertilizing the eggs

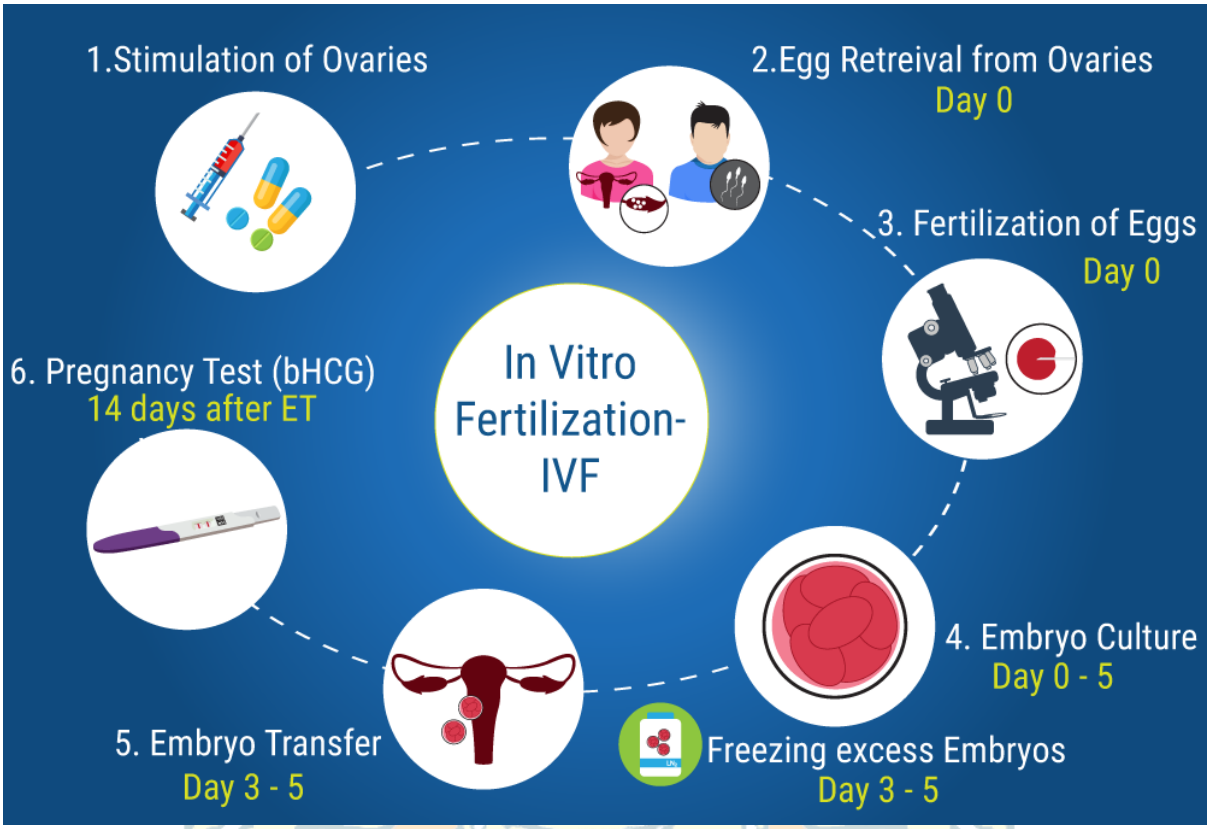
Select the correct code

a) 1-2- 3-4
b) 2-1- 4-3
c) 2-1- 3-4
d) 1-2- 4-3

Q.146) Solution (b)

Steps in Women's In-Virto Fertilization (IVF) technique process

1. Suppressing your natural monthly hormone cycle
2. Boosting the egg supply
3. Checking on progress
4. Collecting the eggs
5. Fertilising the eggs
6. Embryo transfer



Pic link: http://www.indoreinfertilityclinic.com/wp-content/uploads/2013/08/IVF-Steps.png

Q.147) Which of the following is/are the differences between Laser light and Ordinary light?

1. The Laser light is collimated and coherent, that is, it travels in a single direction whereas ordinary light is scattered in every direction.

2. The Laser light is monochromatic, that is, it contains only one colour or a narrow range of colours of same frequency whereas ordinary light have a wide variety of colours of varying wavelengths.

Select the correct option from the codes given below:

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.147) Solution (c)

Both ordinary light and laser light are electromagnetic waves. Therefore, both travel with the velocity of light in vacuum. However, laser light has very important and unique properties that cannot be seen in nature. Ordinary light is divergent and incoherent whereas laser light is highly directional and coherent. Ordinary light is a mixture of electromagnetic waves having different wavelengths. Laser light, on the hand, is monochromatic. This is the main difference between ordinary light and laser light. This article focuses on the differences between ordinary light and laser light.

Further reading: http://pediaa.com/difference-between-ordinary-light-and-laser-light/

Q.148) Which among the following is/are genetic diseases?

1. Hemophilia
2. Down's syndrome
3. Sickle-cell anemia
4. Kyasanur Forest disease (KFD)

Select the correct answer using the code given below.

a) 1 and 2 only
b) 2 and 3 only
c) 1, 2 and 3
d) All the above

Q.148) Solution (c)

Hemophilia: In this disease, a single protein that is a part of the cascade of proteins involved in the clotting of blood, is affected. Due to this, in an affected individual, a simple cut will result in non-stop bleeding. The heterozygous female (carrier) for hemophilia may transmit

the disease to sons. The possibility of a female becoming a hemophilic is extremely rare because mother of such a female has to be at least carrier and the father should be hemophilic.

Sickle-cell anemia: This is an autosome linked recessive trait that can be transmitted from parents to the offspring when both the partners are carrier for the gene (or heterozygous). It results in an abnormality in the oxygen-carrying protein hemoglobin (hemoglobin S) found in red blood cells. This leads to a rigid, sickle-like shape under certain circumstances.

Down's Syndrome: The cause of this genetic disorder is the presence of an additional copy of the chromosome number 21 (trisomy of 21). The affected individual is short statured with small round head, furrowed tongue and partially open mouth. Palm is broad with characteristic palm crease.

Kyasanur Forest disease (KFD) is a tick-borne viral hemorrhagic fever endemic to South Asia. The disease is caused by a virus belonging to the family Flaviviridae, which also includes yellow fever and dengue fever.

Do you know?

- Other examples of genetic disorders are: Klinefelter Syndrome, Turners syndrome, Cystic fibrosis, Color blindness, Phenylketonuria, Thalassemia

THINK!

- Vitamin deficiency diseases.

Q.149) Which of the following organisms are common pollinating agents in flowering plants?

1. Bat
2. Bees
3. Wasp
4. Ants

Select the correct answer using the code given below.

a) 1 and 2 only
b) 2 and 3 only
c) 1, 3 and 4 only
d) 1, 2, 3 and 4

Q.149) Solution (d)

Flowering plants use a range of animals as pollinating agents. Bees, butterflies, flies, beetles, wasps, ants, moths, birds (sunbirds and humming birds) and bats are the common pollinating agents, particularly bees are the dominant biotic pollinating agents. Even larger animals such as some primates (lemurs), arboreal (tree-dwelling) rodents, or even reptiles (gecko lizard and garden lizard) have also been reported as pollinators in some species.

Do you know?

A pollenizer (or polleniser), sometimes pollinizer (or polliniser, see spelling differences) is a plant that provides pollen.

The word pollinator is often used when pollenizer is more precise. A pollinator is the biotic agent that moves the pollen, such as bees, moths, bats, and birds. Bees are thus often referred to as 'pollinating insects'.

The verb form to pollenize is to be the source of pollen, or to be the site of the next plant generation.

THINK!

- Pollinator Partnership or P2

Q.150) With reference to respiration, consider the following statements:

1. Oxygen is required by all the organisms to break down glucose.
2. Rate of breathing is faster in aquatic animals than the terrestrial animals.

Which of the statements given above is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.150) Solution (b)

The food material taken in during the process of nutrition is used in cells to provide energy for various life processes. Diverse organisms do this in different ways - some use oxygen to break-down glucose completely into carbon dioxide and water, some use other pathways that do not involve oxygen. In all cases, the first step is the break-down of glucose, a six-carbon molecule, into a three-carbon molecule called pyruvate. This process takes place in the cytoplasm. Further, the pyruvate may be converted into ethanol and carbon dioxide. This process takes place in yeast during fermentation. **Since this process takes place in the absence of air (oxygen), it is called anaerobic respiration.**

Animals have evolved different organs for the uptake of oxygen from the environment and for getting rid of the carbon dioxide produced. Terrestrial animals can breathe the oxygen in the atmosphere, but animals that live in water need to use the oxygen dissolved in water. **Since the amount of dissolved oxygen is fairly low compared to the amount of oxygen in the air, the rate of breathing in aquatic organisms is much faster than that seen in terrestrial organisms.**

Do you know?

- **Cardiopulmonary resuscitation (CPR)** is an emergency procedure that combines chest compressions often with artificial ventilation in an effort to manually preserve intact brain function until further measures are taken to restore spontaneous blood circulation and breathing in a person who is in cardiac arrest. It is recommended in those who are unresponsive with no breathing or abnormal breathing, for example, agonal respirations.

THINK!

- Respiratory therapy

Q.151) With reference to the CHARGE syndrome, consider the following statements

1. It causes multiple life-threatening problems including heart defects and growth retardation.
2. It is a result of defective embryonic development.

Which of the statements given above is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.151) Solution (c)

CHARGE syndrome is a rare birth defect that affects approximately 1 in 20,000 people around the world. CHARGE syndrome causes multiple life-threatening problems in a newborn, such as facial bone and nerve defects that cause breathing and swallowing difficulties, deafness and blindness, heart defects, genital problems and growth retardation. The children may survive and go on to live with these deficiencies if the heart and bone defects are corrected with multiple surgeries, but those without access to such support usually do not survive past their first year.

CHARGE syndrome is a result of defective embryonic development. Two-thirds of the patients with CHARGE syndrome have a sporadic mutation in the gene called CHD7

Do you know?

- The diagnosis of CHARGE syndrome is often difficult, because it is rare. The syndrome spans many disciplines, and as such, can be diagnosed by a pediatrician, oral and maxillofacial surgeon, ENT specialist, ophthalmologist, audiologist, endocrinologist, cardiologist, urologist, developmental specialist, radiologist, geneticist, physiotherapist, occupational therapist, speech therapist, or orthopedic specialist.

THINK!

- "CHILD syndrome"

Q.152) A false fruit or pseudo-carp is derived from the floral parts other than ovary. Which of the following are false fruits?

1. Apple
2. Strawberry
3. Mango
4. Grapes
5. Pine apple

Select the correct answer using the code given below.

a) 1 and 3 only
b) 2 and 4 only
c) 1, 2 and 5 only
d) 1, 2, 3, 4 and 5

Q.152) Solution (c)

A false fruit or pseudo-carp is derived from the floral parts other than ovary, e.g., peduncle in cashewnut, thalamus in apple, pear, strawberry, gourd and cucumber and fused perianth in mulberry. Jack fruit and pine apple are also false fruits as they develop from the entire inflorescence. False fruits are also called spurious or accessory fruits.

A true fruit or eucarp is a mature or ripened ovary, developed after fertilization, e.g., Mango, Grape etc.

Do you know?

- An aggregate fruit or etaerio is a fruit that develops from the merger of several ovaries that were separate in a single flower. In contrast, a simple fruit develops from one ovary. In languages other than English, the meanings of aggregate and multiple fruit are reversed, so that aggregate fruits merge several flowers.

THINK!

- Compound fruit

Q.153) With reference to Photodynamic Therapy, consider the following statements:

1. It uses a photosensitive drug that becomes active under the action of light.
2. It is used in treatment of cancer.

Which of the statements given above is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.153) Solution (c)

Photodynamic therapy uses a photosensitive drug that becomes active under the action of light and converts molecular oxygen into reactive oxygen species that kill cancer cells.

It uses special drugs, called photosensitizing agents, along with light to kill cancer cells. Depending on the part of the body being treated, the photosensitizing agent is either put into the bloodstream through a vein or put on the skin. Over a certain amount of time the drug is absorbed by the cancer cells. Then light is applied to the area to be treated. The light causes the drug to react with oxygen, which forms a chemical that kills the cells. PDT might also help by destroying the blood vessels that feed the cancer cells and by alerting the immune system to attack the cancer.

Do you know?

- Photoimmunotherapy is an oncological treatment for various cancers that combines photodynamic therapy of tumor with immunotherapy treatment. Combining photodynamic therapy with immunotherapy enhances the immunostimulating response and has synergistic effects for metastatic cancer treatment.

THINK!

- Blood irradiation therapy

Q.154) Which among the following is/are parts of innate immunity of human body?

1. Lymphocytes
2. Tears
3. Saliva

Select the correct answer using the code given below.

a) 1 only
b) 1 and 2 only
c) 2 and 3 only
d) 1, 2 and 3

Q.154) Solution (d)

Innate immunity is non-specific type of defense, that is present at the time of birth. This is accomplished by providing different types of barriers to the entry of the foreign agents into our body. Innate immunity consists of four types of barriers. These are:

Physical barriers: Skin on our body is the main barrier which prevents entry of the micro-organisms. Mucus coating of the epithelium lining the respiratory, gastrointestinal and urogenital tracts also help in trapping microbes entering our body.

Physiological barriers: Acid in the stomach, saliva in the mouth, tears from eyes-all prevent microbial growth.

Cellular barriers: Certain types of leukocytes (WBC) of our body like polymorpho-nuclear leukocytes (PMNL-neutrophils) and monocytes and natural killer (type of lymphocytes) in the blood as well as macrophages in tissues can phagocytose and destroy microbes.

Cytokine barriers: Virus-infected cells secrete proteins called interferons which protect non-infected cells from further viral infection.

Do you know?

- Passive or "adoptive transfer" of cell-mediated immunity, is conferred by the transfer of "sensitized" or activated T-cells from one individual into another. It is rarely used in humans because it requires histocompatible (matched) donors, which are often difficult to find.

THINK!

- Inoculation

Q.155) Which of the following statements regarding Kalam SAT are correct?

1. It is named after Dr A P J Abdul Kalam and is claimed to be the World's lightest satellite.
2. It was launched by ISRO.
3. The probe is composed of 3-D printed reinforced carbon fiber polymer.

Select the code from following:

a) 1 and 2

b) 2 and 3
c) 1 and 3
d) All of the above

Q.155) Solution (c)

Kalam SAT is a Femto Satellite and widely claimed to be the world's lightest satellite. It is named after former Indian president Dr. A. P. J. Abdul Kalam and was built by an Indian High school student team, led by Rifath Sharook, an 18-year-old from the Tamil Nadu town of Pallapatti. The high school team participated in Cubes in Space, a STEM-based education program by Idoodle Learning.Inc and NASA. As selected student competitors, the team won an opportunity to design experiments to be launched into space on a NASA rocket. Kalam SAT was launched by NASA along with several other experiments on Terrier Orion sounding rocket on 22 June 2017 from Wallops Island flight facility in Virginia.

The weight of the probe is just 64 grams and it is fitted in a 3.8 centimeters cube. The probe is composed of 3-D printed reinforced carbon fiber polymer. Part of the components were supplied from India and other parts from abroad. The probe was launched by a sub-orbital spaceflight. The expected time span of the mission (post flight) is 240 minutes. The tiny probe will be operated only for less than 12 minutes to demonstrate the performance of 3-D printed carbon fiber in a micro-gravity environment of space.

Q.156) NASA's QueSST has passed preliminary tests and is set to become a reality. What is QueSST?

a) Supersonic passenger plane
b) Zero gravity chamber developed on earth.
c) Virtual platform to give a feel of space to visitors
d) Passenger Moon rover

Q.156) Solution (a)

NASA's Quiet Supersonic Transport (QueSST) aircraft passed a preliminary design review last week, marking a major milestone for the agency's experimental X-plane concept.

NASA has been developing new designs for supersonic aircraft, with a specific focus on reducing the strength of the sonic booms — the sound created by a shock wave from an aircraft that moves faster than the speed of sound. The shape and overall design of a supersonic plane is particularly important for minimizing the loudness of the boom during flight.

Q.157) A large supercluster has been discovered 600 million light years across by Indian Scientists. It has been named

a) Ganga
b) Saraswati
c) Yamuna
d) Godavari

Q.157) Solution (b)

These are the largest coherent structures seen in the universe. Firstly there are clusters of galaxies together with associated gas and dark matter. Large groups of such clusters, linked by filaments, separated by voids together form the superclusters. Though initially a supercluster was used to describe groups of two-four clusters, now it is understood that much larger superclusters, comprising clusters that number an order of magnitude higher, exist. The first such large supercluster to be discovered was the Shapley supercluster.

Recently, a group of scientists from IUCAA (Pune), IISER (Pune), NIT Jamshedpur and Newman College (Thodapuzha) announced that they have discovered a very large "supercluster" of galaxies. They have named it **Saraswati.**

Q.158) Diesel Electric Multiple Unit (DEMU) broad gauge train has been launched by Indian Railways. The train has been made operational between

a) Delhi and Haryana
b) Mumbai and Ahmadabad
c) Patna and Haldia
d) Cochin to Kozhikode

Q.158) Solution (a)

The Railways launched the country's first solar-powered local train with a battery bank facility that ensures sufficient power even in the absence of sunlight.

The entire electrical need of the coaches, which includes lights, fans and information display system, will be met by the energy produced by solar panels fitted atop the coaches of the DEMU (diesel electric multiple unit) train.

This train has been inducted in the link of Train Number 740033 between Delhi Sarai Rohilla - Garhi Harsaru - Farukhnagar in Northern Railway.

The details of reduction in Carbon Emission and fuel saving shall be known after running this train for a period of one year.

Q.159) The Union Ministry of Science and Technology has launched SOHUM device. Which of the following statements is/are correct regarding SOHUM?

1. It is an indigenously developed low-cost hearing screening device for senior citizens.
2. It is a non invasive portable device which uses Brain Stem Auditory evoked response.

Select the code from following:

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.159) Solution (b)

Sohum Device

The indigenously developed newborn hearing screening device – SOHUM was formally launched by the Minister of State for Science and Technology & Earth Sciences.

Sohum is a low cost and unique device which uses brainstem auditory evoked response, the gold standard in auditory testing to check for hearing response in a newborn. As of now, this technology is prohibitively expensive and inaccessible to many. Start-up Sohum has made the technology appropriate for the resource constrained settings and aims to cater to nearly 26 million babies born every year in India.

One of the most common birth disorders – congenital hearing loss – is a result of both genetic and non-genetic factors. These factors are mostly associated with resource-poor economies such as India where, unlike advanced healthcare systems, hearing impairment goes undiagnosed. Thus, when it is discovered at 4+ years, it's too late to reverse the damage and this leads to a host of problems such as impaired communication skills and even possible mental illness; all of which have a deep impact on the child, emotionally and economically life-long.

Do you know?

The newborn hearing screening device developed by School of International Biodesign (SIB) startup M/s Sohum Innovation Labs India Pvt. Ltd.

This innovative medical device has been developed under Department of Biotechnology (DBT), Ministry of Science and Technology, Government of India supported (SIB). SIB is a flagship Program of the DBT aimed to develop innovative and affordable medical devices as per unmet clinical needs of India and to train the next generation of medical technology innovators in India, it is a valuable contribution to the Make in India campaign of the Government. This Program is implemented jointly at AIIMS and IIT Delhi in collaboration with International partners. Biotech Consortium India Limited manages techno-legal activities of the Program.

Q.160) UIDAI has launched a virtual ID that can be used instead of the actual Aadhar number. Which of the following statements are correct regarding Virtual ID?

1. It is a temporary code which contains 16 numerals.
2. The code is valid for at least one day.
3. All personal details are not revealed by virtual ID.

Select the code from following:

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

Q.160) Solution (d)

Considering the privacy of the personal data including the demographic and biometric information mentioned on the Aadhar card, UIDAI has recently decided to come up with a unique feature, termed as Aadhar Virtual ID.

The Aadhar Virtual ID offers limited KYC access providing only that much information which is required for verification rather than offering the complete details of an individual's Aadhar card.

The Aadhaar Virtual ID consists of 16-digit random numbers that is mapped to an individual's Aadhaar card at the back end. An Aadhaar card holder using the virtual ID need not submit his Aadhaar number every time for verification purpose, instead he can generate a Virtual ID and use it for various verification purposes like mobile number, bank and other financial documents.

The Aadhaar Virtual ID gives access to the biometric information of an Aadhaar card holder along with the basic details like name, address and photograph that are sufficient for the e-KYC. Unlike in the past, the agency will not know the 12-digit Aadhaar number and other personal details.

Q.161) Consider the following statements:

1. An asteroid belt in our solar system is found between Earth and Mars.
2. All asteroids in our solar system are found in the asteroid belt.

Which of the above statements are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.161) Solution (d)

Asteroids are rocky worlds revolving around the sun that are too small to be called planets. They are also known as planetoids or minor planets. There are millions of asteroids, ranging in size from hundreds of miles to several feet across.

Asteroids lie within three regions of the solar system. Most asteroids lie in a vast ring between the orbits of Mars and Jupiter. This main asteroid belt holds more than 200 asteroids larger than 60 miles (100 km) in diameter. Scientists estimate the asteroid belt also contains between 1.1 million and 1.9 million asteroids larger than 1 km (3,281 feet) in diameter and millions of smaller ones.

Many asteroids lie outside the main belt. Trojan asteroids orbit a larger planet in two special places, known as Lagrange points, where the gravitational pull of the sun and the planet are balanced. Jupiter Trojans are the most numerous, boasting nearly as high a population as the main asteroid belt. Neptune, Mars and Earth also have Trojan asteroids.

Near-Earth asteroids (NEAs) circle closer to Earth than the sun. Amor asteroids have close orbits that approach but no not cross Earth's path, according to NASA. Apollo asteroids have Earth-crossing orbits but spend most of their time outside the planet's path. Aten asteroids also cross Earth's orbit but spend most of their time inside Earth's orbit. Atira asteroids are near-Earth asteroids whose orbits are contained within Earth's orbit. According to the European Space Agency, roughly 10,000 of the known asteroids are NEAs.

Q.162) CRISPR-Cas9 technology has become popular in recent years. The technology is about –

a) Altering DNA sequences and modifying gene function.
b) Environment-friendly propellant to power satellites and spacecraft.
c) World's largest single earth observation programme.
d) Global Monitoring for Environment and Security.

Q.162) Solution (a)

CRISPR technology is a simple yet powerful tool for editing genomes. It allows researchers to easily alter DNA sequences and modify gene function. Its many potential applications include correcting genetic defects, treating and preventing the spread of diseases and improving crops.

"CRISPR" (pronounced "crisper") is shorthand for "CRISPR-Cas9." CRISPRs are specialized stretches of DNA. The protein Cas9 (or "CRISPR-associated") is an enzyme that acts like a pair of molecular scissors, capable of cutting strands of DNA.

CRISPR technology was adapted from the natural defense mechanisms of bacteria and archaea (the domain of single-celled microorganisms). These organisms use CRISPR-derived RNA and various Cas proteins, including Cas9, to foil attacks by viruses and other foreign bodies. They do so primarily by chopping up and destroying the DNA of a foreign invader. When these components are transferred into other, more complex, organisms, it allows for the manipulation of genes, or "editing."

Q.163) This material which forms the building block of another, well-known allotrope of carbon, is about 200 times as strong as steel. What is it called?

a) Graphite
b) Graphene
c) Buckminsterfullerene
d) Lonsdaleite

Q.163) Solution (b)

Graphene is a semi-metal with a small overlap between the valence and the conduction bands (zero bandgap material). It is an allotrope (form) of carbon consisting of a single layer of carbon atoms arranged in a hexagonal lattice.

It is the basic structural element of many other allotropes of carbon, such as graphite, diamond, charcoal, carbon nanotubes and fullerenes.

Graphene has many uncommon properties. It is the strongest material ever tested, efficiently conducts heat and electricity, and is nearly transparent.

Q.164) A merger of 14 galaxies that took place more than 12 billion years ago was recently spotted by this telescope array. Name the array.

a) Chilean Atacama Large millimeter-submillimeter Array (ALMA)
b) James Webb Telescope
c) Very Large Array (VLA) in New Mexico
d) Cherenkov Telescope Array

Q.164) Solution (a)

The colossal merger of 14 galaxies more than 12 billion years ago has been captured by astronomers who used the world's most powerful telescopes to peer 90% of the way across the observable universe.

The galaxy cluster was first spotted as a faint smudge of light, using the South Pole telescope and the Herschel space observatory. Astronomers then used the Atacama large millimeter/submillimeter Array (Alma), a telescope comprising 66 antennas spread over 16km in the Chilean Andes, to make more detailed observations.

Q.165) Which is the longest continental mountain range in the world?

a) The Appalachian range
b) The Ural range
c) The Andes
d) Atlas Mountains

Q.165) Solution (c)

The Andes or Andean Mountains are the longest continental mountain range in the world. They form a continuous highland along the western edge of South America.

This range is about 7,000 km (4,300 mi) long, about 200 to 700 km (120 to 430 mi) wide (widest between 18° south and 20° south latitude), and of an average height of about 4,000

m (13,000 ft). The Andes extend from north to south through seven South American countries: Venezuela, Colombia, Ecuador, Peru, Bolivia, Argentina and Chile.

Q.166) Who are the mathematicians credited with the creation of analytic geometry – basically the description of geometry by means of equations and coordinates, for instance?

a) Aryabhata and Brahmagupta
b) Rene Descartes and Pierre de Fermat
c) Leonhard Euler and Joseph-Louis Lagrange
d) Sudarshan-Glauber representation

Q.166) Solution (b)

Analytic geometry was independently invented by René Descartes and Pierre de Fermat, although Descartes is sometimes given sole credit.

Cartesian geometry, the alternative term used for analytic geometry, is named after Descartes.

Pierre de Fermat also pioneered the development of analytic geometry.

Q.167) Richter scale is to measure earthquakes. What is the scale to measure the strength of hurricanes?

a) Saffir-Simpson scale
b) Mercalli scale
c) Moment Magnitude Scale
d) Seismic scale

Q.167) Solution (a)

The Saffir–Simpson hurricane wind scale (SSHWS), formerly the Saffir–Simpson hurricane scale (SSHS), classifies hurricanes – Western Hemisphere tropical cyclones that exceed the intensities of tropical depressions and tropical storms – into five categories distinguished by the intensities of their sustained winds. To be classified as a hurricane, a tropical cyclone must have maximum sustained winds of at least 74 mph (33 m/s; 64 kn; 119 km/h) (Category 1). The highest classification in the scale, Category 5, consists of storms with sustained winds exceeding 156 mph (70 m/s; 136 kn; 251 km/h).

The scale was developed in 1971 by civil engineer Herbert Saffir and meteorologist Robert Simpson, who at the time was director of the U.S. National Hurricane Center (NHC).

The classifications can provide some indication of the potential damage and flooding a hurricane will cause upon landfall.

Q.168) Recently Indian astronomers discovered a huge galactic supercluster that has the form of an enormous wall, located about 4 billion light years away. What did they name this supercluster?

a) Ganga
b) Brahmaputra
c) Saraswati
d) Tethys

Q.168) Solution (c)

Recently, a group of scientists from IUCAA (Pune), IISER (Pune), NIT Jamshedpur and Newman College (Thodapuzha) announced that they have discovered a very large "supercluster" of galaxies. They have named it Saraswati.

Galaxies are like the building blocks of the universe, they contain a huge number of stars, something like 100 billion at a count. Galaxy groups can have three to 20 galaxies, the richest systems are called clusters (like the Virgo cluster) which can have several hundred galaxies.

Superclusters are clusters of clusters. They can have as few as two clusters, and superclusters with two to four clusters are common. Saraswati has 42.

The newly discovered Saraswati supercluster is 600 million light years across. The Milky Way is 150,000 light years across.

Article link: http://www.thehindu.com/sci-tech/science/what-is-the-saraswati-supercluster/article19279697.ece

Q.169) Which of the following parts of circulatory system carry the oxygenated blood?

1. Pulmonary artery
2. Left Ventricle
3. Pulmonary Vein

Select the correct answer using the code given below.

a) 1 only
b) 2 and 3 only
c) 1 and 3 only
d) 1, 2 and 3

Q.169) Solution (b)

Left Ventricle of the heart supplies the oxygenated blood through the pulmonary veins throughout the body.

Pulmonary arteries carry the deoxygenated blood from heart to the lungs for purification.

The heart is a muscular organ about the size of a closed fist that functions as the body's circulatory pump. It takes in deoxygenated blood through the veins and delivers it to the lungs for oxygenation before pumping it into the various arteries

The heart contains 4 chambers: the right atrium, left atrium, right ventricle, and left ventricle. The atria are smaller than the ventricles and have thinner, less muscular walls than the ventricles. The atria act as receiving chambers for blood, so they are connected to the veins that carry blood to the heart. The ventricles are the larger, stronger pumping chambers that send blood out of the heart. The ventricles are connected to the arteries that carry blood away from the heart.

The chambers on the right side of the heart are smaller and have less myocardium in their heart wall when compared to the left side of the heart. This difference in size between the sides of the heart is related to their functions and the size of the 2 circulatory loops. The right side of the heart maintains pulmonary circulation to the nearby lungs while the left side of the heart pumps blood all the way to the extremities of the body in the systemic circulatory loop.

Do you know?

- The lymphatic system is part of the vascular system and an important part of the immune system, comprising a network of lymphatic vessels that carry a clear fluid called lymph (from Latin, lympha meaning "water") directionally towards the heart.

THINK!

- Spleen

Q.170) Which among the following hormones is/are produced by the human body?

1. Insulin
2. Cytokinin

3. Thyroxine

Select the correct answer using the code given below.

a) 1 only
b) 1 and 3 only
c) 2 and 3 only
d) 1, 2 and 3

Q.170) Solution (b)

Insulin is a hormone made by the pancreas that allows body to use sugar (glucose) from carbohydrates in the food or to store glucose for future use. Insulin helps keep blood sugar level from getting too high (hyperglycemia) or too low (hypoglycemia).

Cytokinins are a class of plant growth substances (phytohormones) that promote cell division, or cytokinesis, in plant roots and shoots. They are involved primarily in cell growth and differentiation, but also affect apical dominance, axillary bud growth, and leaf senescence.

Thyroxin is the main hormone secreted into the bloodstream by the thyroid gland. It is the inactive form and most of it is converted to an active form called triiodothyronine by organs such as the liver and kidneys. Thyroid hormones play vital roles in regulating the body metabolic rate, heart and digestive functions, muscle control, brain development and maintenance of bones.

Do you know?

- Steroid – Hormones derived from cholesterol. Examples of steroid hormones include the sex hormones estradiol and testosterone as well as the stress hormone cortisol.

THINK!

- Endocrine system

Q.171) With reference to the passive immunity of human body to fight the disease, consider the following statements:

1. Passive immunity is generated due to antibodies obtained from outside the body.
2. Passive immunity is slow and takes time to give its full effective response.

Which of the statements given above is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.171) Solution (a)

Active immunity results when exposure to a disease organism triggers the immune system to produce antibodies to that disease. Exposure to the disease organism can occur through infection with the actual disease (resulting in natural immunity), or introduction of a killed or weakened form of the disease organism through vaccination (vaccine-induced immunity).

Passive immunity is provided when a person is given antibodies to a disease rather than producing them through his or her own immune system. A newborn baby acquires passive immunity from its mother through the placenta.

When antibodies are directly given to protect the body against foreign agents, it is called passive immunity for example foetus receives antibodies from their mother, through the placenta during pregnancy, the yellowish fluid colostrum secreted by mother during the initial days of lactation has abundant antibodies (IgA) to protect the infant.

Active immunity is slow and takes time to give its full effective response whereas passive immunity immediately gives effective response. Passive immunity lasts for few days or shorter duration whereas active immunity lasts for sufficiently longer period or may be lifelong.

Do you know?

- The adaptive immune system evolved in early vertebrates and allows for a stronger immune response as well as immunological memory, where each pathogen is "remembered" by a signature antigen. The adaptive immune response is antigen-specific and requires the recognition of specific "non-self" antigens during a process called antigen presentation.

THINK!

- Immunosuppressive drugs.

Q.172) With reference to human digestive system, consider the following statements:

1. The hydrochloric acid in the stomach facilitates the action of digestive enzymes.
2. The pancreatic juice helps in breaking down fats.
3. The complete digestion of carbohydrates and fats takes place in the small intestine.

Which of the statements given above is/are correct?

a) 1 only
b) 1 and 2 only
c) 2 and 3 only

d) 1, 2 and 3

Q.172) Solution (d)

The digestion functions are taken care of by the gastric glands present in the wall of the stomach. These release hydrochloric acid, a protein digesting enzyme called pepsin, and mucus.

The hydrochloric acid creates an acidic medium which facilitates the action of the enzyme pepsin.

The pancreas secretes pancreatic juice which contains enzymes like trypsin for digesting proteins and lipase for breaking down emulsified fats.

The small intestine is the site of the complete digestion of carbohydrates, proteins and fats. It receives the secretions of the liver and pancreas for this purpose.

Do you know?

- The gastrointestinal tract (digestive tract, digestional tract, GI tract, GIT, gut, or alimentary canal) is an organ system within humans and other animals which takes in food, digests it to extract and absorb energy and nutrients, and expels the remaining waste as feces.
- The mouth, esophagus, stomach and intestines are part of the gastrointestinal tract. Gastrointestinal is an adjective meaning of or pertaining to the stomach and intestines. A tract is a collection of related anatomic structures or a series of connected body organs.

THINK!

- Bile

Q.173) With reference to nutrition in humans, consider the following processes:

1. assimilation
2. absorption
3. digestion
4. ingestion
5. egestion

Arrange the process in sequence of their occurrence in digestive system.

a) 4-3-2-1-5
b) 4-1-2-5-3
c) 3-4-5-1-2
d) 3-2-4-1-5

Q.173) Solution (a)

Nutrition is a complex process involving: (i) ingestion, (ii) digestion, (iii) absorption, (iv) assimilation and (v) egestion. Food is taken into the body through the mouth. The process of taking food into the body is called ingestion. The inner lining of the stomach secretes mucous, hydrochloric acid and digestive juices and this helps in digestion.

The digested food pass into the blood vessels in the wall of the intestine. This process is called absorption. The absorbed substances are transported via the blood vessels to different organs of the body where they are used to build complex substances such as the proteins required by the body. This is called assimilation.

The remaining waste passes into the rectum and remains there as semi-solid faeces. The faecal matter is removed through the anus from time-to-time. This is called egestion.

Do you know?

- The cecum is a pouch marking the division between the small intestine and the large intestine. The cecum receives chyme from the last part of the small intestine, the ileum, and connects to the ascending colon of the large intestine.
- At this junction there is a sphincter or valve, the ileocecal valve which slows the passage of chyme from the ileum, allowing further digestion. It is also the site of the appendix attachment.

THINK!

- Diaphragm

Q.174) With reference to human blood, consider the following statements:

1. It is a connective tissue.
2. Red blood cells in blood are devoid of nucleus.
3. White blood cells are short lived cells which lack haemoglobin.

Which of the statements given above are correct?

a) 1 and 3 only
b) 1 and 2 only
c) 2 and 3 only
d) 1, 2 and 3

Q.174) Solution (d)

Blood is a special connective tissue consisting of a fluid matrix, plasma, and formed elements (Erythrocytes, leucocytes and platelets).

Erythrocytes or red blood cells (RBC) are the most abundant of all the cells in blood. A healthy adult man has, on an average, 5 millions to 5.5 millions of RBCs mm-3 of blood. RBCs are formed in the red bone marrow in the adults. RBCs are devoid of nucleus in most of the mammals and are biconcave in shape. They have a red coloured, iron containing complex protein called haemoglobin, hence the colour and name of these cells.

Leucocytes are also known as white blood cells (WBC) as they are colourless due to the lack of haemoglobin. They are nucleated and are relatively lesser in number which averages 6000- 8000 mm-3 of blood.

Leucocytes are generally short lived. We have two main categories of WBCs - granulocytes and agranulocytes. Neutrophils, eosinophils and basophils are different types of granulocytes, while lymphocytes and monocytes are the agranulocytes.

Do you know?

- **The main function of platelets is to contribute to hemostasis:** the process of stopping bleeding at the site of interrupted endothelium. They gather at the site and unless the interruption is physically too large, they plug the hole.

THINK!

- Hemostasis

Q.175) Which of the following are the Purines nitrogen bases?

1. Adenine
2. Guanine
3. Cytosine
4. Uracil
5. Thymine

Select the correct answer using the code given below.

a) 1 and 2 only
b) 3 and 4 only
c) 2, 4 and 5 only
d) 1, 2 and 3 only

Q.175) Solution (a)

There are two types of nitrogenous bases - Purines (Adenine and Guanine), and Pyrimidine (Cytosine, Uracil and Thymine). Cytosine is common for both DNA and RNA and Thymine is present in DNA. Uracil is present in RNA at the place of Thymine.

Do you know?

- In cell biology, chromosome territories are regions of the nucleus preferentially occupied by particular chromosomes.

THINK!

- DNA profiling

Q.176) Liquid Biopsies are an alternative to traditional tissue based biopsies. Which of the following statements regarding liquid biopsies are correct?

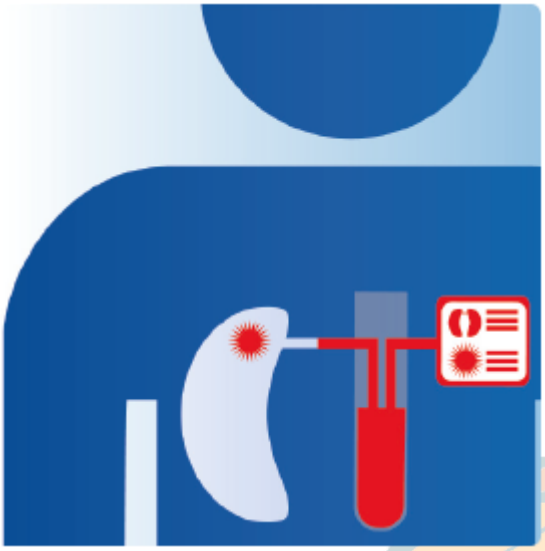
1. They provide a full spectrum of information compared to tissue samples, which only reflect the information available in the sample.
2. Disease progression or resistance to treatment can be spotted much faster than otherwise relying on symptoms or imaging.

Select the code from following:

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.176) Solution (c)

Liquid biopsies



Liquid biopsies mark a step forward in the fight against cancer. First, they are an alternative where traditional tissue-based biopsies are not possible. Second, they provide a full spectrum of information compared to tissue samples, which only reflect the information available in the sample. Lastly, by homing in on circulating-tumor DNA (ctDNA), genetic material that routinely finds its way from cancer cells into the bloodstream, disease progression or resistance to treatment can be spotted much faster than otherwise relying on symptoms or imaging.

Q.177) Deep Learning (deep neural network) is an aspect of Artificial Intelligence (AI). Which of the following statements correctly describe Deep learning?

a) It allows machine to emulate the learning process of human beings to gain certain type of knowledge.
b) It allows students to memorise the details quickly and permanently.
c) It is a voice command system, where once a command is given will be automatically remembered by the machine till it is changed.
d) It helps the user to gain knowledge while sleeping.

Q.177) Solution (a)

Deep learning

Deep learning is an aspect of artificial intelligence (AI) that is concerned with emulating the learning approach that human beings use to gain certain types of knowledge. At its simplest, deep learning can be thought of as a way to automate predictive analytics.

While traditional machine learning algorithms are linear, deep learning algorithms are stacked in a hierarchy of increasing complexity and abstraction. To understand deep learning, imagine a toddler whose first word is dog. The toddler learns what a dog is (and is not) by pointing to objects and saying the word dog. The parent says, "Yes, that is a dog," or, "No, that is not a dog." As the toddler continues to point to objects, he becomes more aware of the features that all dogs possess. What the toddler does, without knowing it, is clarify a complex abstraction (the concept of dog) by building a hierarchy in which each level of abstraction is created with knowledge that was gained from the preceding layer of the hierarchy.

Q.178) Which of the following regarding 'Human Cell Atlas' are correct?

1. It is a project to map all types of genes in a human cell.
2. To create comprehensive reference maps of all human cells—the fundamental units of life
3. It is an initiative of WHO

Select the code from following:

a) 1 and 3
b) 2 only
c) 2 and 3
d) All of the above

Q.178) Solution (b)

The Human Cell Atlas is a global collaboration to map and characterize all cells in a healthy human body: cell types, numbers, locations, relationships, and molecular components. Once complete, it will be a fundamental resource for scientists, allowing them to better understand how healthy cells work, and what goes wrong when disease strikes.

It is a ChanZukerberg initiative.

Q.179) Which of the following statements clearly explains 'Precision Farming'?

a) It is the use of exact amount to water and nutrients for each plant to control the yield.
b) It is a farm management system where each plant is manually planted at optimum distance in a field to maximize the yield.

c) It is a digital/satellite based farm management system where technology is used for observing, measuring and responding to inter and intra-field variability in crops.
d) It is an act of using an exact amount of seeds in a farm to germinate maximum number of healthy plants.

Q.179) Solution (c)

Precision agriculture (PA)

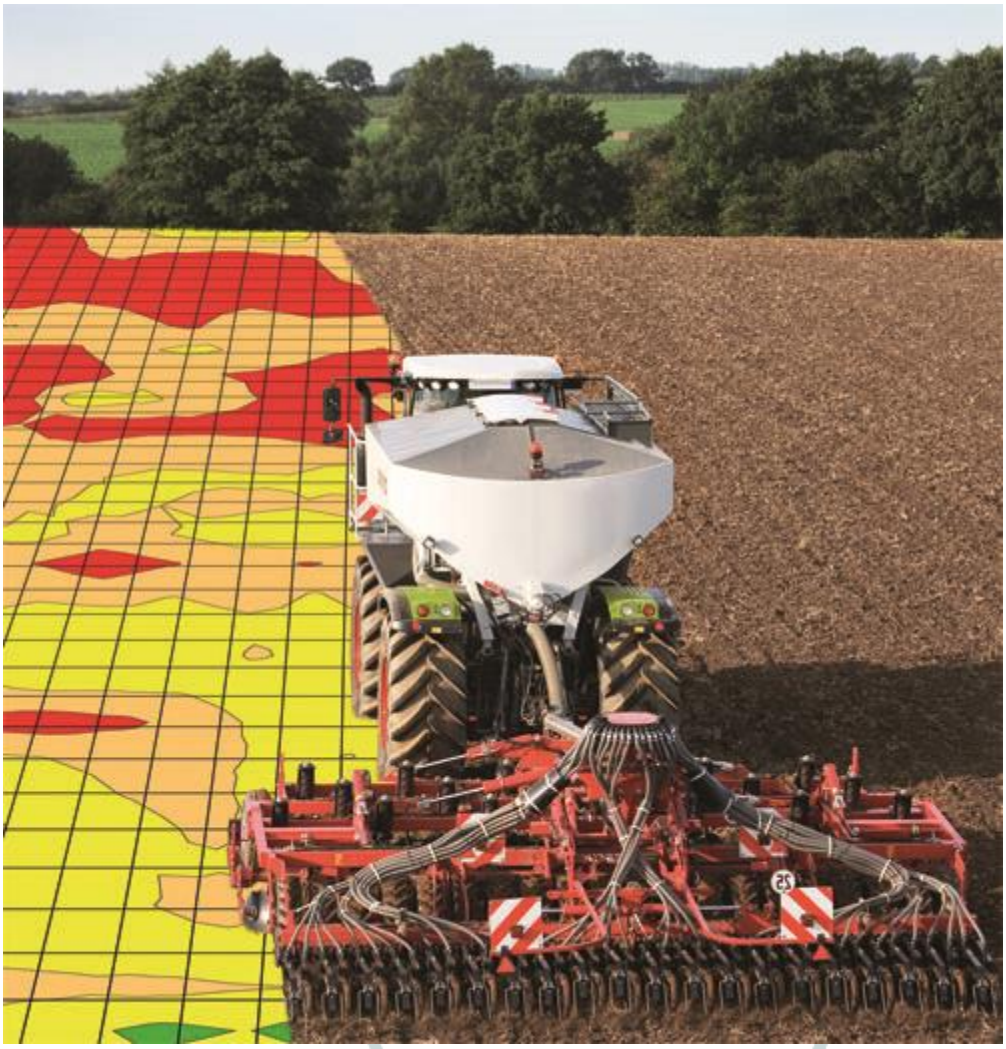
Precision agriculture (PA), satellite farming or site specific crop management (SSCM) is a farming management concept based on observing, measuring and responding to inter and intra-field variability in crops. The goal of precision agriculture research is to define a decision support system (DSS) for whole farm management with the goal of optimizing returns on inputs while preserving resources.

If you want a detailed list of the **most common technologies** applied to Precision Farming practices, take a look at the following explanatory items:

• **High precision positioning systems (like GPS)** are the key technology to achieve accuracy when driving in the field, providing navigation and positioning capability anywhere on earth, anytime under any all conditions. The systems record the position of the field using geographic coordinates (latitude and longitude) and locate and navigate agricultural vehicles within a field with 2cm accuracy.

• **Automated steering systems:** enable to take over specific driving tasks like auto-steering, overhead turning, following field edges and overlapping of rows. These technologies reduce human error and are the key to effective site management:

- Assisted steering systems show drivers the way to follow in the field with the help of satellite navigation systems such as GPS. This allows more accurate driving but the farmer still needs to steer the wheel.
- Automated steering systems, take full control of the steering wheel allowing the driver to take the hands off the wheel during trips down the row and the ability to keep an eye on the planter, sprayer or other equipment.
- Intelligent guidance systems provide different steering patterns (guidance patterns) depending on the shape of the field and can be used in combination with above systems.



Seeder using a geomapping system

• **Geomapping:** used to produce maps including soil type, nutrients levels etc in layers and assign that information to the particular field location. (see picture on the left)

• **Sensors and remote sensing:** collect data from a distance to evaluating soil and crop health (moisture, nutrients, compaction, crop diseases). Data sensors can be mounted on moving machines.

• **Integrated electronic communications** between components in a system for example, between tractor and farm office, tractor and dealer or spray can and sprayer.

• **Variable rate technology (VRT):** ability to adapt parameters on a machine to apply, for instance, seed or fertiliser according to the exact variations in plant growth, or soil nutrients and type.

Q.180) For past few years, the term blockchain has been in news. Which of the following statements correctly defines a blockchain?

a) It is a record of transactions which a shell company maintains to keep a check on money routed by it.
b) It is an interlinked list of records which is secured using cryptography.
c) It is an algorithm developed by multilevel marketing companies to calculate the monetary profit at each level of hierarchy.
d) It is an interconnection of networks which connects producers to the consumers.

Q.180) Solution (b)

Blockchain

A blockchain, originally block chain, is a continuously growing list of records, called blocks, which are linked and secured using cryptography. Each block typically contains a cryptographic hash of the previous block, a timestamp and transaction data. By design, a blockchain is inherently resistant to modification of the data. It is "an open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way". For use as a distributed ledger, a blockchain is typically managed by a peer-to-peer network collectively adhering to a protocol for inter-node communication and validating new blocks. Once recorded, the data in any given block cannot be altered retroactively without the alteration of all subsequent blocks, which requires collusion of the network majority.

Blockchain was invented by Satoshi Nakamoto in 2008 for use in the cryptocurrency bitcoin, as its public transaction ledger. The invention of the blockchain for bitcoin made it the first digital currency to solve the double-spending problem without the need of a trusted authority or central server. The bitcoin design has been the inspiration for other applications.

The financial sector is the most affected area by Blockchain technology. As block chain eliminates the need for a middleman in transactions, the process becomes more transparent. Blockchain manages these three important roles, it records the transactions, establishes the identity and establishes the contracts.

Q.181) Which of the following statements are correct regarding Internet of Nano Things?

1. When nano scale devices are connected with existing communication devices or internet, it is called internet of Nano things.

2. Internet of Nano Things improves the data storage and computing ability at the sensor level, thus improving the overall process capability.

Select the code from following:

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.181) Solution (c)

Internet of Nano-Things

Internet of Things (IoT) is not new. You can find smart home accessories very prevalent, but Internet of Nano-Things (IoNT) is an emerging field having vital technical and social importance. IoT will connect 30 billion devices by 2020.

When nanoscale devices interconnect with existing communication devices, it enables us to leverage the Internet of Nano Things (IoNT). Nanotechnology offers solutions for many fields including biological sciences, engineering, environment, consumer and military use. Internet of Nano Things improves the data storage and computing ability at the sensor level, thus improving the overall process capability.

According to Markets and Markets analysts, the current market size (in 2016) of IoNT is $4.26 billion, and it will become $9.69 billion by 2020, estimating the Compound Annual Growth Rate at 22.8%.

The Key vendors for the IoNT market include Intel, Cisco Systems, IBM, Alcatel-Lucent, Qualcomm.Humavox is an exciting IOT startup which is creating technologies to power up the IOT devices, thus removing the need for wires. Greenbird, Worldsensing, IFTTT, EllieGrid, and Litbit are some top IOT startups making a difference. We see IoNT as the pioneer of emerging technologies which would open new dimensions in fields like Medicine, Biomedical, and consumer industry.

Q.182) An enhanced version of reality where live direct or indirect views of physical real-world environments are enhanced with superimposed computer-generated images over a user's view of the real-world, thus enhancing one's current perception of reality is called

a) Virtual Reality
b) Pseudo Reality
c) Superimposed Reality

d) Augmented Reality

Q.182) Solution (d)

Augmented Reality noun

An enhanced version of reality where live direct or indirect views of physical real-world environments are augmented with superimposed computer-generated images over a user's view of the real-world, thus enhancing one's current perception of reality.

Augmented Reality vs Virtual Reality

Unlike virtual reality, which requires you to inhabit an entirely virtual environment, augmented reality uses your existing natural environment and simply overlays virtual information on top of it. As both virtual and real worlds harmoniously coexist, users of augmented reality experience a new and improved natural world where virtual information is used as a tool to provide assistance in everyday activities.

Q.183) Second-generation biofuel technologies have been developed because first-generation biofuels manufacture has important limitations. Identify from below the new second-generation routes/methods currently under development.

1. Ethanol fermentation
2. Transesterification
3. Biochemical routes
4. Pyrolysis

Choose the appropriate answer:

a) 1 and 2 only
b) 2 and 3 only
c) 3 and 4 only
d) 1, 2 and 3 only

Q.183) Solution (c)

Second-generation biofuels, also known as advanced biofuels, are fuels that can be manufactured from various types of biomass.

First-generation biofuels are made from the sugars and vegetable oils found in arable crops, which can be easily extracted using conventional technology – such as Ethanol fermentation and Transesterification.

In comparison, second-generation biofuels are made from lignocellulosic biomass or woody crops, agricultural residues or waste, which makes it harder to extract the required fuel. Therefore, they require new methods/routes which are currently under development.

Gasification: Gasification technologies are well established for conventional feedstocks such as coal and crude oil. Second-generation gasification technologies include gasification of forest and agricultural residues, waste wood, energy crops and black liquor.

Pyrolysis: Pyrolysis is a well established technique for decomposition of organic material at elevated temperatures in the absence of oxygen. In second-generation biofuels applications forest and agricultural residues, wood waste and energy crops can be used as feedstock to produce e.g. bio-oil for fuel oil applications. Bio-oil typically requires significant additional treatment to render it suitable as a refinery feedstock to replace crude oil.

Torrefaction: Torrefaction is a form of pyrolysis at temperatures typically ranging between 200–320 °C. Feedstocks and output are the same as for pyrolysis.

Biochemical routes: Chemical and biological processes that are currently used in other applications are being adapted for second-generation biofuels. Biochemical processes typically employ pre-treatment to accelerate the hydrolysis process, which separates out the lignin, hemicellulose and cellulose. Once these ingredients are separated, the cellulose fractions can be fermented into alcohols.

Q.184) This laboratory made for detecting muons is made from recycled material from the disbanded Kolar Gold Field experiment. Where is it?

a) GRAPES-3 experiment, Ooty
b) Giant Metrewave Radio Telescope, Pune
c) Vainu Bappu observatory, Javadi Hills, TN
d) Dr. Abdul Kalam Island, Odisha

Q.184) Solution (a)

The GRAPES-3 experiment is a special telescope-array established in Ooty to detect muons from cosmic ray showers. The experiment has detected a surge in muon intensity correlated with a weakening of the earth's magnetic field due to a solar storm that hit the earth on June 22, 2015.

An Indo-Japanese collaboration, this experiment is unique in that it can be used to study solar storms and space weather at distances up to two times the earth's radius, unlike

satellite-based studies that can yield information only about what is happening in their vicinity.

The 6m-long pipes, sourced from Kolar Gold Fields in Karnataka, are recycled here to detect solar storms.

Q.185) In the context of cosmology, what do the words CMB stand for?

a) Cosmic Metal Background
b) Cosmic Microwave Background
c) Cosmic Millimetre Background
d) Cell and molecular biology

Q.185) Solution (b)

The cosmic microwave background (CMB) is electromagnetic radiation as a remnant from an early stage of the universe in Big Bang cosmology. In older literature, the CMB is also variously known as cosmic microwave background radiation (CMBR) or "relic radiation". The CMB is a faint cosmic background radiation filling all space that is an important source of data on the early universe because it is the oldest electromagnetic radiation in the universe, dating to the epoch of recombination.

Q.186) What technique is used to measure the distance of a celestial object from the Earth?

a) Hubble's law
b) Moore's Law
c) Murphy's Law
d) Leap's Law

Q.186) Solution (a)

Hubble's Law

Hubble's law is used to measure the distance of a celestial object from the Earth. If one knows Hubble's constant accurately, then one can calculate the distance to any galaxy in the Universe simply by measuring its velocity (which is reasonably easy to do for any galaxy for which one can observe its spectrum).

Q.187) Lachrymal glands are responsible for…

a) Sweat
b) Yawning
c) Tears
d) Sneeze

Q.187) Solution (c)

Behind each of our upper eyelids, is a tiny pair of almond-shaped organs called the lachrymal glands, more commonly known as the tear glands. These glands secrete a fluid called lachrymal fluid which is carried by tiny ducts and released into the space between the eyeball and the eyelids. When we blink, the fluid flows out.

Sometimes the fluid enters our nasal cavity – that explains the runny noses that sometimes accompany a sob session.

Q.188) Where do you find the "natural killers" in our body?

a) Lymphocytes
b) Erythrocytes
c) Mitochondria
d) Chloroplast

Q.188) Solution (a)

The lymphocytes – these are a type of white blood cells found in the lymph and are part of our immune system. They are meant to take on virus-infected cells and fight tumour formation.

Q.189) Antibodies are formed by

a) T-cells
b) Monocytes
c) Phagocytes
d) B-cells

Q.189) Solution (d)

Antibody, also called immunoglobulin, a protective protein produced by the immune system in response to the presence of a foreign substance, called an antigen. Antibodies recognize and latch onto antigens in order to remove them from the body. A wide range of substances are regarded by the body as antigens, including disease-causing organisms and toxic materials such as insect venom.

When an alien substance enters the body, the immune system is able to recognize it as foreign because molecules on the surface of the antigen differ from those found in the body. To eliminate the invader, the immune system calls on a number of mechanisms, including one of the most important—antibody production.

Antibodies are produced by specialized white blood cells called B lymphocytes (or B cells). When an antigen binds to the B-cell surface, it stimulates the B cell to divide and mature into a group of identical cells called a clone. The mature B cells, called plasma cells, secrete millions of antibodies into the bloodstream and lymphatic system.

Q.190) Which of the following are endocrine glands in human system?

1. Pituitary gland
2. Pineal gland
3. Thyroid gland

Select the correct answer using the codes given below.

a) 1 only
b) 2 only
c) 1, 2 and 3
d) None

Q.190) Solution (c)

Endocrine glands lack ducts and are hence, called ductless glands. Their secretions are called hormones.

Hormone is a chemical produced by endocrine glands and released into the blood and transported to a distantly located target organ.

Hormones are non-nutrient chemicals which act as intercellular messengers and are produced in trace amounts.

The endocrine glands and hormone producing diffused tissues/cells located in different parts of our body constitute the endocrine system. **Pituitary, pineal, thyroid, adrenal,**

pancreas, parathyroid, thymus and gonads (testis in males and ovary in females) are the organized endocrine bodies in our body.

In addition to these, some other organs, e.g., **gastrointestinal tract, liver, kidney, heart also produce hormones.**

Do you know?

- The pineal gland is located on the dorsal side of forebrain. Pineal secretes a hormone called melatonin. Melatonin plays a very important role in the regulation of a 24-hour (diurnal) rhythm of our body.

THINK!

- Mechanism of Hormone Action

Q.191) Which of the following best defines biomarker?

a) A biomarker is anything that can be used as an indicator of a particular disease state or some other physiological state of an organism.
b) A living organism used to gauge change in climatic patterns.
c) A chemical substance used to regulate the circadian rhythm.
d) None

Q.191) Solution (a)

In medicine, a biomarker is a measurable indicator of the severity or presence of some disease state. More generally a biomarker is anything that can be used as an indicator of a particular disease state or some other physiological state of an organism.

A biomarker can be a substance that is introduced into an organism as a means to examine organ function or other aspects of health. For example, rubidium chloride is used in isotopic labeling to evaluate perfusion of heart muscle. It can also be a substance whose detection indicates a particular disease state, for example, the presence of an antibody may indicate an infection.

Do you know?

- Hematology, also spelled haematology, is the branch of medicine concerned with the study of the cause, prognosis, treatment, and prevention of diseases related to blood.

THINK!

- Hemostasis

Q.192) Which among the following are the products of anaerobic respiration?

1. Adenosine Tri Phosphate (ATP)
2. Lactic Acid
3. Glucose

Select the correct answer using the code given below.

a) 1 and 3 only
b) 2 and 3 only
c) 1 and 2 only
d) 1, 2 and 3

Q.192) Solution (c)

In biology terms, respiration is the process by which cells break down sugar. Within a cell, two types of respiration may occur: "aerobic" and "anaerobic." Aerobic respiration is the more productive of the two and requires the presence of oxygen. Without oxygen, anaerobic respiration, which is also known as "fermentation," occurs. And the products of anaerobic respiration are

- ATP
- Lactic acid
- Ethyl alcohol

Do you know?

- Anaerobic respiration produces the relatively lesser amount of energy as compared to aerobic respiration as glucose is not completely broken down in the absence of oxygen.

THINK!

- Cellular respiration

Q.193) DOTS is the treatment given to treat which of the following disease?

a) Malaria
b) TB
c) Kala azhar
d) Leprosy

Q.193) Solution (b)

DOTS is currently the WHO-recommended strategy for TB control. DOTS must be used throughout the entire course of therapy for best cure rates. The core intervention involves a

health worker who observes the patient when s/he is swallowing each dose of anti-TB medication. DOTS also involve the regular collection of sputum specimens until two consecutive samples test negative for AFB.

Do you know?

- NIKSHAY- A web-based solution for monitoring of TB patients To monitor Revised National Tuberculosis Programme (RNTCP) effectively, a web enabled and case based monitoring application called NIKSHAY has been developed by National Informatics Centre (NIC).

THINK!

- RNTCP

Q.194) Cobas Zika test is used to detect Zika virus. The test confirms the presence of zika virus by detecting which of the organelle

a) DNA
b) RNA
c) Plastids
d) Vacuoles

Q.194) Solution (b)

Cobas Zika test is qualitative nucleic acid test for **detection of Zika virus RNA** in individual plasma specimens obtained from volunteer donors of w hole blood and blood components and from living organ donors. It has shown more than 99% clinical specificity, in earlier evaluation for testing individual samples from blood donations at five external laboratories.

Do you know?

- Zika virus is vector borne disease transmitted primarily by Aedes aegypti mosquitoes, the same mosquito that transmits dengue. It can also spread through blood transfusion and sexual contact.

THINK!

- ELISA test

Q.195) Which of the following statements is/are correct regarding `Yellow fever'?

1. It is spread to humans by infected mosquitoes.
2. The infection is so named because of the yellow skin colour (jaundice) observed in people with serious illness.

Select the correct answer using the code given below.

a) 1 only
b) 2 only
c) Both 1 and 2
d) None

Q.195) Solution (c)

Yellow fever is a tropical disease that is spread to humans by infected mosquitoes and is caused by the yellow fever virus. The disease is found in urban and rural areas of tropical zone countries in Africa and South America. **Yellow fever has not been reported in Asia.**

Yellow fever is a viral disease of short duration and varying severity that is transmitted primarily by mosquitoes. **The infection is so named because of the yellow skin colour (jaundice) observed in people with serious illness.** Symptoms of infection can be mild but often increase in severity with the sudden onset of fever, muscle pain, nausea, vomiting, headache and prostration. The disease may progress to visible haemorrhage, jaundice, kidney and liver failure. The death rate in unvaccinated people may be as high as 50 per cent.

Do you know?

- Jungle yellow fever is mainly a disease of monkeys. It is spread from infected mosquitoes to monkeys in the tropical rain forest. People get jungle yellow fever when they put themselves in the middle of this natural cycle and are bitten by mosquitoes that have been infected by monkeys. Jungle yellow fever is rare and occurs mainly in persons who work in tropical rain forests.

THINK!

- MERS

Q.196) DASTAK Campaign is launched to eradicate

a) Japanese Encephalitis
b) Malaria
c) TB
d) Dengue fever

Q.196) Solution (a)

The government of Uttar Pradesh has recently launched a huge door to door campaign DASTAK, to prevent Acute Encephalitis Syndrome (AES) and Japanese Encephalitis (JE) to

make sure that the disease is eradicated from the state at the earliest. The campaign was launched in association with UNICEF. Awareness about the disease will be created by initiating sanitation drive, ensuring vaccination and early treatment to the disease, through mass media communication etc.

Do you know?

- Japanese Encephalitis virus (JEV) is a flavivirus spread by mosquitoes and is related to same genus as yellow fever, dengue and West Nile Viruses. JEV is the primary cause for viral Encephalitis in a large number of countries in the Asian continent. In 1871, the first case of Japanese Encephalitis was recorded in Japan.

THINK!

- Ebola

(Source https://timesofindia.indiatimes.com/city/lucknow/uttar-pradesh-to-launch-house-to-house-campaign-against-encephalitis/articleshow/62771097.cms)

Q.197) Which of the following illness are correctly matched?

1. Minamata disease – Mercury contamination
2. Itai-itai disease – Cadmium contamination
3. Emphysema – Coal mine pollution
4. Pneumoconiosis – Air pollution

Select the code from following:

a) 1 and 2
b) 3 and 4
c) 1,2 and 4
d) 2,3 and 4

Q.197) Solution (a)

- Blue baby Syndrome- Nitrate contamination
- Minamata disease- Mercury contamination
- Itai-itai disease- Cadmium contamination
- Emphysema- Air pollution
- Pneumoconiosis- Coal mine pollution

Q.198) Xylem and Phloem are the vascular tissues of the plants. Which of the following statements regarding Xylem and Phloem are correct?

1. Xylem is continuous network of channels that connects roots to leaves and transport water and nutrients
2. The food prepared by plants is transported back to all the parts of plants via vascular tissue called phloem.

Select the code from following:

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.198) Solution (c)

Transport of water and minerals

- Plants absorb water and minerals through roots
- The root hairs in roots help in absorbing minerals and nutrients dissolved in water from roots to leaves plants have pipe like vessels (which transport water and nutrients from soil)
- These vessels are made of special cells called as vascular tissue (tissue – group of cells for special function)
- Vascular tissue for transport of water and nutrients is called as xylem. Xylem is continuous network of channels that connects roots to leaves and transport water and nutrient.
- The food prepared by plants is transported back to all the parts of plants via vascular tissue called phloem.

Q.199) Cryogenics finds application in

a) Surgery, Space technology and Magnetic levitation
b) Telemetry, Space technology and Magnetic levitation
c) Space technology, Surgery and Telemetry
d) Surgery, Telemetry and Magnetic levitation

Q.199) Solution (a)

Telemetry

Telemetry is an automated communications process by which measurements and other data are collected at remote or inaccessible points and transmitted to receiving equipment for monitoring.

Applications of cryogenics

- Aerospace-cryogenic engines
- Medical Field
- Manufacturing field
- Electronics Field
- Fuels research

Q.200) Henderson Island is a World Heritage site. he UNESCO website describes Henderson as "a gem" and "one of the world's best remaining examples of a coral atoll," that is "practically untouched by human presence." Where is Henderson Island located?

a) North Pacific
b) South Pacific
c) North Pacific
d) Indian Ocean

Q.200) Solution (b)

Henderson Island lies in the South Pacific, halfway between New Zealand and Chile. No one lives there. It is about as far away from anywhere and anyone on Earth. Yet, on Henderson's white sandy beaches, you can find articles from Russia, the United States, Europe, South America, Japan, and China. All of it is trash, most of it plastic. It bobbed across global seas until it was swept into the South Pacific gyre, a circular ocean current that functions like a conveyor belt, collecting plastic trash and depositing it onto tiny Henderson's shore at a rate of about 3,500 pieces a day.

The accumulation is even more disturbing when considering that Henderson is also a World Heritage site and one of the world's biggest marine reserves. The UNESCO website describes Henderson as "a gem" and "one of the world's best remaining examples of a coral atoll," that is "practically untouched by human presence."

Q.201) Irradiation process significantly increases the shelf life of a food product. Which of the following are the benefits of irradiation process?

1. Effective elimination of harmful bacteria, viruses and insects/pests.
2. Cold & clean process (No temperature raise or residue)
3. Treatment can be done after final packaging
4. Enhances the nutrition level of the food product

Select the code from following:

a) 1,2 and 3
b) 2,3 and 4
c) 1,3 and 4
d) All of the above

Q.201) Solution (a)

Bhabha Atomic Research Centre (BARC) - Department of Atomic Energy (DAE) has been engaged in R&D work on the technology of preservation and hygienization of food and agri - products by radiation.

Irradiation is very effective in treating the horticultural produces. Extension of shelf life of horticultural produces is very much depended on the produce, variety and storage conditions.

Unique advantages of radiation processing are:

- Significant increase in shelf life for many products including fruits, vegetables, cereals, pulses,spices, sea foods and meat products.
- Effective elimination of harmful bacteria, viruses and insects/pests.
- Cold & clean process (No temperature raise or residue);
- Treatment done after final packaging (no repacking necessary).

Recently the harmonization of food irradiation rules with the international regulation through adaptation of class wise clearance of irradiated food items by the Food Safety and Standards Authority of India (FSSAI) has taken place [Food Safety and Standards (Food Products Standards and Food Additives) Sixth Amendment Regulations, 2016] for large scale deployment of this technology.

Q.202) Nobel prize for physics in 2017 was given for:

a) Developing cryo-electron microscopy for the high-resolution structure determination of biomolecules in solution
b) Discoveries of molecular mechanisms controlling the circadian rhythm
c) LIGO detector and the observation of gravitational waves
d) Blue LED

Q.202) Solution (c)

- Developing cryo-electron microscopy for the high-resolution structure determination of biomolecules in solution - Chemistry

- Discoveries of molecular mechanisms controlling the circadian rhythm - Medicine
- LIGO detector and the observation of gravitational waves – Physics
- International Campaign to Abolish Nuclear Weapons (ICAN) - "for its work to draw attention to the catastrophic humanitarian consequences of any use of nuclear weapons and for its ground-breaking efforts to achieve a treaty-based prohibition of such weapons" – Peace

Q.203) Inland waterways are usually connected to the seas to provide passage to the ships. What happens to a ship when it enters from a river into the sea?

a) It rises a little
b) It sinks a little
c) The level remains unchanged
d) It can increase or decrease

Q.203) Solution (a)

The density of sea water is higher than the density of river water. Hence it exerts more buoyant force on the ship. This causes a slight increase in the level of the ship.

Q.204) Is it possible for the sun to become a black hole?

a) No because it's too large in mass
b) No because it's too small in mass
c) Yes at the end of its life
d) May or may not

Q.204) Solution (b)

Only stars with very large masses can become black holes. Our Sun, for example, is not massive enough to become a black hole. Four billion years from now when the Sun runs out of the available nuclear fuel in its core, our Sun will die a quiet death. Stars of this type end their history as white dwarf stars. More massive stars, such as those with masses of over 20 times our Sun's mass, may explode as supernovae and eventually create a black hole.

Q.205) Which of the following is the closest answer to how climate scientists infer that climate change happened?

a) Tree rings
b) Thermometer-based recordings
c) Rain guage measurements
d) Sea-level rise

Q.205) Solution (a)

The analysis of carbon and oxygen isotopes embedded in tree rings can reveal information about past climate events.

Carbon and oxygen isotope analysis is a good way to measure past climate change as it can provide accurate data on past events.

Although, scientists have long looked at the width of tree rings to estimate temperature levels of past years but strong correlation between the carbon and oxygen data and temperatures has been found for the first time.

Observing tree rings scientists have reconstructed past climatic patterns and environmental change in the region. Beyond providing valuable insight into how the environment reacted to events like fires and climatic shifts in the past, these observations can also help predict how the Arctic environment may respond to the inevitable warming of the future.

Thin rings would indicate low precipitation, wide rings higher precipitation.

Q.206) In astronomy, what is gravitational lensing?

a) Introducing a very large lens or series of lenses to view distant objects
b) Observing massive celestial bodies
c) The bending of light from a celestial body when it passes close to a massive object
d) It is work done by the gravitational field moving a body to its given position in space from infinity

Q.206) Solution (c)

When astronomers refer to lensing, they are talking about an effect called gravitational lensing. Normal lenses such as the ones in a magnifying glass or a pair of spectacles work by bending light rays that pass through them in a process known as refraction, in order to focus the light somewhere (such as in your eye).

Gravitational lensing works in an analogous way and is an effect of Einstein's theory of general relativity – simply put, mass bends light. The gravitational field of a massive object

will extend far into space, and cause light rays passing close to that object (and thus through its gravitational field) to be bent and refocused somewhere else. The more massive the object, the stronger its gravitational field and hence the greater the bending of light rays - just like using denser materials to make optical lenses results in a greater amount of refraction.

Q.207) This is the structure that allows nerve cells to communicate with their neighbours by passing on electrical or chemical signals. Name it.

a) Dendron
b) Axon
c) Synapse
d) Glial

Q.207) Solution (c)

In the nervous system, a synapse is a structure that permits a neuron (or nerve cell) to pass an electrical or chemical signal to another neuron or to the target efferent cell.

The function of the synapse is to transfer electric activity (information) from one cell to another. The transfer can be from nerve to nerve (neuro-neuro), or nerve to muscle (neuro-myo). The region between the pre- and postsynaptic membrane is very narrow, only 30-50 nm.

Q.208) In signal processing what is "white noise"?

a) A signal whose intensity peaks around a single frequency
b) A signal having a sharply defined frequency
c) A signal having an equal distribution of intensity over all frequencies
d) It is effectively silence with a tiny bit of random noise at some frequencies, which is the upper limit of human hearing

Q.208) Solution (b)

In signal processing, white noise is a random signal having equal intensity at different frequencies, giving it a constant power spectral density.

Q.209) Which is the largest cell in the human body?

a) Epithelial cell
b) Glial cell
c) Neuron
d) Ovum or egg cell

Q.209) Solution (d)

The egg cell, or ovum (plural ova), is the female reproductive cell (gamete) in oogamous organisms. The egg cell is typically not capable of active movement, and it is much larger (visible to the naked eye) than the motile sperm cells. When egg and sperm fuse, a diploid cell (the zygote) is formed, which rapidly grows into a new organism.

Do you know?

- The ovum is one of the largest cells in the human body, typically visible to the naked eye without the aid of a microscope or other magnification device. The human ovum measures approximately 0.1 mm in diameter.

Q.210) Consider the following statements:

1. Both electromagnetic and gravitational waves travel with the speed of light.
2. Both electromagnetic and gravitational waves can create ripples in space-time.

Which of the statements given above is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

Q.210) Solution (a)

Gravitational waves are ripples in the curvature of space-time which propagate as waves, travelling outward from the source. Predicted in 1916 by Albert Einstein on the basis of his theory of general relativity. Gravitational waves transport energy as gravitational radiation, a form of radiant energy similar to electromagnetic radiation. The speed of gravitational waves in the general theory of relativity is equal to the speed of light in vacuum, c.

Electromagnetic waves are synchronized oscillations of electric and magnetic fields that propagate at the speed of light through a vacuum. Visible light is one type of electromagnetic radiation; other familiar forms are invisible electromagnetic radiations, such as radio waves, infrared light and X rays.

Only gravitational waves can create ripples in space-time, electromagnetic waves create vibrations of electric and magnetic field in space only. Thus, statement 1 is correct and statement 2 is wrong. Hence, (a) is the correct answer.