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, and 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. Pluripotent stem cells hold promise in the field of regenerative medicine.

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.

They are a type of pluripotent stem cell that can be generated directly from adult cells. The iPSC technology was pioneered by Shinya Yamanaka's lab in Kyoto, Japan.

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

Pluripotent stem cells hold promise in the field of regenerative medicine. Because they can propagate indefinitely, as well as give rise to every other cell type in the body (such as neurons, heart, pancreatic, and liver cells), they represent a single source of cells that could be used to replace those lost to damage or disease.

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 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) Recently the term 'nosocomial infections' was in news. It 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.

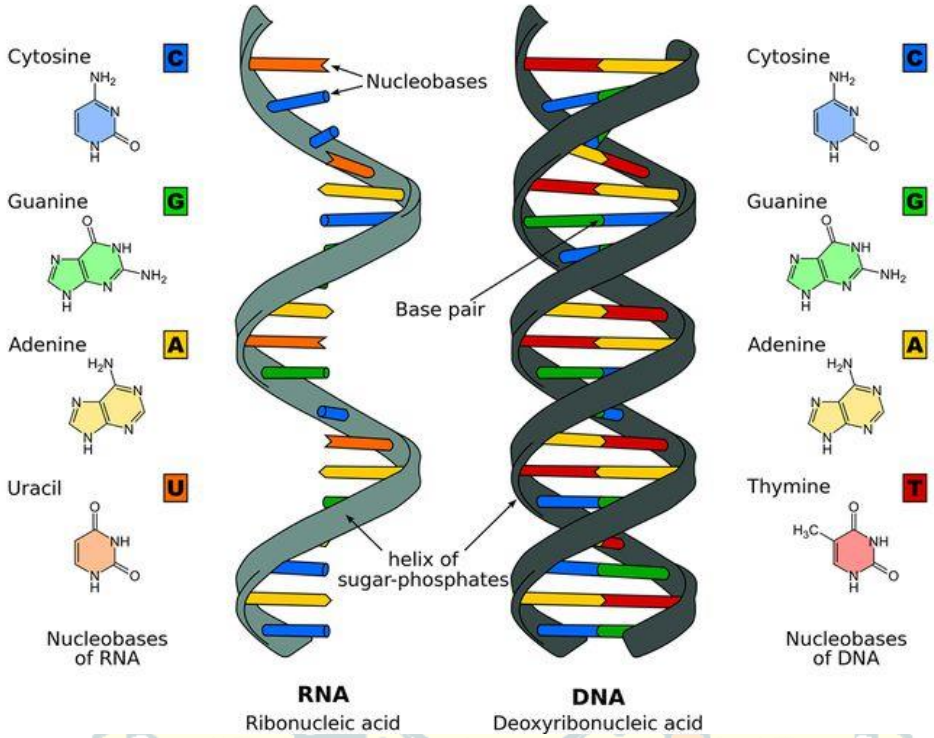
In gene therapy, biological components from different sources (a gene from humans, a plasmid originally from bacteria) are combined to make a new product.

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 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 a 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 (b)

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'.

Clones:

First, we should stress that clones are not completely identical from the genetic point of view to the donors of the nuclei. And second, that the characteristics of living beings are not only the result of the genes, and despite having a large part of their genes in common will not display the same pheonotype.

Thus, and as regards the genetic identity between what is being cloned and the clone, they would be identical in terms of the DNA of the cell nuclei. But they would have different DNAs in the mitochondria of their cytoplasm, since the clone's cytoplasm comes from the egg's donor, and this donor is usually different from the mother from which it is going to be cloned. This can result in differences in characteristics and organs -muscles, heart, brain- in which there is greater mitochondrial activity, which as we know are the "factories" of cell energy.

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

1. Mitochondrial disease can be caused by an adverse effect of drug infection and other environmental causes.
2. Mitochondrial disease is the group of disease caused by a 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/are 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) Recently, 'Rutland Island' was in news in what context?

a) It filed a case against India accusing of not fulfilling its obligations relating to the cessation of the nuclear arms race at an early date and to nuclear disarmament
b) India's long-range missile test facility
c) India's overseas military base in Seychelles to counter China's growing influence over the Indian Ocean
d) Sovereignty dispute between Mauritius and the United Kingdom

Q.22) Solution (b)

In News

- The National Board of Wildlife 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.

Rutland Island is an island of the Andaman Islands. It belongs to the South Andaman administrative district, part of the Indian union territory of Andaman and Nicobar Islands.

Think/Map Activity

- Chagos Archipelago
- Marshall Islands and India
- Assumption Island
- Duncan Passage

Source: https://economictimes.indiatimes.com/news/defence/wildlife-board-okays-andamans-rutland-island-for-drdos-missile-testing-project/articleshow/59007625.cms

Q.23) Consider the following statements about 'NICER' in the context of space technology

1. It is an external payload aboard the International Space Station
2. It focuses especially on pulsars
3. It was funded through NASA's 'Small Explorer' program

Select the correct statements

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

d) 1, 2 and 3

Q.23) Solution (a)

NASA's Neutron star Interior Composition Explorer, or NICER, mission is an International Space Station payload that will provide high-precision measurements of neutron stars – objects containing ultra-dense matter at the threshold of collapse into black holes.

NICER will also test — for the first time in space — technology that relies on pulsars as navigation beacons. The technique may eventually guide human exploration to the distant reaches of the solar system and beyond.

It will also carry out the world's first demonstration of X-ray navigation in space.

It was funded under the Missions of Opportunity (MO) program.

The mission will focus especially on pulsars. Pulsars and neutron Stars are the remnants of massive stars that, after exhausting their nuclear fuel, exploded and collapsed into super-dense spheres.

NICER launched June 3, 2017, from Cape Canaveral Air Force Station in Florida aboard the SpaceX-11 ISS Commercial Resupply Services flight. It was installed on the space station later that month.

Think – Recent missions by NASA

- NASA's Lunar Reconnaissance Orbiter (LRO)
- K2 Mission
- Parker Solar Probe
- GOLD and ICON

Source: http://indianexpress.com/article/technology/science/nasa-set-to-launch-first-ever-mission-to-neutron-stars-4685981/

Q.24) Consider the following statements about the report 'Sending Money Home: Contributing to the SDGs, one family at a time'

1. It is released by the UN International Fund for Agricultural Development (IFAD)
2. According to the report, India is the top receiving country for remittances

Select the correct statements

a) 1 Only

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

Q.24) Solution (c)

This report provides data and analysis of remittances and migration trends for developing countries over the past decade, as well as the potential contributions of remittance families to reaching the SDGs by 2030.

The 'One Family at a Time' study by the UN International Fund for Agricultural Development (IFAD) said about 200 million migrants globally sent more than $445 million in 2016 as remittances to their families, helping to lift millions out of poverty.

Indians working across the globe sent home USD 62.7 billion last year, making India the top remittance-receiving country surpassing China.

India was the top receiving country for remittances in 2016 at $62.7 billion, followed by China ($61 billion), the Philippines ($30 billion) and Pakistan ($20 billion).

Asia is the highest originating region with 77 million migrants; with 48 million remaining within the region. Over the past decade, remittances to Asia and the Pacific increased by 87 per cent, reaching $244 billion, while migration grew by only 33 per cent in comparison.

Asia remains the main remittance-receiving region, with 55 per cent of the global flows and 41 per cent of total migrants.

IFAD

- The International Fund for Agricultural Development (IFAD) is an international financial institution and a specialised agency of the United Nations dedicated to eradicating poverty and hunger in rural areas of developing countries.
- It was established as an international financial institution in 1977 as one of the major outcomes of the 1974 World Food Conference.
- Its headquarters is in Rome, Italy

Source: http://www.thehindu.com/news/international/india-top-remittance-receiving-country-in-2016-un-report/article19053537.ece

Q.25) Consider the following statements about 'Vatsalya – Maatri Amrit Kosh'

1. It is a National Human Milk Bank launched by Ministry of Women and Child Development
2. It is established as part of the Norway India Partnership Initiative (NIPI)
3. It will promote, support and protect the breastfeeding by providing lactation support to mothers

Select the correct statements

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

Q.25) Solution (b)

Vatsalya - Maatri Amrit Kosh', a National Human Milk Bank and Lactation Counselling Centre

- The Ministry of Health and Family Welfare recently launched the National Human Milk Bank at Lady Hardinge Medical College. This will be the first government-run human milk bank, and at present, the country's largest.
- The milk bank, called the Vatsalya — Maatri Amrit Kosh, has been established in collaboration with the Norwegian government and the Oslo University as part of the Norway India Partnership Initiative (NIPI).
- It will not only collect but will also test and will safely store the milk donated by lactating mothers for the infants who are in need
- With the help of dedicated lactated counsellors, the centre will promote, support and protect the breastfeeding by providing lactation support to mothers
- The project will not only act as a dedicated centre to support breastfeeding and improve infant survival, but also act as the teaching, training and demonstration site for other milk banks to be established under the Ministry of Health and Family Welfare, Government of India.

Think

- Mothers' Absolute Affection (MAA) programme

Source: http://pib.nic.in/newsite/PrintRelease.aspx?relid=164479

Q.26) Which of the following groupings established 'a one million dollar fund for boosting media cooperation'?

a) Bay of Bengal Initiative for Multi-sectoral Technical and Economic Cooperation (BIMSTEC)
b) South Asia Association for Regional Cooperation (SAARC)
c) The Brazil-Russia-India-China-South Africa (BRICS)
d) Bangladesh-China-India-Myanmar Economic Corridor (BCIM-EC)

Q.26) Solution (c)

The BRICS media forum is the result of a joint initiative by Xinhua News Agency, Brazil's CMA Group, Russia's Sputnik News Agency and Radio, The Hindu group of publications from India, and South Africa's Independent Media.

Source: http://www.thehindu.com/news/international/one-million-dollar-fund-established-to-bolster-brics-media/article18808579.ece

All the Best

IASbaba