

IASbaba 60 Day plan 2020 – Day 53 Science and technology

Q.1) Consider the following statements with regard to virus -

1. Virus can infect plant, bacteria and fungus.
2. Coronavirus is DNA based virus.
3. Virus lacks enzymes essential for the energy production.

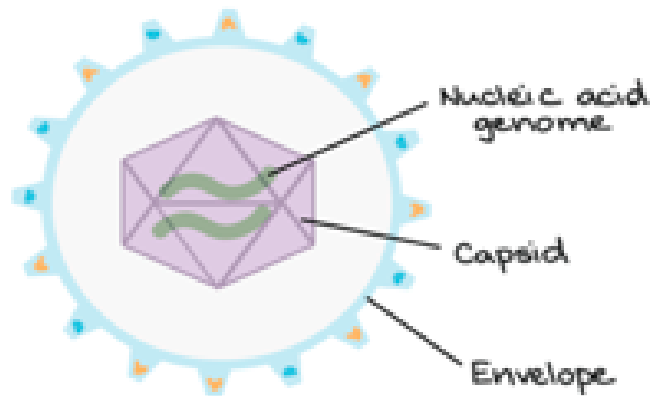
Select the correct option -

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

Q.1) Solution (b)

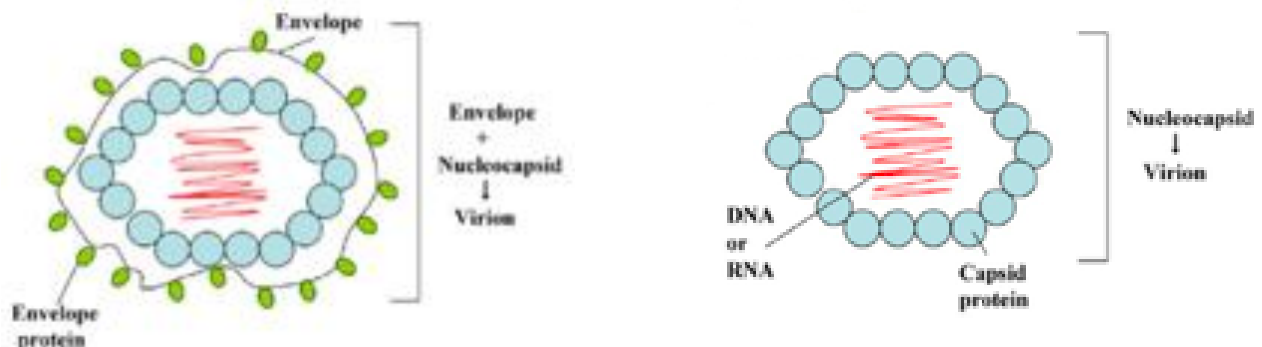
Basics of Virus

- Virus does not have DNA producing machinery. So it enters into the cell and uses the machinery of the cell. It does so by reprogramming the host DNA instead of producing its own DNA cell.
- Because they can't reproduce by themselves, viruses are not considered living.
- Viral particles consist of two or three parts:
 - **the genetic material made from either DNA or RNA.**
 - a protein coat, called the capsid, which surrounds and protects the genetic material
 - an envelope of lipids that surrounds the protein coat when they are outside a cell



Virus could be Enveloped viruses and naked virus depending on presence and absence of outer lipids layer.

Enveloped viruses and naked virus



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Enveloped viruses have outer lipid layer of glycoprotein and lipoproteins (envelop). They can only survive under special conditions ("wet conditions") and they are generally transmitted in "wet" body fluids, like blood or respiratory droplets. Naked viruses can survive under harsh conditions.

The protein capsid of naked viruses is less susceptible to environmental conditions (lipid solvents, pH, temperature etc) than enveloped viruses. Example of naked virus – **norovirus, rotavirus, Human papillomavirus (HPV) and polio** etc

CORONAVIRUS

- Large family of viruses, first identified in the 1960s.
- Can infect both animals and humans.
- It is **RNA based virus**.
- It causes illness ranging from the common cold to more severe respiratory illness like **SARS & MERS**.
- Almost everyone gets a coronavirus infection at least once in their life, most likely as a young child. (

NOVEL CORONAVIRUS – COVID-19

- A new strain that has not been previously identified in humans.
- First detected in Wuhan, China.
- Relative of SARS
- The novel coronavirus like any other **corona virus has its genetic material as a single-stranded RNA**.
- The challenge with RNA virus as compared to DNA virus is that RNA viruses are prone to quick changes and thus continuously mutating into new forms.

Q.2) Consider the following statements –

1. Hemoglobin is also found outside red blood cells.
2. The mammalian hemoglobin molecule can bind (carry) up to four oxygen molecules.
3. Largest amount of CO₂ produced in the cell are carried to the lungs as bicarbonate ions dissolved in the plasma.
4. Both RBC and WBC are produced in bone marrow.

Which of the above is/are correct?

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

Q.2) Solution (d)

Hemoglobin

- Hemoglobin is the iron-containing oxygen-transport metalloprotein in the red blood cells of all vertebrates
- Hemoglobin in the blood carries oxygen from the respiratory organs (lungs or gills) to the rest of the body
- In mammals, the protein makes up about 96% of the red blood cells' dry content (by weight), and around 35% of the total content (including water).
- The mammalian hemoglobin molecule can bind (carry) up to four oxygen molecules.
- Hemoglobin is involved in the transport of other gases: **It carries some of the body's respiratory carbon dioxide** as carbaminohemoglobin, in which CO₂ is bound to the globin protein. (Largest amount of CO₂ produced in the cell are carried to the lungs as bicarbonate ions dissolved in the plasma).
- **The molecule also carries the important regulatory molecule nitric oxide** bound to a globin protein thiol group, releasing it at the same time as oxygen.
- **Hemoglobin is also found outside red blood cells.** In these tissues, hemoglobin has a non-oxygen-carrying function as an antioxidant and a regulator of iron metabolism.
- A variant of the molecule, called **leghemoglobin**, is used to scavenge oxygen away from anaerobic systems, such as the nitrogen-fixing nodules of leguminous plants, before the oxygen can poison (deactivate) the system.
- Hemoglobin (Hb) is synthesized in a complex series of steps. The heme part is synthesized in a series of steps in the mitochondria and the cytosol of immature red blood cells, while the globin protein parts are synthesized by ribosomes in the cytosol.

Largest amount of CO₂ produced in the cell are carried to the lungs as bicarbonate ions dissolved in the plasma.

Q.3) Consider the following elements –

1. Carbon
2. Oxygen
3. Phosphorous
4. Nitrogen
5. Sulphur
6. Boron

Which of the above are present in DNA?

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- a) 1, 2 and 4 only
- b) 1, 2, 3 and 4 only
- c) 1, 2, 3, 4 and 6 only
- d) 1, 2, 3, 4 and 5 only

Q.3) Solution (b)

DNA does not contain sulphur. It is made up of Carbon, hydrogen, oxygen and Nitrogen and phosphorous. Proteins do contain sulphur.

Q.4) Consider the following pairs –

Metal	Function
1. Boron	Pollen germination
2. Manganese	Component of nitrogenase
3. Molybdenum	Splitting of H ₂ O to liberate O ₂ during photosynthesis
4. Zinc	Needed for synthesis of auxins
5. Iron	Present in Haemoglobin molecule and attach to oxygen and carbondioxide molecules.

Which of the above are correctly matched?

- a) 1, 4 and 5 only
- b) 1, 2, 4 and 5 only
- c) 1 and 4 only
- d) All of the above

Q.4) Solution (c)

Metal	Function
1. Boron	Pollen germination
2. Manganese	Splitting of H ₂ O to liberate O ₂ during photosynthesis
3. Molybdenum	Component of nitrogenase
4. Zinc	Needed for synthesis of auxins

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5. Iron	Present in Haemoglobin molecule and attach to oxygen molecules (NOT carbondioxide molecules).
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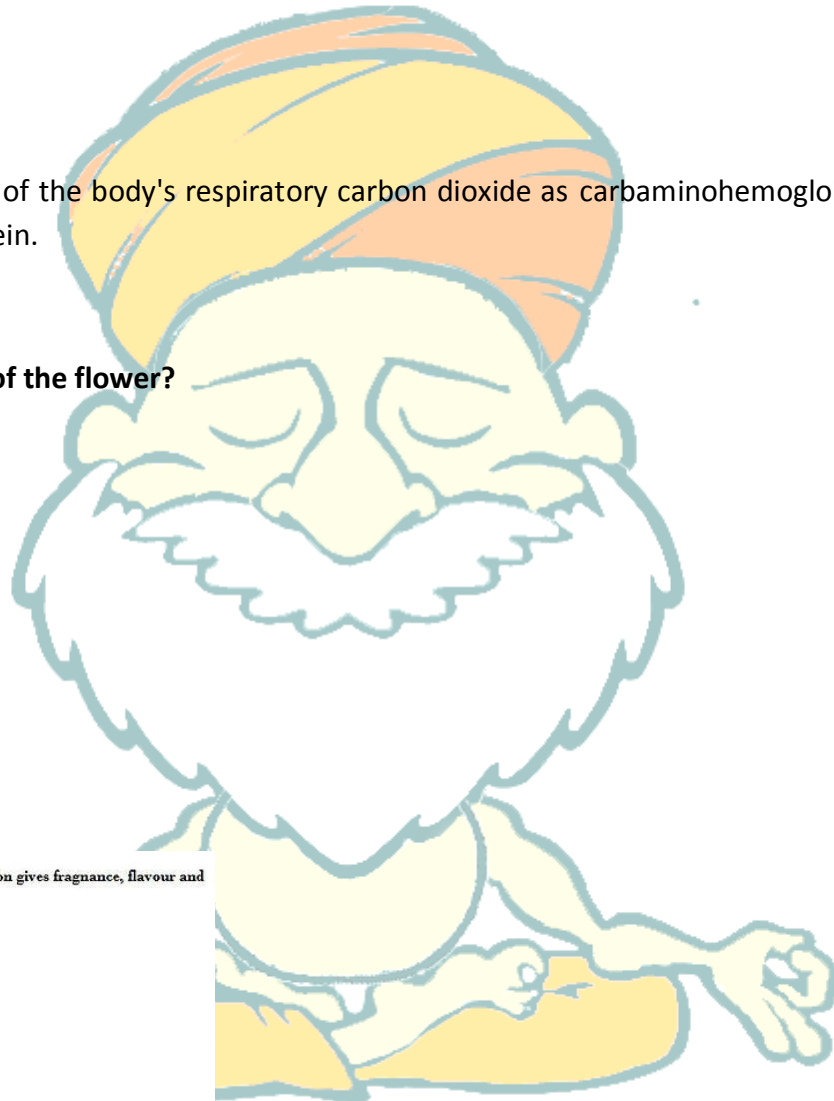
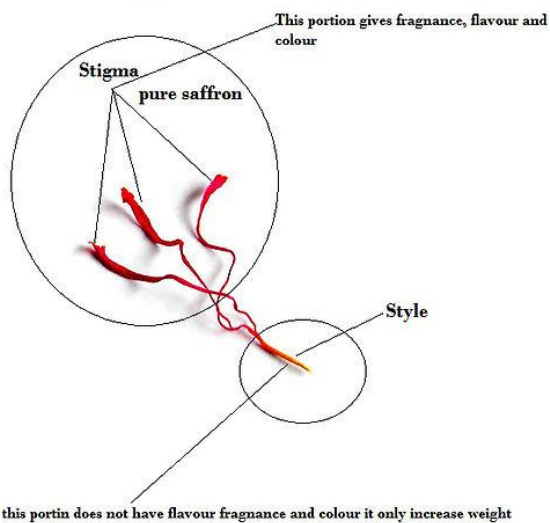
Haemoglobin carries some of the body's respiratory carbon dioxide as carbaminohemoglobin, in which CO₂ is bound to the globin protein.

Q.5) Saffron is which part of the flower?

- a) Stigma
- b) Style
- c) Sepal
- d) filament

Q.5) Solution (a)

Saffron is stigma of flower.



Q.6) In which of the following ways inflammation can help in fighting infection?

1. The area of infection gets more accessible to leucocytes.
2. Plasma protein accumulates in the inflamed area which creates a protective layer, restricting the movement of virus to other parts of the body.
3. Inflamed tissue sends the signal to T-cells and B-cells to initiate immune response.

Selected the correct option -

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

Q.6) Solution (a)

Inflammation

Inflammation is part of the body's defense mechanism and plays a role in the healing process. When the body detects damage or pathogens, cells of the immune system travel to the site of injury or infection and cause inflammation. Cytokines are produced when innate immune defenses are activated. The rapid release of cytokines at the site of infection initiates new responses with far-reaching consequences that include inflammation.

Inflammation and immune response

- Tissues accumulate plasma proteins, leading to a buildup of fluid those results in swelling.
- Small blood vessels enlarge to enable leukocytes and plasma proteins to reach the injury site more easily.
- The body releases neutrophils, a type of white blood cell, or leukocyte, which move toward the affected area. Leukocytes contain molecules that can help fight pathogens.

Statement 2 is completely imaginary and incorrect.

Statement 3 is also incorrect. Anti-bodies when binds with antigens, signals are sent to T-cells and B-cells to initiate immune response.

Q.7) Which of the following statement (s) is/are correct about "convalescent plasma therapy" ?

1. It was applied for the first time in case of Ebola.
2. WBC and blood plasma are transferred to the patient from the donor.
3. Convalescent plasma has the antigen of the infection causing virus.

Select the correct option -

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

Q.7) Solution (d)

Usage of convalescent plasma in the past

The plasma therapy was most famously used during the 1918 Spanish flu pandemic. It was also used during the Ebola epidemic, which started in 2013 and in 2003 against SARS. Even now, there is no vaccine or cure for SARS. The plasma therapy is also used against measles, bacterial pneumonia and numerous other infections before modern medicine came along.

What is convalescent plasma?

Those people who have recovered from COVID-19 have **antibodies** to the disease in their blood. Doctors call this convalescent plasma.

Researchers hope that convalescent plasma can be given to people with severe COVID-19 to boost their ability to fight the virus.

The neutralizing antibodies that when extracted via plasma and transfused on to others with the infection can help their immune system fight it off.

In a plasma-only donation, the liquid portion of the donor's blood is separated from the cells. Blood is drawn from one arm and sent through a high-tech machine that collects the plasma. **The donor's red blood cells and platelets are then returned to the donor along with some saline.** The process is safe and only takes a few minutes longer than donating whole blood.

Q.8) Which of the following are the functions of the blood plasma?

1. Maintaining blood pressure

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2. Delivering important protein for blood clotting
3. Maintenance of pH in the body
4. Carrying oxygen to the body from the lungs.

Select the correct option -

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

Q.8) Solution (b)

Blood plasma is a yellowish liquid component of blood that holds the blood cells in whole blood in suspension. It is the liquid part of the blood that carries cells and proteins throughout the body. It makes up about 55% of the body's total blood volume.

Plasma is about 92% water. It also contains 7% vital proteins such as albumin, gamma globulin and anti-hemophilic factor, and 1% mineral salts, sugars, fats, hormones and vitamins.

Plasma serves four important functions in our bodies:

- Helps maintain blood pressure and volume.
- Supply critical proteins for blood clotting and immunity.
- Carries electrolytes such as sodium and potassium to our muscles.
- Helps to maintain a proper pH balance in the body, which supports cell function.

Note - Oxygen is transported by RBC.

Q.9) Consider the following statements –

1. The RT-PCR test detects the presence of antibodies in a patient to identify the infection
2. RT-PCR tests are effective only in the later stages of the infection after the immune system has responded by synthesizing antibodies.

Which of the above given statements is/are correct?

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

d) Neither 1 nor 2

Q.9) Solution (d)

RT-PCR Test: Basics

Real time RT-PCR (Reverse transcription–polymerase chain reaction) is a nuclear-derived method for detecting the presence of specific genetic material from any pathogen, including a virus

- Normally DNA holds information about ingredients that make up a living being. The information coded in the DNA is converted into functional proteins in a living being which is called as gene expression.
- The process of gene expression happens in 2 processes namely transcription and translation. In the 1st step the information coded in the DNA is transcribed on to RNA in the nucleus. The job of copying this information onto RNA is done by an enzyme in the nucleus called RNA polymerase.
- Now in order to detect the presence of a viral infection the PCR test (Polymerase Chain Reaction) is used which detects the genetic material (DNA) from the samples collected from the patients. Usually the DNA from the patient's sample is collected and multiplied manifold using PCR which is then detected by a probe.
- In case of SAR-COV 2 the virus is an RNA virus which cannot be replicated using PCR. Thus the RNA is reverse-transcribed into DNA which can then be multiplied and then be used for detection using molecular testing.

Advantage of PCR Test over Rapid-Antibody Testing

In case of PCR tests it is the presence of an antigen in the infected patient that is tested for instead of the presence of antibodies which is done in case of Rapid Antibody testing

Detecting the presence of antigen can detect the infection early. Body will take some time to produce antibody. So detecting antibody may not confirm infection in early phase.

Q.10) Which of the following correctly describe the term 'herd immunity' in context of infectious diseases?

- a) Immunity towards those diseases which have been already eradicated.
- b) Immunity towards that disease which occur every year.
- c) Resistance to the spread of a contagious disease as sufficiently high proportion of population has become immune to the disease.
- d) Resistance to the spread of a contagious disease as sufficiently high proportion of population has been vaccinated.

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Q.10) Solution (c)

Herd immunity refers to the resistance to the spread of a contagious disease within a population that results if a sufficiently high proportion of individuals have become immune to the disease.

As herd immunity increases in the community, many infected persons will not find another person to infect during the entire infective period. Consequently, there will be few new cases arising and existing cases will recover or die. Spread of the disease will slow down and the pandemic will end.

Herd immunity can be achieved with or without vaccines.

Q.11) Consider the following statements regarding vaccine –

1. A vaccine is a biological preparation that provides active acquired immunity to a particular infectious disease.
2. A vaccine always contains disease-causing microorganism.

Which of the statements given above is/are incorrect?

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

Q.11) Solution (b)

A vaccine is a biological preparation that improves immunity to a particular disease.

A vaccine typically contains an agent that resembles a disease-causing microorganism, and is often made from weakened or killed forms of the microbe, its toxins or one of its surface proteins. The agent stimulates the body's immune system to recognize the agent as foreign, destroy it, and "remember" it, so that the immune system can more easily recognize and destroy any of these microorganisms that it later encounters.

Vaccines are made using several different processes. Some of them are discussed below:

Type of vaccine	How it is processed?	Diseases covered
Live attenuated vaccines	Live, attenuated vaccines contain a version of the living microbe that has been weakened in the lab so it can't cause disease.	Measles, mumps, rubella (MMR combined vaccine) Varicella (chickenpox) Influenza (nasal spray) Rotavirus

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Inactivated vaccines	It is produce inactivated vaccines by killing the disease-causing microbe with chemicals, heat, or radiation. Inactivated vaccines usually don't require refrigeration, and they can be easily stored and transported in a freeze-dried form, which makes them accessible to people in developing countries.	Hepatitis A, Influenza, Pneumococcal polysaccharide
Sub-unit vaccine	Instead of the entire microbe, subunit vaccines include only the antigens that best stimulate the immune system.	Hepatitis B
Toxoid vaccines	Toxoid vaccines contain a toxin or chemical made by the bacteria or virus. They make a person immune to the harmful effects of the infection, instead of to the infection itself.	Diphtheria and tetanus
Polysaccharide Vaccines	Polysaccharide vaccines are a unique type of inactivated subunit vaccine composed of long chains of sugar molecules that make up the surface capsule of certain bacteria.	pneumococcal disease, meningococcal disease, and Salmonella Typhi
Biosynthetic vaccines	Biosynthetic vaccines contain manmade substances that are very similar to pieces of the virus or bacteria.	HIV

Q.12) Consider the following statements with regard to m-RNA Vaccine –

1. It triggers the body itself into producing some of the viral proteins.
2. It will be easier and quicker to produce than traditional vaccines.
3. It can be used against coronavirus.

Select the correct option –

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

Q.12) Solution (d)

Note – a number of RNA vaccines are under development to combat the 2019–20 coronavirus pandemic. This is a very important topic for coming prelims examination.

What is m-RNA?

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- Every cell in an organism contains all of the information needed to manufacture every protein in its body.
- The DNA is the storehouse of information, an instruction book to build these proteins.
- The message to build these proteins from DNA to the cytoplasm of the cell is carried by a middle man called m-RNA.

m-RNA based Vaccines

A vaccine basically trains the immune system to recognize parts of a virus (antigen) and fight it before it enters the cell.

An RNA vaccine is a novel type of vaccine which is composed of the nucleic acid RNA, packaged within a vector such as lipid nanoparticles.

Traditional vaccines are made up of small or inactivated doses of the whole disease-causing organism, or the proteins that it produces, which are introduced into the body to provoke the immune system into mounting a response.

mRNA vaccines, in contrast, trick the body into producing some of the viral proteins itself. They work by using mRNA, or messenger RNA, which is the molecule that essentially puts DNA instructions into action. Inside a cell, mRNA is used as a template to build a protein. 'An mRNA is basically like a pre-form of a protein and its (sequence encodes) what the protein is basically made of later on.

To produce an mRNA vaccine, scientists produce a synthetic version of the mRNA that a virus uses to build its infectious proteins. This mRNA is delivered into the human body, whose cells read it as instructions to build that viral protein, and therefore create some of the virus's molecules themselves. These proteins are solitary, so they do not assemble to form a virus. The immune system then detects these viral proteins and starts to produce a defensive response to them.

There are two parts to our immune system: **innate** (the defenses we're born with) and **acquired** (which we develop as we come into contact with pathogens). Classical vaccine molecules usually only work with the acquired immune system and the innate immune system is activated by another ingredient, called an adjuvant. Interestingly, **mRNA in vaccines could also trigger the innate immune system**, providing an extra layer of defence without the need to add adjuvants.

All kinds of innate immune cells are being activated by the mRNA. This primes the immune system to get prepared for an endangering pathogen and thus the type of immune response that is triggered is very strong.

And **by getting the human body to produce the viral proteins itself, mRNA vaccines cut out some of the manufacturing process** and should be easier and quicker to produce than traditional vaccines.

So far, no such vaccine has been licensed for infectious disease.

Q.13) Which organelle in the cell other than nucleus contains DNA?

1. Mitochondria
2. Chloroplasts
3. Ribosome
4. Lysosome

Select the correct option?

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

Q.13) Solution (b)

Although the vast majority of DNA in most eukaryotes is found in the nucleus, some DNA is present within the mitochondria of animals, plants, and fungi and within the chloroplasts of plants.

Q.14) Assertion (A) – In three parent baby, embryo would get a small amount of healthy mitochondrial DNA from a woman donor, apart from receiving the usual nuclear DNA from its mother and father

Reason (R) - Mitochondria from sperm are destroyed shortly after fertilisation.

Select the correct option –

- a) A is true, R is True and A is the correct explanation of R
- b) A is true, R is True but A is not the correct explanation of R
- c) A is true, R is false
- d) A is false, R is true.

Q.14) Solution (a)

THREE PARENT BABY

Apart from receiving the usual “nuclear” DNA from its mother and father, the embryo would also include a small amount of healthy mitochondrial DNA from a woman donor.

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This is resorted to when the actual mother is suffering from an incurable mitochondrial disease.

This technique involves removing the faulty mitochondrial DNA from the actual mother and nucleus from the mother's egg and the resultant egg fertilizes with the sperm cell of the father outside the body (in-vitro).

Although both sperm and egg cells contain mitochondria, the mitochondria from the sperm are broken down shortly after fertilisation, which means that all the mitochondria, and all the copies of the mitochondrial DNA in the fertilised egg are from the mother.

Q.15) What is the fundamental need of oxygen in animals?

- a) Maintenance of blood pressure.
- b) Production of new cells.
- c) Conversion of food into useful energy.
- d) Prevention of cancer

Q.15) Solution (c)

Oxygen, with the formula O_2 , makes up about one fifth of Earth's atmosphere. Oxygen is essential for animal life: it is used by the mitochondria present in virtually all animal **cells in order to convert food into useful energy**. Otto Warburg, the recipient of the 1931 Nobel Prize in Physiology or Medicine, revealed that this conversion is an enzymatic process.

Q.16) The fundamental property of our immune system is the ability to discriminate "self" from "non-self" so that invading bacteria, viruses and other pathogens can be attacked and eliminated. T-cells, a type of white blood cell, are key players in this defense. T-cells have receptors that bind to structures recognized as non-self and such interactions trigger the immune system to engage in defense. Other proteins function as brakes on the T-cells, inhibiting immune activation. This intricate balance between accelerators and brakes is essential for tight control. It ensures that the immune system is sufficiently engaged in attack against foreign microorganisms while avoiding the excessive activation that can lead to autoimmune destruction of healthy cells and tissues.

James P. Allison in 1990's observed that CTLA-4 functions as a brake on T cells. He developed an antibody that could bind to CTLA-4 and block its function. This will disengage the T-cell brake and unleash the immune system.

What could be the medical advantage of this inhibition of negative immune regulation?

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1. It can help in fighting new disease like COVID-19
2. It can be utilised in cancer therapy.
3. It can reduce development of free radicals and aging.

Select the correct option –

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

Q.16) Solution (c)

Antibodies against CTLA-4 block the function of the brake leading to activation of T cells and attack on cancer cells. Mice with cancer had been cured by treatment with the antibodies that inhibit the brake and unlock antitumor T-cell activity. In 2010 an important clinical study showed striking effects in patients with advanced melanoma, a type of skin cancer. In several patients signs of remaining cancer disappeared.

The 2018 Nobel Prize in Physiology or Medicine was jointly given to James P. Allison and Tasuku Honjo for their discovery of **cancer therapy by inhibition of negative immune regulation**.

Statement 1 is incorrect as new diseases can be fought only when there is acquired immunity against the disease and not just by increasing the immune response.

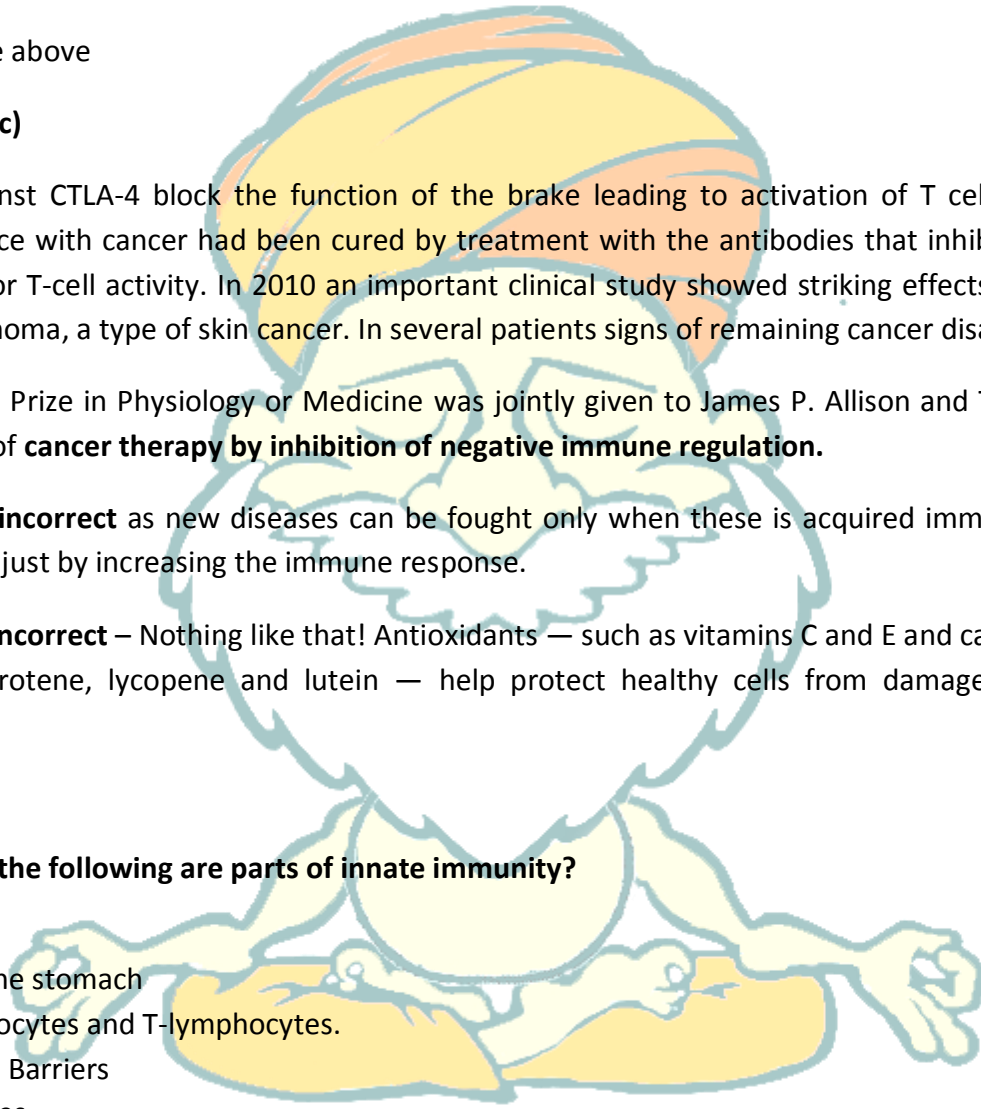
Statement 3 is incorrect – Nothing like that! Antioxidants — such as vitamins C and E and carotenoids, which include beta-carotene, lycopene and lutein — help protect healthy cells from damage caused by free radicals.

Q.17) Which of the following are parts of innate immunity?

1. Skin
2. Acid in the stomach
3. B-lymphocytes and T-lymphocytes.
4. Cytokine Barriers
5. Antibodies

Select the correct option?

- a) 1, 2 and 3 only
- b) 1, 2 and 4 only
- c) 1, 2, 4 and 5 only
- d) All of the above



Q.17) Solution (b)

Innate immunity

- **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.

Acquired Immunity

- Acquired immunity is pathogen specific. It is characterized by memory. This means that our body when it encounters a pathogen for the first time produces a response called primary response which is of low intensity.
- Subsequent encounter with the same pathogen elicits a highly intensified secondary or anamnestic response. This is ascribed to the fact that our body appears to have memory of the first encounter.
- The primary and secondary immune responses are carried out with the help of two special types of lymphocytes present in our blood, i.e., B-lymphocytes and T-lymphocytes.
- The B-lymphocytes produce an army of proteins in response to pathogens into our blood to fight with them. These proteins are called Antibodies [a blood protein produced by the body in response to and counteracting an antigen].
- The T-cells themselves do not secrete antibodies but help B cells produce them.
- Each antibody molecule has four peptide chains, two small called light chains and two longer called heavy chains. Hence, an antibody is represented as H₂L₂.
- Different types of antibodies are produced in our body. IgA, IgM, IgE, IgG are some of them.
- Because these antibodies are found in the blood, the response is also called as humoral immune response. This is one of the two types of our acquired immune response – antibody mediated. The second type is called cell-mediated immune response or cell mediated immunity (CMI). The T-lymphocytes mediate CMI.
- Very often, when some human organs like heart, eye, liver, kidney fail to function satisfactorily, transplantation is the only remedy to enable the patient to live a normal life. Then a search begins – to find a suitable donor. Why is it that the organs cannot be taken from just anybody? What is it that the doctors check?

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- Grafts from just any source – an animal, another primate, or any human beings cannot be made since the grafts would be rejected sooner or later. Tissue matching, blood group matching are essential before undertaking any graft/transplant and even after this the patient has to take immunosuppressants all his/her life. The body is able to differentiate 'self' and 'nonself' and the cell-mediated immune response is responsible for the graft rejection.

Q.18) Consider the following statements –

1. It is possible to make numerous copies of a DNA molecule in laboratory.
2. Base excision repair is a cellular mechanism that repairs damaged DNA by in vivo gene editing.

Select the correct option –

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

Q.18) Solution (a)

In 1983, Kary Mullis discovered the polymerase chain reaction (PCR), a process that allows scientists to make numerous copies of DNA molecules that they can then study. Today, PCR is used for

- Making lots of DNA for sequencing
- Finding and analyzing DNA from very small samples for use in forensics
- Detecting the presence of disease-causing microbes in human samples
- Producing numerous copies of genes for genetic engineering

Base excision repair is a cellular mechanism, studied in the fields of biochemistry and genetics, that repairs damaged DNA throughout the cell cycle. It is responsible primarily for removing small, non-helix-distorting base lesions from the genome. (This is not gene editing)

CRISPR gene editing is a genetic engineering technique in molecular biology by which the genomes of living organisms may be modified. It is based on a simplified version of the bacterial CRISPR-Cas9 antiviral defense system. By delivering the Cas9 nuclease complexed with a synthetic guide RNA (gRNA) into a cell, the cell's genome can be cut at a desired location, allowing existing genes to be removed and/or new ones added in vivo.

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Q.19) Recombinant DNA is the general name for taking a piece of one DNA, and combining it with another strand of DNA. Recombinant DNA technology allows genes to be transferred:

1. From species of plant to another.
2. From microorganisms to higher organisms
3. From animals to plants

Select the correct answer using the codes given below.

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

Q.19) Solution (d)

Recombinant DNA is the general name for taking a piece of one DNA, and combining it with another strand of DNA. Examples of these methods are:-

- The gene 'Chitinase' has source organism 'Rice' and characteristic conferred on transformed plants is fungal resistance.
- The gene '2'-5' oligoadenylate synthetase' has source organism 'Rat' and characteristic conferred on transformed plants is Virus resistance .
- Human Proteins 'Somatostatin' have been synthesized from genes in bacteria and used in the treatment of Growth disorders.

Q.20) There has been widespread resistance in malarial parasite to drugs like chloroquine. This has encouraged attempts to develop a malarial vaccine. However it is difficult to develop an effective malaria vaccine. Which of the following is the most appropriate explanation?

- a) Malaria is caused by several species of Plasmodium, mutating at rapid rate.
- b) We lack naturally acquired protective immunity against the plasmodium
- c) Vaccines can be developed only against virus.
- d) Plasmodium does not release any nuclear material for antigen development in the body.

Q.20) Solution (b)

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For most infectious diseases for which effective vaccines are available, a single infection confers long standing protective immunity. A person who had measles does not develop measles again. This type of sterile protective immunity does not exist for malaria. We lack naturally acquired protective immunity against the plasmodium or other malarial parasites. Plasmodium has its own ingenious way of avoiding hosts' immune response and that is why it has been very difficult.

Q.21) Consider the following statements:

1. NASSCOM Foundation launched 'Innovate for Accessible India' campaign along with Google.
2. The major objective of this campaign is to empower divyaang people with Apple Cloud, AI and other latest technologies.

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.21) Solution (d)

- **Microsoft India and NASSCOM Foundation launched the 'Innovate for Accessible India' campaign.**
- The initiative has been launched in partnership with Ministry of Social Justice & Empowerment, Ministry of Science and Technology and ERNET, Department of Empowerment of Persons with Disabilities (DEPWD) and other departments.
- The major objective of 'Innovate for Accessible India' campaign is to empower divyaang people with the tools and technology.
- This campaign wants to equip divyaang people with a technology that can help them to make their life easier.
- Innovate for Accessible India campaign will use Microsoft cloud, AI and other latest technologies that can sort out the issues faced by divyaang people.
- Microsoft and NASSCOM are working together in this initiative to provide better employment opportunities, education, rehabilitation and other government services.
- This campaign will include social impact organizations, students and citizens with social work impact.
- It will prepare some solutions that can address issues faced by people with disabilities.

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- There are 21 officially recognized disabilities and this campaign is working on all of them.

Persons with Disabilities in India

- The data of the Indian Census 2011 shows that the total population of disabled people in the country is about 2% of the total population.

Q.22) Which of the following statements is/are Correct regarding Convalescent plasma therapy?

1. Plasma can also be taken from people infected with HIV, hepatitis or syphilis.
2. The whole blood or plasma from such people is taken, and the plasma is then injected in critically ill patients so that the antibodies are transferred and boost their fight against the virus.
3. WHO guidelines mandate the donor's permission before extracting plasma.

Select the correct answer using the code given below:

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

Q.22) Solution (b)

- Convalescent plasma therapy seeks to make use of the antibodies developed in the recovered patient against the virus.
- The whole blood or plasma from such people is taken, and the plasma is then injected in critically ill patients so that the antibodies are transferred and boost their fight against the virus.
- If the plasma is injected at an early stage, it can possibly help fight the virus and prevent severe illness.

How often has it been used in the past?

- The United States used plasma of recovered patients to treat patients of Spanish flu (1918-1920).
- Hong Kong used it to treat SARS patients in 2005.
- In 2009, H1N1 patients were treated with plasma.

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- In 2014, the World Health Organization released guidelines to treat Ebola patients with convalescent whole blood and plasma.
- In 2015, plasma was used for treating MERS patients.

How is it done?

- The process to infuse plasma in a patient can be completed quickly. It only requires standard blood collection practices, and extraction of plasma.
- If whole blood is donated (350-450 ml), a blood fractionation process is used to separate the plasma.
- Otherwise, a special machine called aphaeresis machine can be used to extract the plasma directly from the donor.
- While blood is indeed extracted from the donor, the aphaeresis machine separates and extracts the plasma using a plasma kit, and the remaining blood components are returned into the donor's body.
- **WHO guidelines in 2014 mandate a donor's permission before extracting plasma.**
- **Plasma from only recovered patients must be taken, and donation must be done from people not infected with HIV, hepatitis, syphilis, or any infectious disease.**
- If whole blood is collected, the plasma is separated by sedimentation or centrifugation, then injected in the patient.
- If plasma needs to be collected again from the same person, it must be done after 12 weeks of the first donation for males and 16 weeks for females.

Q.23) Earth Hour is an annual event organized by

- a) International Union for Conservation of Nature
- b) World Wildlife Fund
- c) United Nations Environment Programme
- d) World Nature Organization

Q.23) Solution (b)

- Every year, Earth Hour is observed on the last Saturday of March at 8:30 pm.

What is Earth Hour?

- Earth Hour is an annual event **organized by the World Wildlife Fund** that promotes conservation and sustainable energy.

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- During this time, civilians are encouraged to switch off their lights for one hour to help reduce the effect of global warming and raise awareness for climate change and wildlife conservation.
- In 2007, we encouraged people around the world to switch off their lights to call attention to climate change.
- Today, Earth Hour aims to spark global conversations on protecting nature not only to combat the climate crisis, but to ensure our own health, happiness, prosperity and even survival.
- **Earth Hour is the world's biggest switch off event** – a moment millions come together for nature, people and the planet.
- It was famously started as a lights-off event in Sydney, Australia in 2007.

What's the difference between Earth Hour and Earth Day?

- Whereas Earth Hour stands as a climate change initiative where people reduce their electricity usage, **Earth Day (April 22)** celebrates our natural environment by inspiring people to plant trees, recycle regularly and keep the planet tidy.

Q.24) Which of the following is/are Correctly matched regarding Traditional New Year?

1. Vaisakhi – Punjab
2. Bohag Bihu – Odisha
3. Puthandu – Tamil Nadu
4. Pana Sankranti – Assam

Select the correct answer using the code given below:

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

Q.24) Solution (a)

According to Hindu New Year or Vikram Samvat, the month of Chaitra (usually falls between the months of March and April) marks the New year or first month of Hindu calendar.

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The great king of Ujjain, Vikramaditya, first established the new Hindu year.

Gudi Padwa - Maharashtra, Goa

- Gudi Padwa is the first day of the Chaitra month, beginning of the New year celebrated in Maharashtra. A gudi with stick displayed in out of a window or households in the state.

Ugadi - Karnataka, Telangana and Andhra Pradesh

- Ugadi is the New Year's day that begins with the month of Chaitra celebrated in Telangana, Andhra Pradesh and Karnataka state. Gudi Padwa and Ugadi are celebrated on the same day.

Vishu - Kerala, Karnataka

- Vishu festival marks the beginning of the harvest year. celebrated in the Indian state of Kerala. The festival of light and fireworks is the most important event in Kerala and devotees visit the Sabarimala Ayyappan Temple and Guruvayur Krishna temple.

Vaisakhi - Punjab

- Vaisakhi or Baisakhi is the most religious festival in Sikhism, marks the Sikh new year. This harvest festival happened in the Punjab region and people gather to socialize and share festive foods.

Pohela Boishakh - West Bengal, Tripura

- Pahela Baishakh in the Bengali New Year, celebrated with grandeur and colours in the state of West Bengal. The Bengali New Year is also considered to be an auspicious time for marriages.

Puthandu - Tamil Nadu

- Puthandu known as Tamil New Year is celebrated on the first month of the Tamil solar calendar in Tamil Nadu and Puducherry. There are list of famous festivals are held at Tiruchirapalli, Kanchipuram, Tiruvidaimarudur near Kumbakonam.

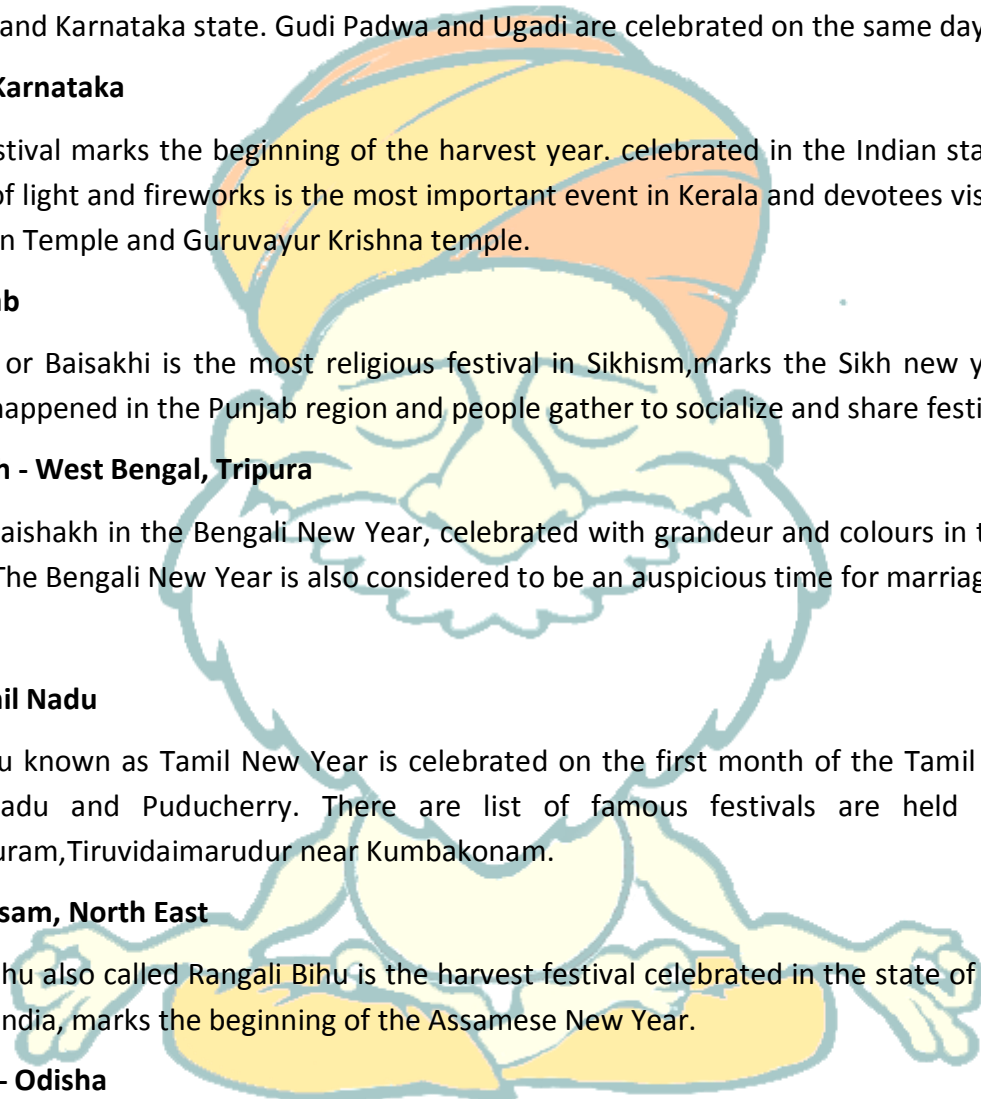
Bohag Bihu - Assam, North East

- Bohag Bihu also called Rangali Bihu is the harvest festival celebrated in the state of Assam and north eastern India, marks the beginning of the Assamese New Year.

Pana Sankranti - Odisha

- Pana Sankranti or Maha Vishuva Sankranti marks the beginning of the New Year in the Odia calendar, generally falls on the 14th or 15th of April. Pana Sankranti is similar to New Year festivals such as Vaisakhi, Maithili New Year, Bisu Parba and Cheti Chand.

Jude Sheetal - Bihar, Jharkhand



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- Jude Sheetal also known as Maithili New Year, usually falls on 14 April on Gregorian calendar. Maithili New Year is a festive occasion celebrated by the Maithils in Bihar and Nepal.

Q.25) Which of the following is/are the member states of Indian Ocean Rim Association (IORA)?

1. Maldives
2. South Africa
3. Oman
4. Sri Lanka
5. Indonesia

Select the correct answer using the code given below:

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

Q.25) Solution (d)

- The Indian Ocean Rim Association (IORA) is an inter-governmental organisation which was established on 7 March 1997. The vision for IORA originated during a visit by late President Nelson Mandela of South Africa to India in 1995
- IORA is a dynamic inter-governmental organization aimed at strengthening regional cooperation and sustainable development within the Indian Ocean region through its 22 Member States and 10 Dialogue Partners.
- 22 member states are Australia, Bangladesh, Comoros, India, Indonesia, Iran, Kenya, Madagascar, Malaysia, Maldives, Mauritius, Mozambique, Oman, Seychelles, Singapore, Somalia, South Africa, Sri Lanka, Tanzania, Thailand, UAE, and Yemen.

The objective of the Blue Economy is to promote smart, sustainable and inclusive growth and employment opportunities within the Indian Ocean region's maritime economic activities.

The IORA Secretariat has identified the following six priority pillars in the blue economy

- Fisheries and Aquaculture
- Renewable Ocean Energy
- Seaports and Shipping

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- Offshore Hydrocarbons and Seabed Minerals
- Marine Biotechnology, Research and Development
- Tourism
- 19th IORA Council of Ministers (COM) Meeting was held in Abu Dhabi (UAE) under the theme of “**Promoting a Shared Destiny and Path to Prosperity in the Indian Ocean**”.
- The United Arab Emirates (UAE) has assumed the position of Chair while Bangladesh will be Vice-Chair of the IORA for the period of 2019-2021.

Q.26) Consider the following statements with respect to ‘Methanotrophs’

1. They are obligate aerobes that use methane as a sole carbon and energy source.
2. They are generally bacteria and can grow aerobically only.

Select the correct statements

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

Q.26) Solution (a)

Methanotrophs (sometimes called methanophiles) are prokaryotes that metabolize methane as their only source of carbon and energy. They can be either bacteria or archaea and can grow aerobically or anaerobically, and require single-carbon compounds to survive.

Q.27) ‘Modified New Pricing Scheme -III (NPS-III) primarily deals with

- a) Sugarcane
- b) Cotton
- c) Urea
- d) Paddy

Q.27) Solution (c)

It provides incentives to the domestic urea manufacturers, encouraged investment in urea production sector, reduced urea imports. It mainly aimed to achieve self-sufficiency in urea production.

Q.28) 'Tectaria macrodonta' was in news recently in the context of

- a) Algal Bloom
- b) Whiteflies
- c) COVID-19
- d) Neglected Tropical Diseases

Q.28) Solution (b)

The leaf extract of an edible fern *Tectaria macrodonta* causes toxicity to the whitefly.

Q.29) Consider the following statements with respect to 'Fourth Branch Institutions'

1. They are independent bodies, which are charged with performing vital functions of oversight.
2. All these institutes are non-constitutional bodies.

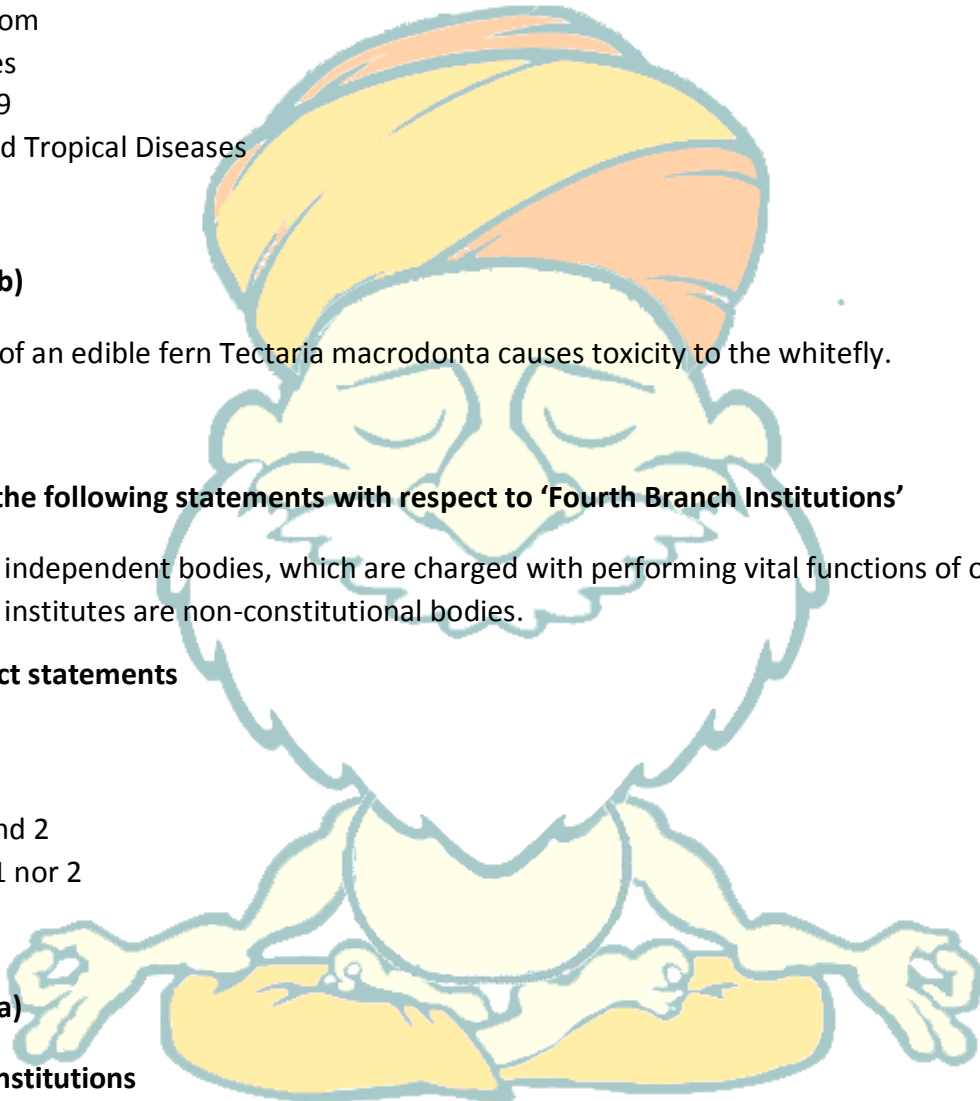
Select the correct statements

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

Q.29) Solution (a)

Fourth Branch Institutions

- The complexity of governance and administration in the modern world has necessitated the existence of a set of independent bodies, which are charged with performing vital functions of oversight.
- Some of these bodies are constitutional bodies — established by the Constitution itself. These include, for instance, the Election Commission and the Office of the Comptroller and Auditor General.



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- Others have been established under law: for example, the Information Commission under the Right to Information Act, and Human Rights Commissions under the Protection of Human Rights Act.

Q.30) Consider the following statements with respect to 'Production Linked Incentive (PLI)' scheme.

1. It will help wooing the large companies to invest in India in mobile phone manufacturing and specified electronic components.
2. It will give India the ability to be as agile as countries like China and Vietnam with respect to manufacturing of products.

Select the correct statements

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

Q.30) Solution (c)

Govt allocates Rs. 48,042 crore in three key schemes to compete with China, Vietnam in electronics manufacturing

Scheme for Promotion of Manufacturing of Electronics Components and Semiconductors (SPECS)

- It will provide financial incentive of 25% on capital expenditure for the select electronic goods that comprise downstream value chain of electronic products, i.e., electronic components, semiconductor/ display fabrication units, ATMP units, etc.
- The scheme will also be applicable to expansion of capacity modernization and diversification of existing units along with investments in new units.

Production Linked Incentive (PLI) scheme

- It will help wooing the large companies come to India, invest here in mobile phone manufacturing and specified electronic components, including Assembly, Testing, Marking and Packaging (ATMP) units.
- They will get 4-6% incentive on the final manufacturing.
- The scheme will also help in creating 2-4 "champion Indian companies.

Electronics Manufacturing Clusters (EMC) 2.0

- It will act as a pull for large companies to come to India bringing along their entire components manufacturing ecosystem.

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- The scheme will provide financial assistance upto 50% of the project cost subject to ceiling of Rs.70 crore per 100 acres of land and For Common Facility Centre (CFC), financial assistance of 75% of the project cost subject to a ceiling of Rs.75 crore will be provided.
- The government has earmarked a budgetary outlay of Rs. 3,762.25 crore for this scheme over a period of 8 years.

