All India Civil Services Coaching Centre

(Under the aegis of Government of Tamil Nadu)

Answer Key Explanation

Environment and Science & Technology

Maximum Questions: 100 **Maximum Marks: 200**

1. Ans. A

Exp: Statement 1 and 2 are incorrect:

Population size is estimated to number fewer than 50 mature individuals

IUCN Classification of Conservation Priority:

- IUCN Red List of Threatened Species is one of the most well-known objective assessment systems for classifying the status of plants, animals, and other organisms threatened with extinction. The International Union for Conservation of Nature (IUCN) unveiled this assessment system in 1994. It contains explicit criteria and categories to classify the conservation status of individual species on the basis of their probability of extinction.

- EXTINCT (EX): A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), and throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

- EXTINCT IN THE WILD (EW): A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), and throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

- CRITICALLY ENDANGERED (CR): A taxon is Critically Endangered when it is considered to be facing an extremely high rate of extinction in the wild and when the best available evidence indicates that it meets any of the following criteria –
- Population size reduction of ≥ 90% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible, understood and ceased.
- Probability of extinction in wild is at least 50% in 10 years
- Population size is estimated to number fewer than 50 mature individuals

- ENDANGERED (EN): A taxon is Endangered when it is considered to be facing an extremely high rate of extinction in the wild and when the best available evidence indicates that it meets any of the following criteria –
- Population size reduction of ≥ 70% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible, understood and ceased.
- Probability of extinction in wild is at least 20% in 20 years

- Population size is estimated to number fewer than 250 mature individuals

- VULNERABLE (VU): A taxon is Vulnerable when it is considered to be facing a high risk of extinction in the wild and when the best available evidence indicates that it meets any of the following criteria –
- Population size reduction of ≥ 70% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible,
- Probability of extinction in wild is at least 20% in 20 years
- Population size is estimated to number fewer than 250 mature individual

- NEAR THREATENED (NT): A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

- LEAST CONCERN (LC): A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

- DATA DEFICIENT (DD): A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

- NOT EVALUATED (NE): A taxon is Not Evaluated when it is has not yet been evaluated against the criteria.

2. Ans. C

Exp: Statement 1, correct: Mangroves for the Future (MFF) is a unique partner-led initiative to promote investment in coastal ecosystem conservation for sustainable development. Co-chaired by IUCN and UNDP.

Objectives: To achieve its goal of conservation, restoration and sustainable management of coastal ecosystems as key natural infrastructure which support human well-being and security, MFF implements actions guided by three main objectives.

So, Statement 2& 3 are correct - It initially focused on the countries that were worst affected by the tsunami -- India, Indonesia, Maldives, Seychelles, Sri Lanka and Thailand. More recently it has expanded to include Bangladesh, Cambodia, Myanmar, Pakistan and Vietnam. So, statement 4 is wrong

3. Ans. D

Exp: Statement 1, incorrect: Pyrolysis – material is exposed to high temperature, and in the absence of oxygen goes through chemical and physical separation into different molecules.

Statement 2, incorrect: Vermiculture - the cultivation of earthworms, especially in

order to use them to convert organic waste into fertilizer.

Statement 3, incorrect: Incineration - Waste destruction in a furnace by controlled burning at high temperatures.

Statement 4, incorrect: Composting - Biological process in which micro-organisms decompose degradable organic waste

4. Ans. D

Exp:Pterocarpus santalinus, with the common name red sanders, is a species of Pterocarpus, endemic to the southern Eastern Ghats mountain range of South India. It is known for its rich hue and therapeutic properties, is high in demand across Asia, particularly in China and Japan, for use in cosmetics and medicinal products, as well as for making furniture, woodcraft and musical instruments.

IUCN Status: Near Threatened. It is endemic to India.

Note: All red sanders farmers, who were not allowed to export their produce as the foreign trade policy prohibited it, now can. The Directorate General of Foreign Trade (DGFT), an agency of the Ministry of Commerce and Industry, on February 18, 2019, revised its export policy to permit its export, if it is obtained from cultivated land.

5. Ans. A

Exp:

- The coastal zone is a transition area between marine and territorial zones. It includes shore ecosystems, wetland ecosystems, mangrove ecosystems, mudflat ecosystems, sea grass ecosystems, salt marsh ecosystems and seaweed ecosystems.
- A Coastal Regulation Zone (CRZ) consists of coastal land up to 500 metres from the High Tide Line (HTL) and a stage of 100 metres along the banks of creeks, estuaries, backwaters and rivers, where tidal fluctuations occur.

6. Ans. C

Exp: Both statements are correct

Agasthyamala Biosphere Reserve:

The Agasthyamala Biosphere Reserve has recently been included in UNESCO's List of World Biosphere Reserve Network.

- The area falls in the Malabar rainforests and is one of the noted hotspot in the Western Ghats. It covers about 3500 sq kms and is part of different districts of Tamil Nadu and Kerala.
- Agastya Mala, the peak after which the reserve is named, rises up to almost 1868 metres above sea level, in Thiruvananthapuram.
- There are many endemic and endangered species of flora and fauna in the reserve including endangered Nilgiri Tahr.
- It includes the Indian eco regions of moist deciduous forests, montane rainforests and Shola forests and grasslands.
- There are three wildlife sanctuaries within the reserve - Shendurney, Peppara, and Neyyar.

7. Ans. A

Exp: Statement 2 is incorrect: Lichens are indicators of air quality and are particularly sensitive to sulfur dioxide.

Indicator species

- It is a species whose presence indicates the presence of a set of other species and whose absence indicates the lack of that entire set of species.
- An indicator species is any biological species that defines a trait or characteristic of the environment. For example, a species may delineate an eco-region or indicate an environmental condition such as a disease outbreak, pollution, species competition or climate change. Indicator species can be among the most sensitive species in a

region and sometimes act as an early warning to monitoring biologists.

- Many indicator species of the ocean systems are fish, invertebrates, periphyton, macrophytes and specific species of ocean birds (like the Atlantic Puffin). Amphibian indicates chemicals, global warming, and air pollution. Lichens are indicators of air quality and are sensitive to sulfur dioxide.

8. Ans. C

Exp: Statement 1 and 3 are incorrect: National Parks are notified by the State Governments; Boundaries of sanctuaries are not well defined and controlled biotic interference is permitted, while the boundaries of a national park are well defined and no biotic interference is permitted.

Protected Area Network (PAN)

- National parks and sanctuaries are areas of significant ecological, floral, faunal or natural significance. They are notified by the State Governments; and protected by the Forest Departments under the provisions of the Wildlife (Protection) Act, 1972 & its amendments, Indian Forest Act of 1927, Forest (Protection) Act of 1980, Biological Diversity Act, 2002 and the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006.
- Hunting of wild animals, encroachment and/or destruction of habitat, construction of tourist lodges and other such activities are prohibited in protected areas.
- A National park is a protected area which is reserved for the conservation of biodiversity, where no human interference in any form of harvesting of timber, collecting minor forest products and private ownership rights is allowed; while a wildlife sanctuary is a protected area which is reserved for the conservation of biodiversity and human activities like harvesting of timber, collecting minor forest products and private ownership rights are allowed as long as they do not interfere with the well-being of animals.
- While most of the provisions are common for sanctuaries and national parks, there are four key differences:
- All rights of people within a national park have to be settled, while in a sanctuary certain rights can be allowed,
- Livestock grazing is prohibited in a national park, but can be allowed in a regulated manner in sanctuaries,
- A sanctuary can be upgraded to a national park, but a national park cannot be downgraded as a sanctuary, and
- Boundaries of sanctuaries are not well defined and controlled biotic interference is permitted, while the boundaries of a national park are well defined and no biotic interference is permitted. Wildlife Sanctuary are species centric and focuses on certain species and National Parks are region centric.

9. Ans. B

Exp: Statement 1 is incorrect: Invasive species results in loss of biodiversity.

Statement 4 is incorrect: Invasive species introduce pathogens that reduce crop and stock yields.

Invasive species

- Aliens are species that occur outside their natural range. Alien species that threaten native plants and animals or other aspects of biodiversity are called alien invasive species.
- They occur in all groups of plants and animals, as competitors, predators, pathogens and parasites, and they have invaded almost every type of native ecosystem.
- Biological invasion by alien species is recognised as one of the major threats

to native species and ecosystems. This is because when non-native species are introduced into new areas, they have few or no natural predators to keep their populations in check.

Effects

- The effects on biodiversity are enormous and often irreversible.
- Loss of Biodiversity
- Decline of Native Species (Endemics)
- Habitat Loss
- Introduced pathogens reduce crop and stock yields
- Degradation of marine and freshwater ecosystems

10. Ans. C

Exp: Statement 1, correct: Wildlife Crime Control Bureau is a statutory multi-disciplinary body established by the Government of India under the Ministry of Environment and Forests, to combat organized wildlife crime in the country. The Bureau has its headquarter in New Delhi. It has been established under Wildlife Protection Act, 1972.

- it is mandated to collect and collate intelligence related to organized wildlife crime activities and to disseminate the same to State and other enforcement agencies for immediate action so as to apprehend the criminals
- to establish a centralized wildlife crime data bank; co-ordinate actions by various agencies in connection with the enforcement of the provisions of the Act
- capacity building of the wildlife crime enforcement agencies for scientific and professional investigation into wildlife crimes and assist State Governments to ensure success in prosecutions related to wildlife crimes. So Statement 3 is correct Statement 2, correct: Advise WCCB is binding in nature.

Note: WCCB has won Asia Environment Enforcement Awards for combating trans-boundary environmental crime. This is second time in row that WCCB is awarded by UN Environment. Last year it was awarded for its efforts in conducting and coordinating species-specific wildlife enforcement operation codenamed 'Operation Save Kurma'. The operation is aimed at combating proliferating illegal trade of live turtles and its parts from the country to destinations abroad.

11. Ans. C

Exp: The restructured National Bamboo Mission (NBM) has been launched in 2018-19 to focus on the development of complete value chain of bamboo sector and link growers with markets. Major objectives of the Mission are:

- To increase the area under bamboo plantation in non-forest government and private lands to supplement farm income and contribute towards resilience to climate change, as well as availability of quality raw material for the industries.
- To improve post-harvest management through establishment of innovative primary processing units near the source of production, primary treatment and seasoning plants, preservation technologies and market infrastructure.
- To promote product development, keeping in view the market demand, by assisting R&D, entrepreneurship and business models at micro, small and medium levels and feed bigger industry.
- To rejuvenate the under-developed bamboo industry in India.
- To promote skill development, capacity building, awareness generation for development of bamboo sector from production to market demand.

To re-align efforts, so as to reduce dependency on the import of bamboo and bamboo products by way of improved productivity and suitability of domestic raw material for industry, so as to enhance income of the primary producers.

12. Ans. B

Exp: Statement 1 is incorrect: Biological Diversity Act, 2002 was brought to realize the objective of Convention on Biological Diversity.

Statement 3 is incorrect: The act establishes three tier structures at national, state and local level.

Biological Diversity Act, 2002:

The Biological Diversity Act, 2002 is an Act of the Parliament of India for preservation of biological diversity in India, and provides mechanism for equitable sharing of benefits arising out of the use of traditional biological resources and knowledge. The Act was enacted to meet the obligations under Convention on Biological Diversity (CBD), to which India is a party.

- The National Biodiversity Authority (NBA) is a statutory autonomous body, headquartered in Chennai, under the Ministry of Environment and Forests, Government of India established in 2003 to implement the provisions under the Act. State Biodiversity Boards (SBB) has been created in 28 States along with 31,574 Biological management committees (for each local body) across India.

Functions include:

- Regulation of acts prohibited under the Act
- Advise the Government on conservation of biodiversity
- Advise the Government on selection of biological heritage sites
- Take appropriate steps to oppose grant of intellectual property rights in foreign countries, arising from the use of biological resources or associated traditional knowledge.

Objectives are:

- Fair and equitable sharing of benefits arising out of the utilization of genetic resources.
- Biological diversity conservation.
- Sustainable use of its components.
- Biological Diversity Act, 2002 was brought to realize the objective of Convention on Biological Diversity.
- The act establishes three tier structures at national, state and local level.

13. Ans. D

Exp: All statements are correct

Indian Species

- Star tortoise Monitor lizard Pygmy hog and Lion Tailed Macaque - All are found in India
- The Indian star tortoise (Geocheloneelegans) is a threatened species of tortoise found in dry areas and scrub forest in India and Sri Lanka.
- The Pygmy Hog is the smallest, rarest and most highly specialized member of the pig family. It was formerly known to occur across a narrow strip of early successional tall grassland plains along the southern Himalayan foothills in the Indian subcontinent
- Lion-tailed macaque (Macacasilenus) also known as Wanderloo is one of the smallest and most endangered of the macaque species. Lion-tailed Macaque is the only Indian macaque with a black coloured coat.
- Lion Tailed Macaque is endemic to Western Ghats and is found only in evergreen broadleaf monsoon forest in Western Ghats states of Karnataka, Kerala and Tamil Nadu.

14. Ans. D

Exp: All statements are correct

Biodiversity Hotspots

- Hot spots are the richest and most threatened reservoirs of plant and animal life of the earth. They have

maximum number of endemic species. They occupy 1.4% of the earth's surface and 20% of worlds human population lives in these areas. Currently, 35 biodiversity hotspots have been identified, most of which occur in tropical forests.

- India hosts 4 biodiversity hotspots: the Western Ghats, the Eastern Himalayas, the Indo-Burma region and the Sundaland.

To qualify as a hot spot, a region must meet two strict criteria:

- Species endemism: the region must contain at least 1,500 species of vascular plants (> 0.5% of the world's total) as endemics, and
- Degree of threat: the region has to have lost at least 70% of its original habitat.
- The biodiversity hotspots are mostly confined to the tropical regions of the world. One idea is that tropical regions harbor greater biodiversity because they are especially fertile grounds for the formation of new species -- i.e., "cradles of diversity." Another idea is that biodiversity hotspots are less likely to lose the species they already have.
- Biodiversity hotspots do not make allowances for changing land use patterns. Hotspots represent regions that have experienced considerable habitat loss, but this does not mean they are experiencing ongoing habitat loss. On the other hand, regions that are relatively intact (e.g. the Amazon Basin) have experienced relatively little land loss, but are currently losing habitat at tremendous rates.

- Factors
- Endemic plants,
- Endemic vertebrates,
- Endemic plants/area ratio (species per 100km2),
- Endemic vertebrates/area ratio (species per 100km2) and
- Remaining primary vegetation as % of original extent.

The eight hottest hot spots in terms of the above five factors are:

- Madagascar
- Philippines
- Sundaland [South East Asia]
- Brazil's Atlantic Forest
- Caribbean
- Indo-Burma
- Western Ghats and Sri Lanka
- Eastern Arc and Coastal Forests of Tanzania/Kenya

These eight 'hottest hot spots', appear at least three times in the top ten listings for each factor.

15. Ans. A

Exp: The list of World Network of Biosphere reserves are,

1. Nilgiri, 2000
2. Gulf of Mannar, 2001
3. Sunderban, 2001
4. Nanda Devi, 2004
5. Nokrek, 2009
6. Pachmarhi, 2009
7. Similipal, 2009
8. Achanakmar-Amarkantak, 2012
9. Great Nicobar, 2013
10. Agasthyamala, 2016
11. Khangchendzonga, 2018

UNESCO's WNBR of the MAB Programme promotes North-South and South-South collaboration and represents a unique tool for international co-operation through sharing knowledge, exchanging experiences, building capacity and promoting best practices.

16. Ans. D

Exp: Statement 3, Correct: PMKSY is an micro irrigation technique. It aims to reduce water consumption and targets "more crop per drop". It thus reduces water requirement and hence contributes to lessening water based CO2 emissions.

Statement 1, Correct: Direct seedling reduces the requirement of nurseries. This inturn minimises the replanting and germination related CO2 emissions.

Statement 1, Correct: Urea coated with neem fertilizer is one of the solutions to increase the efficiency of nitrogen fertilizer and reduce greenhouse gases emission.

Inhibition of the nitrification rate of urea can reduce NO2- and N2O gas, and at the same time urea can be efficiently absorbed by the plants. Soil CO2's levels treated either with 2.5% or 5% neem coated urea showed the lowest levels of CO2 in soil.

17. Ans. B

Exp: Statement 1, correct: The Carbon Neutrality Coalition brings together a group of pioneering countries that have agreed to develop ambitious climate strategies to meet the long-term objectives of the Paris Agreement. In includes cities, local governments and sovereign entities.

Statement 3, correct: The following 32 cities have also pledged to become emissions neutral by 2050 Austin, Accra, Barcelona, Berlin, Boston, Buenos Aires, Cape Town, Caracas, Copenhagen, Durban, London, Los Angeles, Melbourne, Mexico City, Milan, New York City, Oslo, Paris, Philadelphia, Portland, Quito, Rio de Janeiro, Salvador, San Francisco, Santiago, Seattle, Stockholm, Sydney, Toronto, Vancouver, Washington and Yokohama. Member countries are thus:

Statement 2, incorrect: India is still not a member of this coalition.

18. Ans. D

Exp: Statement 1, correct: Such burning releases SOx& NOx pollutants which are primarily responsible for acid rain.

Statement 2, correct: The pH value of rain water is about 5.6 which means its slightly acidic.

Statement 3, correct: Any base can act as neutraliser for acid rain and calcareous regions/soil are one such.

Additional Info: The 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone sets national emission ceilings for 2010 up to 2020 for four pollutants: sulphur (SO2), nitrogen oxides (NOx), volatile organic compounds (VOCs) and ammonia (NH3).

19. Ans. D

Exp: Statement 1, correct: The NCAP will be a mid-term, five-year action plan with 2019 as the first year. The tentative national level target of 20%–30% reduction of PM2.5 and PM10 concentration by 2024 is proposed under the NCAP taking 2017 as the base year for the comparison of concentration.

Statement 2, incorrect: City specific action plans are being formulated for 102 non-attainment cities identified for implementing mitigation actions under NCAP. Overall monitoring will be by CPCB. So, Statement 4 is correct.

Statement 3, incorrect: It has been formulated under The Air (Prevention and Control of Pollution) Act, 1981

20. Ans. C

Exp: Statement 1, incorrect: Blue baby syndrome can also be caused by nitrates in drinking water leading to methemoglobinemia. Nitrates from polluted drinking water form compounds in the body that change haemoglobin to methemoglobin, decreasing the ability of blood to carry oxygen.

In infants, the condition can be fatal. Minamata disease is a disease of the central nervous system, a poisoning caused by long-term consumption, in large amounts, of fish

and shellfish from Minamata Bay. The causative agent is methylmercury.

Statement 2, correct: Cadmium poisoning can also cause softening of the bones and kidney failure. The cadmium was released into rivers by mining companies in the mountains, which were successfully sued for the damage. Itai-itai disease is known as one of the Four Big Pollution Diseases of Japan.

Statement 3, correct: Many dusts can cause pneumoconiosis. The most common workplace mineral dusts that are known to cause pneumoconiosis are asbestos, silica (rock and sand dust), and coal dust.

21. Ans. C

Exp: The ill effects of sand mining on wildlife are not confined to beaches and sandbanks, but also include underwater ecosystems. When sand is mined from sea beds or river beds, it can create turbidity in the water.

- The machines and human disturbance induced by such processes can also adversely impact aquatic wildlife. The turbidity can create a barrier that prevents sunlight from entering the water, which is harmful to corals that need sunlight.
- By sucking too much sediment out of the world's rivers, unsustainable sand mining will contribute to bank erosion and shrinking, sinking deltas – with the loss of agriculture land, houses and infrastructure, including failure of roads, dikes and bridges.

22. Ans. B

Exp: Statement 1, incorrect: A Central Government constituted committee for the National Capital Region vide Gazette Notification in compliance with the Hon'ble Supreme Court order dated January 7, 1998.

Statement 2, Correct: It is mandated to enforce Graded Action Response Plan(GRAP) in NCR as per pollution levels.

23. Ans. C

Exp: Statement 1, correct: POPs are hazardous organic chemical compound that is resistant to biodegradation and thus remains in the environment for a long period of time.

Stockholm Convention on Persistent Organic Pollutants is an international environmental treaty, signed in 2001 and effective from May 2004, that aims to eliminate or restrict the production and use of persistent organic pollutants (POPs).

Statement 2, incorrect: Because POPs have low water solubility, they bond strongly to particulate matter in aquatic sediments. As a result, sediments can serve as reservoirs or "sinks" for POPs.

Statement 3, correct: Slow-growing plants (and the animals that feed on these plants) can be exposed to bio-accumulating contaminants such as POPs for a long time before being consumed at the next level in the food chain

Statement 4, correct: POPs work their way through the food chain by accumulating in the body fat of living organisms and becoming more concentrated as they move from one creature to another. This process is known as "biomagnification." When contaminants found in small amounts at the bottom of the food chain bio-magnify, they can pose a significant hazard to predators that feed at the top of the food chain.

24. Ans. D

Exp: All the mentioned gases are sources which can lead to ozone hole. They include,

1. Chlorofluorocarbons
2. Nitrogen oxides
3. Bromine
4. Sulphuric acid particles
5. Carbon tetrachloride
6. Methyl Chloroform

25. Ans. A

Exp: Statement 1, correct: The plan India unveiled the third National Wildlife Action Plan for 2017-2031 on the inaugural day of the Global Wildlife Programme (GWP) conference held in New Delhi.

The GWP, initiated in 2015, is a World-Bank led partnership of 19 countries to promote the conservation and sustainable development by combating trafficking in wildlife.

Statement 2, correct: The third National Wildlife Action Plan is unique as this is the first time India has recognised the concerns relating to climate change impact on wildlife and stressed on integrating actions that need to be taken for its mitigation and adaptation into wildlife management planning processes.

Statement 3, incorrect: This plan was drafted by a 12-member committee chaired by J C Kala, a former secretary to the ministry. The plan adopts a "landscape approach" in conservation of all wildlife – uncultivated flora and fauna – that have an ecological value to the ecosystem and to mankind irrespective of where they occur.

26. Ans. B

Exp: Quantitative Pollutants- The substances which are already present in the environment, but are termed as pollutants when their concentration (quantity) increases in the environment. eg. CO2 is present in the environment in greater quantity than normal and is hence termed as a quantitative pollutant. Other examples included ozone, NOx, SOx, CO…

Qualitative Pollutant- The substances which are not normally present in the environment and are added by human beings and are pollutants by nature. Eg. insecticides, pesticides. In short, all manmade pollutants can be called as qualitative.

27. Ans. B

Exp: "Compostable plastics" mean plastic that undergoes degradation by biological processes during composting to yield CO2, water, inorganic compounds and biomass at a rate consistent with other known compostable materials, excluding conventional petro-based plastics and do not leave visible, distinguishable or toxic residue.

- Provision of minimum thickness shall not be applicable to carry bags made up of compostable plastics.
- Carry bags made from compostable plastics shall conform to the Indian Standard: IS 17088:2008 titled as Specifications for Compostable Plastics, as amended from time to time. The manufacturers or seller of compostable plastic carry bags shall obtain a certificate from the Central Pollution Control Board before marketing or selling.
- Each carry bag made from compostable plastics shall bear a label "compostable" and shall conform to the Indian Standard: IS or ISO 17088:2008 titled as Specifications for "Compostable Plastics".

28. Ans. C

Exp: Statement 2, incorrect: The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change. It was Created in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP).

It does not carry out new research nor does it monitor climate-related data. It bases its assessment mainly on published and peer reviewed scientific technical literature.

Statement 3, Correct: The 2007 Nobel Peace Prize was shared, in two equal parts, between the Intergovernmental Panel on Climate Change and Al Gore "for their efforts to build up and disseminate greater

knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change.

Statement 1, Correct: The Intergovernmental Panel on Climate Change (IPCC) is the world's foremost collection of climate scientists. Throughout 2013 and 2014, the group released its Fifth Assessment Report in four installments, highlighting the current state of the climate system and climate change, its environmental and socio-economic impacts, and mitigation strategies that can limit emissions It formed the basis for Paris Agreement.

29. Ans. B

Exp: Statement 1, incorrect:
Cyclopentane is a hydroflorocarbon with zero ozone depletion potential and low global warming potential.

Statement 2, correct: India is in the process of phasing out HCFC by 2030 as per the existing agreement signed by India in the Montreal protocol. HCFC is a commonly used refrigerant gas. t is also used in foam blowing agents, solvents, aerosols and fire extinguishers.

MoEFCC has suggested that it will propose for the funding of foam industries to ease shift from using ozone-depleting Hydrochlorofluorocarbons (HCFC) to chemical Cyclopentane.

https://www.downtoearth.org.in/news/climate-change/india-decides-to-put-a-break-on-hfo-in-foam-sectorfor-now-55227

30. Ans. D

Exp: The Central Pollution Control Board (CPCB), a statutory organization, was constituted in September, 1974 under the Water (Prevention and Control of Pollution) Act, 1974. Further, CPCB was entrusted with the powers and functions under the Air (Prevention and Control of Pollution) Act, 1981.

- It serves as a field formation and also provides technical services to the Ministry of Environment, Forest and Climate Change of the provisions of the Environment (Protection) Act, 1986.
- Principal functions of the CPCB, as spelt out in the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981,
  - ➢ to promote cleanliness of streams and wells in different areas of the States by prevention, control and abatement of water pollution, and
  - ➢ to improve the quality of air and to prevent, control or abate air pollution in the country.
- The Chairman of CPCB is appointed by the Ministry of Environment, Forest and Climate Change. The Union Minister of Environment, Forest and Climate Change is not the chairman of CPCB.

31. Ans. B

Explanation:
The International Union for Conservation of Nature (IUCN) is a membership Union uniquely composed of both government and civil society organisations. It provides public, private and non-governmental organisations with the knowledge and tools that enable human progress, economic development and nature conservation to take place together.

It works include,

1. Business and Biodiversity
2. Climate Change
3. Ecosystem management
4. Environmental Law
5. Forests
6. Gender
7. Global policy
8. Governance and Rights
9. Marine and Polar
10. Protect Areas
11. Science & Economics
12. Species

13. Water
14. World heritage

Hence, Statements 2 & 3 are correct & Statement 1 is incorrect

32. Ans. D

Exp: Statement 1, correct & Statement 3, correct: A carbon credit is a permit or certificate allowing the holder to emit carbon dioxide or other greenhouse gases.

The credit limits the emission to a mass equal to one ton of carbon dioxide. The issuance of carbon credits aims to reduce the emission of greenhouse gases into the atmosphere. It has its origins in Kyoto Protocol. Statement 2, correct: A World Bank study has mentioned that China followed by India are the biggest seller of carbon credits.

Explanation: Statement 1, correct: Rising temperatures will cause productivity drop across the equatorial region. This is because, for photosynthesis very high intensity (both due to duration of sunlight and intensity)is not feasible. So balance this loss of productivity, fertilizers have to be used more.

https://krishijagran.com/featured/climate-change-to-increase-fertiliser-consumption/

33. Ans. A

Exp: Statement 1, Correct:

The Global Green Growth Institute (GGGI) is a treaty-based international, intergovernmental organization dedicated to supporting and promoting strong, inclusive and sustainable economic growth in developing countries and emerging economies.

It was launched in Rio+20 summit. It is head quartered at Seoul Working across the thematic priorities of sustainable energy, green cities, sustainable landscapes, and water & sanitation, GGGI aims to deliver impact through six strategic outcomes:

1. GHG emission reduction
2. Creation of green jobs
3. Increased access to sustainable services, such as, clean affordable energy, sustainable public
4. transport, improved sanitation, and sustainable waste management
5. Improved air quality
6. Adequate supply of ecosystem services
7. Enhanced adaptation to climate change.

Statement 2, incorrect: There were 18 founder members which can be found in

https://en.wikipedia.org/wiki/Global_Green_Growth_Institute#Founding_Member_Countries

34. Ans. C

Exp: Statement 3, incorrect: Forests have been placed under concurrent list via 42nd Amendment to Indian Constitution.

Statement 1, incorrect: The Wildlife (Protection) Act, 1972 adopted by all States except Jammu and Kashmir (which has its own Act), governs wildlife conservation and protection of endangered species.

Statement 2, correct: Schedule VI corresponds to Plant species which can be placed under WPA for its protection. In particular, this can be done by individual states as well.

Statement 4, correct: The act makes immunization of livestock within radius of 5 km from a National Park compulsory. It is done to preserve wild flora and fauna.

http://www.envfor.nic.in/legis/wildlife/wildlife1.html

35. Ans. B

Exp: Statement 1, incorrect: AEPW aims to join forces with governments at the national, regional and municipal level and organizations of civil society to bring the menace of plastics to the end.

Statement 2, correct: They have promised to mobilise $1.5 Billion over the next five years.

https://endplasticwaste.org/

36. Ans. C

Exp: The Waste Minimisation Circle (WMC) is an initiative sponsored by the Ministry of Environment, Forest and Climate Change, Government of India, under the policy framework of promoting waste minimisation in India.

- The National Productivity Council, a premier institution engaged in promoting productivity consciousness, is executing the WMC programme.
- Waste Minimization Circles (WMCs) are being established to promote group efforts in increasing productivity and improving the environmental conditions in small and medium scale industries through adoption of waste minimization techniques.

37. Ans. C

Explanation:

- The Brundtland Report, also called 'Our Common Future', was released in 1987 by the World Commission on Environment and Development (WCED) that introduced the concept of sustainable development and described how it could be achieved.
- It was sponsored by the United Nations (UN) and chaired by the Norwegian Prime Minister, Gro Harlem Brundtland.
- It explored the causes of environmental degradation, attempted to understand the interconnections between social equity, economic growth and environmental problems, and developed policy solutions that integrated all three areas.

38. Ans. C

Exp: The Kyoto Protocol applies to the six greenhouse gases listed in Annex A: Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulphur hexafluoride (SF_6).

UNFCCC has decided to include nitrogen trifluoride (NF_3) in the second Kyoto compliance period, which begins this year and ends in 2020

About NF_3: Its 100-year global warming potential of 17,200 is second only to sulphur hexafluoride among the gases covered by the Kyoto Protocol, meaning that it is highly effective at trapping atmospheric heat, and it has a lifetime of 740 years.

Statement 1, incorrect: Nitrogen trifluoride is an inorganic nitrogen-fluorine compound that acts as a replacement for PFCs, specifically hexafluoroethane (C_2F_6).

Statement 2& 3, correct: It is used most frequently in the electronics industry during various processes including plasma etching, cleaning chambers in which silicon chips are made, and semiconductor and LCD panel manufacture. It is not used in Petroleum industries and hence, Statement 4 is incorrect

39. Ans. D

Exp: Statement 1, incorrect: The Green Skill Development Programme (GSDP) of the Ministry of Environment, Forest and Climate Change (MoEF&CC) is an initiative for skill development in the environment and forest sector to enable India's youth to get gainful employment and/or self-employment. There are over 35 courses which is offered under GSDP which aims to skill about 5 lakh people.

http://www.gsdpenvis.gov.in/Upload/List_for_duration.pdf

http://pib.nic.in/newsite/PrintRelease.aspx?relid=179268

Statement 2, incorrect: The pilot project of GSDP was launched in June, 2017, for skilling Biodiversity Conservationists (Basic

Course) and Para-taxonomists (Advance Course) of 3 months duration each at 10 locations spread over 9 bio-geographic regions of the country.

40. Ans. B

Exp: The Sailesh Nayak Committee was commissioned in 2014 after states expressed dissatisfaction regarding the limitations set by the Coastal Regulation Zone (CRZ) notification of 2011.

The Report was submitted in 2015 after rounds of stakeholders meetings with the representatives from the coastal states. The Committee, which was headed by the former secretary of the Ministry of Earth Sciences, recommended several relaxations in the terms set by the 2011 notification.

It also endorsed dilution of regulatory powers held by the central government in the coastal areas. The recommendations have been put forth with the objective of giving a boost to tourism, port construction and real estate.

41. Ans. D

Exp: The satellites are launched from Eastern coast because:

- To take the initial boost of earth's surface velocity i.e 1600km/hr at equator(only for geostationary satellites which will be placed above equator for communication purpose).
- Coriolis force is zero.
- Just in case of failure of launch the satellite does not fall on built up hinterland.

42. Ans. B

Exp: A black hole is a geometrically defined region of space time exhibiting such strong gravitational effects that **nothing-including** particles and electromagnetic radiation such as light-can escape from inside it.

When an object falls into a black hole, any information about the shape of the object or distribution of charge on it is evenly distributed along the horizon of the black hole, and is lost to outside observers.

43. Ans. D

Exp: Maglev (derived from magnetic levitation) is a transport method that uses magnetic levitation to move vehicles without touching the ground.

With maglev, a vehicle travels along a guideway using magnets to create both lift and propulsion, thereby reducing friction by a great extent and allowing very high speeds.

Maglev trains move more smoothly and more quietly than wheeled mass transit systems. They are relatively unaffected by weather. The power needed for levitation is typically not a large percentage of its overall energy consumption; most goes to overcome drag, as with other high-speed transport.

44. Ans. A

Exp: Atmospheric refraction cause bending of light gradually producing a curved path. This causes the sun to remain visible to our eyes for several minutes after it has set below horizon. Thus atmospheric refraction tends to lengthen the day.

Elliptical appearance of sun near the horizon is the result of atmospheric refraction this happens because rays from the lower edge of the sun are bent more than those from the upper edge.

We see a blue sky due to the phenomenon of scattering of light.

45. Ans. C

Exp: Ethernet is a family of computer networking technologies for local area networks (LANs) and metropolitan area networks (MANs). Ethernet has largely replaced competing wired LAN technologies.

46. Ans. C

Exp: Doppler effect: The phenomenon of apparent change in the frequency of sound, whenever there is a relative motion between the source of sound and observer.

Marine animals use "echo" to navigate in the dark (and not "Doppler effect")

47. Ans. B

Exp: Air exerts enormous pressure on living organisms. This pressure is not felt because the blood exerts a slightly higher pressure from inside. At high altitudes where atmospheric pressure is less nose bleeding may occur due to greater pressure of blood.

The melted wax of a candle is drawn up into the wick due to capillarity action and not due to atmospheric pressure.

When the piston is pulled, the atmospheric pressure pushes up the liquid up the tube.

48. Ans. B

Exp: During severe winters, Eskimos live in snow huts called igloos because snow being poor conductor shields them from cold. Ice slabs are covered with saw dust to minimize melting because saw dust is a bad conductor of heat.

A refrigerator has to be switched off for defrosting whenever a thick layer of ice deposits on the outside and inside of the freezer. Ice, being a poor conductor, affects the cooling action of the freezer. Thus defrosting helps in efficient functioning of refrigerator.

Heating elements in water heaters and geysers are fitted near the bottom so that water can be heated by convective currents, hence an application of convection and not conduction.

49. Ans. D

Exp: Carbon dioxide is carried in the blood as bicarbonates, as dissolved in blood plasma & in combination with Haemoglobin.

- Breathing becomes faster in fever due to oxygen carrying capacity of blood becomes lower.
- Oxygen is carried in human beings through chiefly by the ammonia molecule.
- Oxygen is transported to various parts of the body through Erythrocytes.

50. Ans. D

Exp: A synthetic diamond (also known as an artificial diamond, cultured diamond, or cultivated diamond) is diamond produced in an artificial process, as opposed to natural diamonds, which are created by geological processes.

Synthetic diamond is also widely known as HPHT diamond or CVD diamond after the two common production methods (referring to the high pressure high temperature and chemical vapour deposition crystal formation methods, respectively).

Because diamond is mechanically and chemically stable, it can be used as an electrode under conditions that would destroy traditional materials. As an electrode, synthetic diamond can be used in waste water treatment of organic effluents and the production of strong oxidants.

51. Ans. C

Exp: The examples of natural carbon sink:

- Absorption of carbon dioxide by the oceans.
- Photosynthesis by terrestrial plants.

52. Ans. A

Exp: UV radiation is unsuitable for water with high levels of suspended solids, turbidity, colour, or soluble organic matter. These materials can react with or absorb the UV radiation, reducing the disinfection performance.

53. Ans. C

Exp: Washing soda is used to treat permanent hardness of water.

Applications:

- Fire extinguisher
- Cooking
- Neutralisation of acids and bases
- Medical uses
- Personal hygiene
- In sports
- As a cleaning agent
- As a bio-pesticide
- Cattle feed supplements

54. Ans. A

Exp: Ascorbic acid is a form of Vitamin C. However, it is Vitamin D, which is essential for the formation of bones and teeth.

55. Ans. C

Exp: Laughing gas is N2O

56. Ans. A

Exp: Polio Vaccination

Option (a) is correct: OPV consists of a mixture of live attenuated (IPV is not a 'live' vaccine) poliovirus strains of each of the three serotypes (strains of a microorganism), selected by their ability to mimic the immune response following infection with wild polioviruses, but with a significantly reduced incidence of spreading to the central nervous system. IPV are more effective for reasons stated in the figure.

OPV produces antibodies in the blood ('humoral' or serum immunity) to all three types of poliovirus, and in the event of infection, this protects the individual against polio paralysis by preventing the spread of poliovirus to the nervous system.

Unlike OPV, IPV is given by intramuscular or intra-dermal injection and needs to be administered by a trained health worker.

DIFFERENCE BETWEEN IPV AND OPV	
IPV	**OPV**
Mani formoeseel Virus	Live area virus
Given IM/SC	Given orally
Induces circulating antibarly, no local Immunity	Both humeral anti - intestinal immunity
Prevents paralysis; does not prevent re-infection by wild polio viruses	Prevents paralysis and intestinal re-infection
Not useful in Epidemics	Effective in controlling epidemics
Centent.10,000 times more than OPV; Costlier	Cheaper
Does not require stringent conditions during storage and transportation	Requires to be stored and transported at sub - zero temperature, unless stabilised

57. Ans. D

Exp: Gene Cloning

- Statement 1, 2, 3 and 4 are correct:
- Cloning is the method of producing identical genes through different procedures. Method of gene cloning is useful in studying the structure and function of genes in detail.
- Medical Applications: In medicine, cloned bacteria plays important role for the synthesis of vitamins, hormones and antibiotics, to make experimental stem cells and create an identical clone of extinct species (Human Genome Project).
- Agricultural Applications include cloning in Bacteria facilitates nitrogen fixation in plants.
- The Human Genome Project is an international research effort to determine the sequence of the human genome and identify the genes that it contains. Its international partners include USA, United Kingdom, France, Germany, Japan, and China. The Human Genome Project formally began in 1990

and was completed in 2003, 2 years ahead of its original schedule.

- The work of the Human Genome Project has allowed researchers to begin to understand the blueprint for building a person. As researchers learn more about the functions of genes and proteins, this knowledge will have a major impact in the fields of medicine, biotechnology, and the life sciences.

58. Ans. D

Exp: Biotechnology and Human health:

- Statement 1 and 2 are correct: Humulin is synthetic human insulin prepared by using genetic engineering from DNA sources in laboratory, using recombinant DNA technology.
- Synthetic insulin is also called genetically engineered insulin. The synthetic insulin (humulin) is as effective as hormone insulin secreted by human pancreas.
- Statement 3 is correct: Humulin is considered better than animal insulin because:
- Humulin is absorbed more rapidly and show its effectiveness in short duration.
- Humulin causes fewer allergic and autoimmune reactions as compared to animal insulin.
- Humulin is less expensive than animal Insulin

59. Ans. A

Exp: Adaptations of Human body to low oxygen levels

- At high altitude places like Rohtang Pass near Manali (> 3500 m) and Mansarovar, in China occupied Tibet, people suffer from altitude sickness.
- Statement 1 and 2 are correct: Its symptoms are nausea, fatigue and heart palpitations. This is because at low atmospheric pressure of high altitudes, body does not get enough oxygen. The relief occurs gradually due to acclimatisation.

The body cope up with this low oxygen stress by:

- Increasing red blood cells production.
- Decreasing the binding affinity of haemoglobin.

Statement 3 is incorrect: Increasing the breathing rate to intake more oxygen .

60. Ans. A

Exp: Human organs and its functions

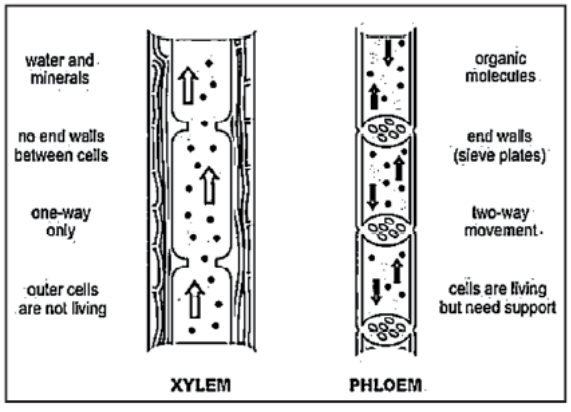
Pancreas:

- It is the second largest gland of human body.
- It produces enzymes which can digest all the three types of food materials. It is called complete digestive juice.
- It acts as simultaneously endocrine (glands which secrete hormones directly into the blood) and exocrine [secrete their products through ducts opening on to an epithelium (a tissue) rather than directly into the blood.] type of gland.

61. Ans. D

Exp: Transportation of water and minerals in plants:

- Statement 1 is incorrect: Xylem: It forms a continuous network of channel that connects roots to leaves through the stem and branches and thus transports water to entire plant leaves.
- Statement 2 is incorrect: Phloem: The food has to be transported to all parts of the plant through vascular tissue called xylem.
- Statement 3 is incorrect: Phloem is bi-directional and xylem is unidirectional.



62. Ans. D

Exp: Phytoremediation

- Phytoremediation refers to the natural ability of plants to maintain, demolish or dismantle the toxic chemicals and pollutants from soil. These plants also help to prevent pollution carried by wind, rain and groundwater from one area to another.
- Phytoremediation of organic compounds and metal pollutants in contaminated areas is performed through one of the following methods:
- Statement 1 is correct: Rhizo-filtration: This method is applicable to the removal of pollutants from surface water and groundwater. In this process, the root absorbs pollutants directly from the environment. It is used in artificial wetlands for wastewater treatment and cemetery drainage.
- Phyto-transformation: In this process, plants absorb soil and ground water pollutants and break down chemicals through the metabolic processes.
- Statement 2 is correct: Phtostabilization: In this method, plants maintain soil and water pollutants or they reduce the movement of the heavy metal pollutants in the soil environment. This is done by surface adsorption or absorption through the roots.
- Phyoextraction: It includes pollutants absorption by roots and their accumulation in the shoots. These plants are mostly harvested and destroyed as herbaceous biomass. The inner parts of the plants are not broke down and deformed.
- Statement 3 is correct: Phytovolatilization: It is the absorption of pollutants by plant roots, transferring them to the leaves and their evaporation through stomata.
- Rhizosphere Bioremediation: In this method, plants act as stimulus for the growth of microorganisms that are spherically around the roots. Microorganisms such as yeast, fungi and bacteria - break down the pollutants through metabolic processes.

63. Ans. B

Exp: Sepsis

- Sepsis is a life-threatening illness caused by our body's response to an infection. Our immune system protects us from many illnesses and infections, but it's also possible for it to go into overdrive in response to an infection.
- Sepsis develops when the immune system releases chemicals into the bloodstream to fight an infection cause inflammation throughout the entire body instead. Severe cases of sepsis can lead to septic shock, which is a medical emergency.
- Therapy for sepsis has been recently developed by a team led by an American professor of Indian origin, Pinaki Panigrahi. The therapy has been found to reduce the risk of infection by 40% in trials and it can be inexpensive — less than one dollar for a course

64. Ans. D

Exp: Cell behaviour and Cancer

- In our body, cell growth and differentiation is highly controlled and regulated. The phenomena of cancer is associated with cancer cells .In these cells, there is breakdown of these regulatory mechanisms. Normal cells show a property called contact inhibition by virtue of which contact with other cells inhibits their uncontrolled growth. Cancer cells appears to have lost this property. As a result of this, cancerous cells just continue to divide giving rise to masses of cells called tumours.
- Tumours are of two types: benign and malignant.
- Benign tumours normally remain confined to their original location and do not spread to other parts of the body and cause little damage.

- The malignant tumours, on the other hand are a mass of proliferating cells called neo-plastic or tumour cells.
- These cells grow very rapidly, invading and damaging the surrounding normal tissues. As these cells actively divide and grow they also starve the normal cells by competing for vital nutrients.
- Cells sloughed from such tumours reach distant sites through blood, and wherever they get lodged in the body, they start a new tumour there. This property called metastasis is the most feared property of malignant tumours.
- Option 2,3 and 4 are correct: Causes of cancer : Transformation of normal cells into cancerous cells may be induced by physical, chemical or biological agents. These agents are called carcinogens.
- Ionising radiations like X-rays and gamma rays and non-ionizing radiations like UV cause DNA damage leading to neo-plastic transformation.
- The chemical carcinogens present in tobacco smoke have been identified as a major cause of lung cancer. Cancer causing viruses called oncogenic viruses have genes called viral oncogenes. Furthermore, several genes called cellular oncogenes (c-onc) or proto oncogenes have been identified in normal cells which, when activated under certain conditions, could lead to oncogenic transformation of the cells.
- The International Agency for Research on Cancer (IARC), the specialised agency of the World Health Organisation, in 2016 announced that it had classified outdoor air pollution as carcinogenic to humans. This is the first time that experts have done so and claimed there is sufficient evidence to prove it.

65. Ans. D

Exp: RABIES virus

- Statements 1,2,3 and 4 are correct: Rabies is a viral infection that mainly spreads through a bite from an infected animal(like cats, dogs, foxes, jackals, mongoose). It is an RNA virus of the rhabdovirus family. Without early treatment, it is usually fatal.
- The virus can affect the body in one of two ways:
- It enters the peripheral nervous system (PNS) directly and migrates to the brain.
- It replicates within muscle tissue, where it is safe from the host's immune system. From here, it enters the nervous system through the neuromuscular junctions.
- Once inside the nervous system, the virus produces acute inflammation of the brain. Coma and death soon follow.
- There are two types of rabies:
- Furious or encephalitic rabies: This occurs in 80 percent of human cases. The person is more likely to experience hyperactivity and hydrophobia.
- Paralytic or "dumb" rabies: Paralysis is a dominant symptom.
- Several cities are culling street dogs to curb this disease and maintain hygiene.

66. Ans. A

Exp: Statement 1 is incorrect: The Anti-satellite mission (ASAT) mission was conducted by DRDO.

- Statement 3 is incorrect: It made India the fourth nation to possess anti-satellite capability after the USA, Russia, and China.

Mission Shakti

- Defense Research and Development Organisation (DRDO) successfully conducted an Anti-Satellite (A-SAT) missile test in March 2019 'Mission Shakti' from the Dr. A P J Abdul Kalam Island in Odisha.
- A DRDO-developed Ballistic Missile Defence (BMD) Interceptor Missile successfully engaged an Indian orbiting target satellite in Low Earth Orbit (LEO) in a 'Hit to Kill' mode.

- The interceptor missile was a three-stage missile with two solid rocket boosters.
- The test has demonstrated the Nation's capability to defend its assets in outer space.
- The destroyed satellite was Microsat-R, an imaging satellite was successfully injected into the intended orbit of 274 km by PSLVC44 on January 24, 2019
- This makes India the fourth nation to possess and test- anti-satellite capability, behind the U.S., Russia, and China.
- The technology is aimed at destroying, if necessary, satellites owned by enemy countries. The test, however, can be carried out only on one's own satellite. There are a large number of satellites currently in space, many of which have outlived their utility and orbiting aimlessly. One such satellite was chosen for the test.

67. Ans. D

Exp: All statements are correct

Chemical Weapons Convention:

- Entered into force in April 1997, the Convention aims to eliminate an entire category of weapons of mass destruction by prohibiting the development, production, acquisition, stockpiling, retention, transfer or use of chemical weapons by States Parties.
- It is administered by the Organisation for the Prohibition of Chemical Weapons (OPCW), an intergovernmental organization based in The Hague, The Netherlands.
- India is a signatory and party to the Chemical Weapons Convention (CWC).
- India signed the treaty at Paris on the 14th of January 1993. As on date, 193 countries are parties to the Convention.
- India was the first State Party to secure the distinction of chemical weapon free state Party by destructing all its stockpile of its chemical weapons amongst all State Parties of the Convention.
- India, pursuant to provisions of the Convention enacted the Chemical Weapons Convention Act, 2000.
- India established National Authority Chemical Weapons Convention (NACWC) under the Chemical Weapons Convention Act, 2000 for implementing the provisions of the Convention.
- NACWC is an office in the Cabinet Secretariat, Government of India.
- A unique feature of the Convention is its incorporation of the 'challenge inspection', whereby any State Party in doubt about another State Party's compliance can request a surprise inspection and the inspected party has no right of refusal.

68. Ans. B

Exp: Statement 2 is incorrect: The L1 Lagrangian point is located between the Sun and the Earth along the line connecting the two bodies and not perpendicular to it.

- Statement 3 is incorrect: Parker Solar Probe is a NASA robotic spacecraft launched in 2018, with the mission of repeatedly probing and making observations of the outer corona of the Sun.

Aditya-L1 mission

- Aditya-L1 mission (originally Aditya-1) is the 1st Indian space-based Solar Coronagraph intended to study the outermost region of the sun called 'Corona'. The project will increase our understanding of the Sun. It is scheduled to be launched by 2020-21
- It will be placed in the Lagrangian point 1 (L1) of the Sun-Earth orbit which has the advantage of continuously viewing the Sun without any obstructions that eclipses may offer.
- Lagrange Points are positions in space where the gravitational forces of a two body system like the Sun and the Earth produce enhanced regions of attraction

and repulsion. At this point, the gravitational pull of two large masses precisely equals the centripetal force required for a small object to move with them.

- The primary payload on the Aditya-L1 satellite will be coronagraph, which is meant to observe the solar corona.
- A corona is an aura of plasma that envelopes the Sun and other stars and is visible to the naked eye during a total solar eclipse.
- This corona of the Sun, which extends millions of kilometers into space, will also be studied by the Parker Solar Probe of NASA.
- Other payloads on the satellite will measure the particle flux originating from the Sun and reaching the L1 orbit, while a magnetometer will measure the variation in magnetic field strength at the halo orbit.
- A Lagrange point is a location in space where the combined gravitational forces of two large bodies, such as Earth and the sun or Earth and the moon, equal the centrifugal force felt by a much smaller third body.
- There are five Lagrange points around major bodies such as a planet or a star. Three of them lie along the line connecting the two large bodies.
- The Aditya-L1 will be inserted in a halo orbit around the L1, which is located between Sun and the earth along the line connecting two bodies and is around 1.5 million kilometers from the Earth.

69. Ans. C

Exp: Both statements are correct

Dhanush

- Dhanush is the indigenously upgraded variant of the Swedish Bofors gun imported in the 1980s. These indigenously built Dhanush artillery guns are often referred to as the 'Desi Bofors'.
- The Dhanush gun, which has a calibre of 155x45mm, is the first indigenous artillery gun of this calibre.
- It is also the first long-range artillery gun to be produced in India, having a range of 38 km.
- The Dhanush is equipped with a navigation based sighting system, on board ballistic computation and an advanced day and night direct-firing system. The self-propulsion unit allows the gun to deploy itself in mountainous terrains with ease.
- Dhanush is a joint effort by the Ordnance Factory Board the Army, Defence Research and Development Organisation, Directorate General Quality Assurance, PSUs Bharat Electronics Limited, SAIL, and private firms.
- Ordnance Factory Board is an industrial organisation of Indian Ordnance Factories, functioning under the Department of Defence Production of Ministry of Defence.
- In April 2019, the Ordnance Factory Board handed over the first batch of six Dhanush guns from the total 144 given approval for the production.
- Indian army will have its first regiment of Dhanush Guns in place by March 2020.

70. Ans. C

Exp: Statement 1 is incorrect:

The strength of inactivated vaccines tends to wear off over time, resulting in less long-lasting immunity. Hence multiple doses are required to provide long-lasting immunity.

Types of Vaccines

- Inactivated Vaccines: When inactivated vaccines are made, the bacteria are completely killed using a chemical, usually formaldehyde. Dead pieces of disease causing microorganisms (usually bacteria) are put into the vaccine. Because the antigens are dead, the strength of these vaccines tends to

wear off over time, resulting in less long-lasting immunity. So, multiple doses of inactivated vaccines are usually necessary to provide the best protection. The benefit of inactivated vaccines is that there is zero chance of developing any disease-related symptoms — allergic reactions are possible but extremely rare. Examples of inactivated vaccines are hepatitis A, hepatitis B, poliovirus, hemophilic influenza type b, pneumococcal and the injected form of influenza.

- Live-Attenuated Vaccine: Live – attenuated basically means alive, but very weak. These vaccines are made when the virus is weakened to such a level that they reproduce only about 20 times in the body.
- When the vaccine is made, the virus or bacteria is weakened in a laboratory to the point where it's alive and able to reproduce, but can't cause serious illness. Its presence is enough to cause the immune system to produce antibodies to fight off the particular disease in the future. They typically provoke more durable immunological responses and are preferred for healthy adults.
- If administered to a person who has an impaired immune system response, e.g. they have leukemia or HIV infection, or are taking immunosuppressing medications; administration of a live attenuated vaccine may cause severe disease as a result of uncontrolled replication (growth) of the vaccine virus. Examples include the viral diseases yellow fever, measles, rubella, and mumps and the bacterial disease typhoid.
- Recombinant Vaccines: The gene segment for a protein from the disease causing organism that is known to stimulate a protective immune response (protein of interest) is inserted into the gene of another cell, such as a yeast cell. When the cell replicates it has the same shape as the protein of interest. Yeats cells are used for the hepatitis B and human papillomavirus Schedule vaccines.

71. Ans. A

Exp: Statement 2 is incorrect: This technology is deployed on aircraft and surface ships.

Stealth technology

- Stealth technology, also termed "low observable" technology, is a set of techniques that render military vehicles, mostly aircraft, hard to observe.
- RADAR—an acronym for Radio Detection and Ranging—is the primary detection technology for aircraft, most stealth technologies are directed at suppressing RADAR returns from aircraft, but stealth technology minimizes other "observables" as well, including energy emissions that of any kind that might be observed by an opponent.
- Stealth technology is deployed today on several types of aircraft and a few surface ships.
- For a submarine, stealth is the most important protection.
- Stealth is a relative concept. It can be increased relative to varying levels by adopting several measures right from the design of the platform to operational measures to reduce noise and vibrations to stay away from prowling radars and sonars.

72. Ans. C

Exp: Both statements are correct

Industrial genetics

- Industrial genetics means mass scale production of desired species of plants and animals. This field includes activities such as animal breeding, cattle breeding. Dairying is an example of industrial genetics.

- For this industrial genetics, cells of the organisms are transformed with a gene coding for a useful protein, such as an enzyme. This desired protein is then overexpressed in the organism.
- Mass quantities of the protein can then be manufactured by growing the transformed organism in bioreactor equipment using industrial fermentation, and then purifying the protein.
- This transformation of organisms can be done in bacteria, yeast, insect cells and mammalians.
- This transformation technique is used to produce medicines such as insulin, human growth hormone, vaccines, supplements (such as tryptophan), aid in the production of food (chymosin in cheese making) and fuels.
- Other applications are making biofuels, cleaning up oil spills, carbon and other toxic waste and detecting arsenic in drinking water, bio-mining and bioremediation (due to their ability to extract heavy metals from their environment and incorporate them into compounds that are more easily recoverable).

73. Ans. D

Exp: All statements are correct

Doppler Weather Radar

- Doppler Weather Radar (DWR) is used for forecasting storms, cyclones, and other severe weather conditions.
- The Doppler Weather Radar provides advance information, enhancing the lead time so essential for saving lives and property, in the event of natural disasters associated with severe weather.
- The DWR has been designed and developed by Radar Development Area, ISRO Telemetry Tracking and Command Network (ISTRAC), ISRO and manufactured by Bharat Electronics Limited (BEL), Bengaluru. It is the first indigenously developed Polarimetric Doppler Weather Radar (DWR) and is installed at Cherrapunjee, Meghalaya.
- Though the conventional radars are able to track and predict cyclones, the DWR provides detailed information on storm's internal wind flow and structure. The severity of the weather systems can thus be quantitatively estimated more accurately than ever before and more precise advance warnings can be generated for saving human lives and property.
- The DWR, being the first S-band dual polarimetric Doppler Weather Radar can detect the Weather phenomenon up to 500 km.
- India is set to bring its entire coast under the cover of the Doppler Weather Radar (DWR) network for cyclone monitoring by 2019-20.

74. Ans. B

Exp: Statement 1 is incorrect:

- FSSAI in 2016 operationalized the fortification of staples namely wheat flour, rice, milk, edible oil and salt.
- Statement 3 is incorrect: Double fortified salt delivers crucial amount of iodine and iron.

Food Fortification

- Food fortification is usually regarded as the deliberate addition of one or more micronutrients to particular foods, so as to increase the intake of these micronutrients in order to correct or prevent a demonstrated deficiency and provide a health benefit.
- In October 2016, FSSAI operationalized the Food Safety and Standards (Fortification of Foods) Regulations, 2016 for fortifying staples namely Wheat Flour and Rice (with Iron, Vitamin B12 and Folic Acid), Milk and Edible Oil (with Vitamins A and D) and Double Fortified Salt (with Iodine and

Iron) to reduce the high burden of micronutrient malnutrition in India.

- The '+F' logo has been notified to identify fortified foods.
- Food Safety and Standards (Fortification of Foods) Regulations, 2018

As per these rules:

- Fortification of staples is not compulsory.
- The fortification of the products and use of +F logo is allowed to FBO only if the enrichment of the food is done according to the standards laid under it.
- Adding iodine to commercial salt is mandatory in India.
- Whenever the food articles standards stated under 'Food Safety and Standards Regulations' instructs for adding specific minerals or vitamins as an obligatory demand of that particular standard, the same shall comply, but +F logo shall not be used.
- New standards now provide a minima and a maxima range for fortification of staples like wheat flour, maida, rice, salt, vegetable oil and milk.
- The dosage of the micronutrients has been adjusted so that they provide 30 to 50 percent of the daily requirements.

75. Ans. B

Explanation:

- Statement 2 is incorrect: Viruses have only one type of nucleic acid either DNA or RNA whereas bacteria have got both.

Difference between Virus and Bacteria:

- Viruses have only one type of nucleic acid either DNA or RNA whereas bacteria have got both.
- Viruses are devoid of ribosomes and the enzyme systems needed to generate ATP molecules whereas bacteria have got ribosomes as well as enzymes needed in ATP synthesis.
- Therefore, viruses cannot lead a free living mode of life for the performance of fundamental life activities such as reproduction, genetically determined structures and functions. They have to lead a parasitic mode of existence. (Viruses that parasitize bacterial cells are called bacteriophages).
- Viruses are tinier; the largest of them are smaller than the smallest bacteria.
- Viruses lack various cytoplasmic organelles whereas bacteria have cytoplasmic organelles
- Viruses do not have cell wall but bacteria have well defined cell wall
- Viruses cannot multiply or synthesize their proteins and enzymes independent of the host cell, but, bacteria can.
- Viruses are not able to reproduce by itself while bacteria can (through fission – an asexual mode of reproduction).Virus reproduces by invading a host cell and taking over it causing it to make copies of the viral DNA/RNA thus releasing new viruses.

76. Ans. C

Exp: Statements 1 is incorrect: It is an In-situ remediation technology.

- Statements 2 is incorrect: It increases the content of groundwater oxygen.

Different types of In-situ bioremediation techniques are-

- Bio-venting
- Bio-sparging
- Bioaugmentation

Different types of Ex-situ bioremediation techniques are-

- Land farming
- Composting
- Bio piles
- Bioreactors

Bio-sparging

- It involves the pressurized injection of air below the water table to increase the content of groundwater oxygen.

- It also increase the rate of biological degradation of wastes by naturally occurring Microorganisms.
- Bio-sparging enhances the mixing in the saturated zone and causing it to increases the contact between soil and groundwater. The biggest advantage with the use of the Bio-sparging technique is its handling ease and low cost of installing small-diameter air injection points.

77. Ans. D

Exp: Statement 1 is incorrect: A Cruise missile is a self-propelled guided vehicle that sustains flight through aerodynamic lift for most of its flight path.

- Statement 2 is incorrect: A Ballistic missile depends on gravity to reach its target.
- Statement 3 is incorrect: Dhanush and Agni II are a type of Ballistic missiles.

Cruise Missile

- Cruise missile is an unmanned self-propelled guided vehicle that sustains flight through aerodynamic lift for most of its flight path and whose primary mission is to place an ordnance or special payload on a target.
- Cruise missiles generally consist of a guidance system, payload, and aircraft propulsion system, housed in an airframe with small wings and empennage for flight control.
- They fly within the earth's atmosphere and use jet engine technology.
- They are known specifically for the low level flight which is staying relatively close to the surface of the earth to avoid detection from anti-missile systems and are designed to carry large payloads with high precision.
- Cruise missiles can be categorized by size, speed (subsonic or supersonic), range and whether launched from land, air, surface ship or submarine.
- Examples of cruise missile include BrahMos (Super sonic cruise missile), Nirbhay (sub sonic cruise missile) , Shaurya (Hyper sonic cruise missle).

Ballistic Missile

- The Ballistic missile is targeted as a projectile from a single launch force with not much-added guidance.
- It is launched directly into the high layers of the earth's atmosphere.
- It travels well outside the atmosphere and then the warhead detaches and falls back to earth. It follows the path of a ball thrown upwards which falls down.
- Since it depends on gravity to reach its target, it's called a ballistic missile.
- Ballistic missiles that fly above the atmosphere have a much longer range than would be possible for cruise missiles of the same size.
- Ballistic missiles can travel extremely quickly along their flight path. An Inter - Continental Ballistic Missile can strike a target within a 10,000 km range in about 30 to 35 minutes.
- With terminal speeds of over 5,000 m/s, ballistic missiles are much harder to intercept than cruise missiles, due to the much shorter time available.
- Long- and medium-range ballistic missiles are generally designed to deliver nuclear weapons because their payload is too limited for conventional explosives to be cost-effective.
- Ballistic missiles can be launched from ships and land-based facilities.
- Prithvi I, Prithvi II, Agni I, Agni II and Dhanush ballistic missiles are currently operational in the Indian defense forces.

78. Ans. A

Exp: Statement 1 is incorrect: There are four bases (A, C, G, and T) in a strand of DNA.

Statement 2 is incorrect: Each human has a specific base sequence.

DNA and its sequencing:

- DNA sequencing is the process of determining the order of four

nucleotide bases (Adenine (A), Cytosine (C), Guanine (G) and Thymine (T)) present in a strand of DNA.

- These bases provide the underlying genetic basis (the genotype) for revealing the function of a cell and its location. Each individual and organism has a specific nucleotide base sequence.
- It is an essential tool for many basic and applied research applications today. It has provided an important tool for determining the thousands of nucleotide variations associated with specific genetic diseases, like Huntington's, which will help to better understand these diseases and advance treatment.
- It helps to record the response and the effect of person's individual genome variations to a drug. Such data is being used to determine which drug gives the best outcome in a particular patient.

Four key steps in DNA sequencing process:

1. In the first instance DNA is removed from the cell. This can be done either mechanically or chemically.
2. The second phase involves breaking up the DNA and inserting its pieces into vectors, cells that indefinitely self replicate, for cloning.
3. In the third phase the DNA clones are placed with a dye-labelled primer (a short stretch of DNA that promotes replication) into a thermal cycler, a machine which automatically raises and lowers the temperature to catalyse replication.
4. The final phase consists of electrophoresis, whereby the DNA segments are placed in a gel and subjected to an electrical current which moves them. When subjected to an electrical current the smaller nucleotides in the DNA move faster than the larger ones. Electrophoresis thus helps sort out the DNA fragments by their size.

- The different nucleotide bases in the DNA fragments are identified by their dyes which are activated when they pass through a laser beam. All the information is fed into a computer and the DNA sequence displayed on a screen for analysis.

79. Ans. A

Exp: Statement 2 is incorrect: There are no enzymes present in bile juice. Bile salts in bile juice helps in emulsification of fats.

Statement 3 is incorrect: The digestion of proteins, fats and carbs is complete in the duodenum region of small intestine.

Digestion of Food

- The chemical process of digestion is initiated in the oral cavity by the hydrolytic action of the carbohydrate splitting enzyme, the salivary amylase. About 30 per cent of starch is hydrolysed here by this enzyme (optimum pH 6.8) into a disaccharide – maltose.
- The stomach stores the food for 4-5 hours. The food mixes thoroughly with the acidic gastric juice of the stomach by the churning movements of its muscular wall and is called the chyme. The proenzyme pepsinogen, on exposure to hydrochloric acid gets converted into the active enzyme pepsin, the proteolytic enzyme of the stomach. Pepsin converts proteins into proteoses and peptones (peptides).
- The bile, pancreatic juice and the intestinal juice are the secretions released into the small intestine.
- The pancreatic juice contains inactive enzymes – trypsinogen, chymotrypsinogen, procarboxypeptidases, amylases, lipases and nucleases. Trypsinogen is activated by an enzyme, enterokinase, secreted by the intestinal mucosa into active trypsin, which in turn activates the other enzymes in the pancreatic juice.

- The bile released into the duodenum contains bile pigments (bilirubin and bili-verdin), bile salts, cholesterol and phospholipids but no enzymes. Bile helps in emulsification of fats, i.e., breaking down of the fats into very small micelles. Bile also activates lipases.
- The intestinal juice contains a variety of enzymes like disaccharidases (e.g., maltase, lactase), dipeptidases, lipases, nucleosidases, etc.
- Proteins, proteoses and peptones (partially hydrolysed proteins) in the chyme reaching the intestine are acted upon by the proteolytic enzymes of pancreatic juice and are converted into dipeptides.
- Carbohydrates in the chyme are hydrolysed by pancreatic amylase into disaccharides.
- Fats are broken down by lipases with the help of bile into di-and monoglycerides.
- The enzymes in the intestinal juice act on the end products of the above reactions to form the respective simple absorbable forms.
- The breakdown of biomacromolecules mentioned above occurs in the duodenum region of the small intestine. The simple substances thus formed are absorbed in the jejunum and ileum regions of the small intestine. The undigested and unabsorbed substances are passed on to the large intestine.
- No significant digestive activity occurs in the large intestine.
- The undigested, unabsorbed substances called faeces enters into the caecum of the large intestine through ileo-caecal valve, which prevents the back flow of the faecal matter. It is temporarily stored in the rectum till defaecation.

80. Ans. B

Exp: Statement 3 is incorrect: Oxytocin does not help in milk formation though it promotes the release of breast milk.

Oxytocin

- It was in news as the Health Ministry notified a ban on private firms from manufacturing and selling oxytocin, stating that it wanted to restrict the responsibility of supplying the drug to a Karnataka-based public sector manufacturer to avoid its misuse in the veterinary field.
- It is also known as the 'love hormone', is a hormone secreted by the pituitary glands of mammals during sex, childbirth, lactation or social bonding. However, it can also be chemically manufactured and is sold by pharma companies for use during childbirth.
- Oxytocin is a uterine stimulant hormone, prescribed for the initiation of uterine contractions and induction of labour in women as well as stimulation of contractions during labour. It is also used to help abort the foetus in cases of incomplete abortion or miscarriage, and control bleeding after childbirth.
- It may promote the release of breast milk. Its use is especially crucial to prevent new mothers from excessively bleeding after giving birth—a common cause of maternal deaths.
- Oxytocin is listed in the National List of Essential Medicines (NLEM) for reproductive health.
- Oxytocin is a controversial hormonal injection that is used widely in the dairy industry, agriculture and horticulture. Authorities are also concerned that the misuse of this growth booster is reported among trafficked children, injected to accelerate puberty among girls.

81. Ans. C

Exp: Statement 2 is incorrect: Packet filtering firewalls checks the surface-level information of the coming packet without opening up the packet to inspect its contents.

Firewall

- A firewall is a computer security tool that is used to block malicious traffic requests and data packets while allowing legitimate traffic through.
- They can be used to separate network nodes from external traffic sources, internal traffic sources, or even specific applications. They can be software, hardware, or cloud-based.
- Packet-Filtering Firewalls: The firewall performs a simple check of the data packets coming through the router—inspecting information such as the destination and origination IP address, packet type, port number, and other surface level information without opening up the packet to inspect its contents.
- The good thing about these firewalls is that they aren't very resource-intensive. This means they don't have a huge impact on system performance and are relatively simple.
- There is a limitation that they are relatively easy to bypass compared to firewalls with more robust inspection capabilities.
- Circuit-Level Gateways: They work by verifying the transmission control protocol (TCP) handshake. This TCP handshake check is designed to make sure that the session the packet is from is legitimate.
- They are meant to quickly and easily approve or deny traffic without consuming significant computing resources.
- There is a limitation that they do not check the packet itself. So, if a packet held malware, but had the right TCP handshake, it would pass right through. This is why circuit-level gateways are not enough for protection.

82. Ans. C

Explanation: Both statements are correct

Nano fabrics

- Nano fabrics are textiles embedded with small nano particles to give ordinary materials advantageous properties such as Lotus effect, odour and moisture elimination and even bacterial resistance.
- The lotus effect refers to self-cleaning properties that are a result of water repellent properties as exhibited by the leaves of a lotus flower.
- It is done by a technique known as Nano finishing which includes coating the surface of textiles and clothing with nanoparticles.
- Zinc oxide nanoparticles embedded in polymer matrices like soluble starch are a good example of functional nanostructures with potential for applications such as UV-protection ability in textiles and sunscreens.
- Nano-silver coating provides antimicrobial properties to the fabric.
- Nano fabrics can also be used for delivery of drugs such as antibiotics, anticancer drugs etc. in precise quantities. It can be done by Electro spinning that creates porous nano fabrics which can be loaded with the desired drug and the drug passes through the skin tissue by diffusion process.

83. Ans. C

Exp: Option (c) is correct:

Column 1		**Column 2**	
A.	Controller	2.	Coordinates movements of mechanical system
B.	Manipulator	3.	Arm of the robot
C.	End Effector	1.	End-of-arm tooling on the robot
D.	Sensors	4.	Information Gatherers

Robotic Parts

- Robots consist of a number of components that work together such as:

- Controller: It is the part of a robot that coordinates all movements of the mechanical system. It also receives input from the immediate environment through various sensors. The heart of the robot's controller is generally a microprocessor linked to input/output and monitoring devices.
- Manipulator: The manipulator consists of segments that may be jointed and that move about, allowing the robot to do work. The manipulator is the arm of the robot that must move materials, parts, tools, or special devices through various motions to provide useful work.
- End Effector: The end effector is the robot's hand or the end-of-arm tooling on the robot. It is a device attached to the wrist of the manipulator for the purpose of grasping, lifting, transporting, manoeuvring or performing operations on a work piece.
- Sensors: Robot Vision Sensors are what allow a robot to gather information about its environment. This information can be used to guide the robot's behaviour. Some sensors are relatively familiar pieces of equipment.

84. Ans. C

Explanation:

- Statement 1 is incorrect: Telecom Commission is responsible for Formulating the policy of Department of Telecommunications for approval of the Government.
- Statement 2 is incorrect: The TRAI Act was amended by an ordinance, effective from 24 January 2000, establishing a Telecommunications Dispute Settlement and Appellate Tribunal (TDSAT) to take over the adjudicatory and disputes functions from TRAI.

Telephone Regulatory Authority of India (TRAI)

- The Telecom Regulatory Authority of India (TRAI) was established with effect from 20th February 1997 by an Act of Parliament, called the Telecom Regulatory Authority of India Act, 1997, to regulate telecom services, including fixation/revision of tariffs for telecom services which were earlier vested in the Central Government.
- TRAI's mission is to create and nurture conditions for growth of telecommunications in the country in a manner and at a pace which will enable India to play a leading role in emerging global information society.
- One of the main objectives of TRAI is to provide a fair and transparent policy environment which promotes a level playing field and facilitates fair competition.
- The TRAI Act was amended by an ordinance, effective from 24 January 2000, establishing a Telecommunications Dispute Settlement and Appellate Tribunal (TDSAT) to take over the adjudicatory and disputes functions from TRAI.
- TDSAT was set up to adjudicate any dispute between a licensor and a licensee, between two or more service providers, between a service provider and a group of consumers, and to hear and dispose of appeals against any direction, decision or order of TRAI.

Functions of TRAI are:

- Making recommendations on various issues. The recommendations made by the TRAI are not binding on the Central Government. However, the Central Government has to mandatorily ask for recommendations from TRAI with respect to need and timing of new service provider and terms and conditions of the license to be granted to the service provider.
- General administrative and regulatory functions
- Fixing tariffs and rates for telecom services

- Any other functions entrusted by the Central Government

Telecom Commission

- The Telecom Commission was set up by the Government of India vide the Resolution dated 11th April, 1989 with administrative and financial powers of the Government of India to deal with various aspects of Telecommunications. The Government, vide Resolution dated 22nd October, 2018, has re-designated the 'Telecom Commission' as the 'Digital Communications Commission'.

It is responsible for:

- Formulating the policy of Department of Telecommunications for approval of the Government
- Preparing the budget for the Department of Telecommunications for each financial year and getting it approved by the Government
- Implementation of Government's policy in all matters concerning telecommunication

85. Ans. D

Explanation: All statements are correct

Robotics Terminology

- Robotics is a branch of engineering that involves the conception, design, manufacture, and operation of robots.
- This field overlaps with electronics, computer science, artificial intelligence, mechatronics, nanotechnology, and bioengineering.

Few terminologies related to Robotics include:

- Actuator: A power mechanism used to affect motion, or maintains the position of the robot, for example, a motor which converts electrical energy to effect motion of the robot. The actuator responds to a signal received from the control system.
- Degrees of Freedom: The number of independent directions or joints of the robot, which would allow the robot to move its end-effector through the required sequence of motions. For arbitrary positioning, 6 degrees of freedom are needed: 3 for the position (left-right, forward-backward, and up-down), and 3 for orientation (yaw, pitch, and roll).
- Optical Encoder: A detection sensor, which measures linear or rotary motion by detecting the movement of markings past a fixed beam of light. This can be used to count revolutions, identify parts, etc.
- Through-beam: An object detection system used within a robot's imaging sensor system. A finely focused beam of light is mounted at one end and a detector at the other. When the beam of light is broken, an object is sensed.
- Transducer: A device that converts energy from one form to another. Generally, a device that converts an input signal into an output signal of a different form. It can also be thought of as a device that converts static signals detected in the environment (such as pressure) into an electrical signal that is sent to a robot's control system.

86. Ans. D

Exp: Statement 1 is incorrect: Uranium enrichment is the process by which a sample of uranium has its proportion of U-235 increased.

Statement 2 is incorrect: Nuclear power plants require uranium with three to four percent U-235 i.e. low enriched uranium (LEU).

Uranium Enrichment

- Uranium is element 92 on the periodic table–every molecule has 92 protons in its nucleus. The number of neutrons can vary, and that's the difference between the three isotopes of uranium that we

find here on Earth. Uranium-238 (92 protons plus 146 neutrons) is the most abundant form, and about 99.3 percent of all uranium is U-238. The rest is U-235 (0.7 percent), with a trace amount of U-234.

- However the more abundant U-238 isn't fissile i.e. it can't start a nuclear reaction and sustain it whereas U-235 is fissile. But that 0.7 percent in naturally occurring uranium isn't enough to make a bomb or even a nuclear reactor for a power plant.
- A power plant requires uranium with three to four percent U-235 (this is known as low-enriched or reactor grade uranium), and a bomb needs uranium with a whopping 90 percent U-235 (highly enriched uranium).
- Uranium enrichment is the process by which a sample of uranium has its proportion of U-235 increased.
- Low enriched uranium (LEU) has a lower than 20% concentration of U-235 while highly enriched uranium (HEU) has a concentration of 20% or more.
- The most common methods for enriching uranium today are centrifugation and gaseous diffusion. And other methods are being developed, including several based on laser techniques.

87. Ans. C

Exp: Statement 2 is incorrect: It is a part of Digital India initiative of Government of India.

Cyber Swachhta Kendra

- The "Cyber Swachhta Kendra " (Botnet Cleaning and Malware Analysis Centre) is a part of the Government of India's Digital India initiative under the Ministry of Electronics and Information Technology (MeitY) to create a secure cyber space by detecting botnet infections in India and to notify, enable cleaning and securing systems of end users so as to prevent further infections.
- The "Cyber Swachhta Kendra " (Botnet Cleaning and Malware Analysis Centre) is set up in accordance with the objectives of the "National Cyber Security Policy", which envisages creating a secure cyber eco system in the country.
- This centre operates in close coordination and collaboration with Internet Service Providers and Product/Antivirus companies. This website provides information and tools to users to secure their systems/devices.
- This centre is being operated by the Indian Computer Emergency Response Team (CERT-In) under provisions of Section 70B of the Information Technology Act, 2000.

88. Ans. D

Exp: All statements are correct

Graphene

- Graphene is a single layer of carbon atoms, tightly bound in a hexagonal honeycomb structure.
- It is an allotrope of carbon in the form of a plane of sp2-bonded atoms and forms the basis of all graphitic nanostructures.
- It can be folded and moulded into different shapes to form Fullerenes and Carbon Nanotubes.
- Layers of graphene stacked on top of each other form graphite, with an interplanar spacing of 0.335 nanometres.

Properties of Graphene are:

- Graphene is the thinnest compound known to man (one atom thick).
- It is the lightest material known and is strongest compound discovered which is more than 100 times stronger than steel.

- It is the best conductor of heat at room temperature and also the best conductor of electricity known.
- It absorbs uniform light across the visible and near-infrared parts of the spectrum.
- Graphene has photosensitive properties and can be used in solar cells and photo detection devices.
- It is highly impermeable and can be used in water filtration or purification technology.

89. Ans. A

Exp: Statement 2 is incorrect: The owner of a registered industrial design has the right to prevent third parties from making, selling or importing articles bearing or embodying a design which is a copy, or substantially a copy, of the protected design, when such acts are undertaken for commercial purposes.

Industrial Design

- An industrial design constitutes the ornamental or aesthetic aspect of an article. It may consist of three dimensional features, such as the shape of an article, or two dimensional features, such as patterns, lines or colour.
- The owner of a registered industrial design has the right to prevent third parties from making, selling or importing articles bearing or embodying a design which is a copy, or substantially a copy, of the protected design, when such acts are undertaken for commercial purposes.
- Industrial designs are applied to a wide variety of products of industry and handicraft items: from packages and containers to furnishing and household goods, from lighting equipment to jewellery, and from electronic devices to textiles. Industrial designs may also be relevant to graphic symbols, graphical user interfaces (GUI), and logos.
- In most countries, an industrial design needs to be registered in order to be protected under industrial design law as a "registered design". In some countries, industrial designs are protected under patent law as "design patents ".
- The Designs Act in India was enacted in 2000 to consolidate and amend the law relating to protection of designs.
- The total time of a registered design is 15 years. Initially the right is granted for a period of 10 years, which can be extended, by another 5 years by making an application and paying a fee of Rs. 2000/- to the Controller before the expiry of initial 10 years period.

90. Ans. D

Exp: All statements are correct

ChatBots

- A Chatbot or Chatter Robot is a computer program designed to simulate conversation with human users, especially over the Internet.
- It is an assistant that communicates with us through text messages, a virtual companion that integrates into websites, applications or instant messengers and helps entrepreneurs to get closer to customers.
- Such a bot is an automated system of communication with users.
- Chatbots works in two ways- Rule based and Smart machine based.
- Rule based chatbots provide predefined responses from a data base, based on the keywords used for the search.
- Smart machine based chatbots inherit its capabilities from Artificial Intelligence and Cognitive Computing and adapt their behaviour based on the customer interactions.

There are two main types of chatbots:

- Task-oriented (declarative) chatbots are single-purpose programs that focus on performing one function. Interactions with these chatbots are highly specific

and structured and are most applicable to support and service functions. These are currently the most commonly used chatbots.

- Data-driven and predictive (conversational) chatbots are often referred to as virtual assistants or digital assistants, and they are much more sophisticated, interactive, and personalized than task-oriented chatbots. Digital assistants can learn a user's preferences over time, provide recommendations, and even anticipate needs. In addition to monitoring data and intent, they can initiate conversations. Apple's Siri and Amazon's Alexa are examples of consumer-oriented, data driven, predictive chatbots.

91. Ans. B

Exp: Statement 1 is incorrect: With 5G, the peak network data speeds are expected to be in the range of 2-20 Gigabits per second.

5G Network

- It is the next generation cellular technology that will provide faster and more reliable communication with ultra-low latency.
- With 5G, the peak network data speeds are expected to be in the range of 2-20 Gigabit per second (Gbps).
- This is in contrast to 4G link speeds in averaging 6-7 Megabit per second (Mbps) in India as compared to 25 Mbps in advanced countries.
- With 5G technology, consumers will be able to download data heavy content such as 8K movies and games with better graphics in just a few seconds.
- But once 5G becomes commercial, users will be required to change their current devices in favour of 5G-enabled ones.
- It is likely that the primary use of the technology will go beyond delivery of services on personal mobiles devices.
- 5G is expected to form the backbone of emerging technologies such as the Internet of Things (IoT) and machine to machine communications, thereby supporting a much larger range of applications and services, including driverless vehicles, tele-surgery and real time data analytics.
- The ultra-low latency offered by 5G makes the technology desirable for such use cases. Latency is the amount of time data takes to travel between its source and destination.
- The committee was set up in September 2017 and submitted its report on August 24, 2018, under the chairmanship of A J Paulraj to suggest road map for 5G adoption.

92. Ans. B

Exp: Statement 3 is incorrect: Cold Fusion seeks to produce nuclear energy without any complex equipment.

Cold Fusion

- India is taking tentative steps towards restarting research into cold fusion, some 25 years after it was shut down at the Bhabha Atomic Research Centre (BARC) following global criticism heaped on the idea.
- At least three research groups have taken up the theme. An effort in IIT-Kanpur is focusing on transmutation of elements at lower temperatures. Another at IIT Bombay, funded by the National Thermal Power Corporation (NTPC), has constructed an apparatus that has produced energy spikes, but researchers are trying to verify that these were not an outcome of quirks in the apparatus that were not accounted for. Yet another group at the Center for Energy Research of the Swami Vivekananda Yoga Anusandhana Samasthana (S-Vyasa) in Bengaluru says the Department of Science and Technology has approved funding for

their research through its High Risk High Reward programme.

- Cold Fusion is a hypothesized type of nuclear reaction that would occur at, or near, room temperature in contrast to the normal nuclear fusion reactions that require high temperatures and immense pressure.
- The interaction of hydrogen or deuterium gas with metals such as palladium, zirconium and nickel is claimed to set off a nuclear reaction at lower temperature releasing energy.
- The first claim in this regard was made by Martin Fleischmann and Stanley Pons at University of Utah in 1989.
- Cold fusion seeks to produce nuclear energy without harmful radiation, complex equipment and the application of very high temperatures and pressures.
- It has garnered attention as a way to produce clean energy.
- But it has no conclusive theory explaining it and flies in the face of a well-established physics law that goes against easy fusion of nuclei.
- There is no guarantee that every time a cold fusion or LENR experiment is done, energy will be produced, says critics.
- But advocates put forward that much progress has been made in achieving repeatability.
- Low energy nuclear reaction (LENR) is regarded as the successor of the cold fusion.

93. Ans. C

Exp: Statement 1 is incorrect: CIPAM is setup under the aegis of Ministry of Commerce.

National IPR Policy 2016

- Union Cabinet approved the National Intellectual Property Rights (IPR) Policy in 2016 to lay the future roadmap for IPRs in India.

The salient features of the policy include:

- A Cell for IPR Promotion and Management (CIPAM) shall be created as a professional body under aegis of Department for Promotion of Industry and Internal Trade (DPIIT) to simplify and streamline IP processes, monitor public grievances, oversee capacity building of human resources and institutions along with promotion of commercialization of IPRs in India.
- Awareness Campaign to be launched in schools, institutions of higher education and centres of skill development to foster an IP culture in the country.
- IP cells shall be created in key Ministries / Departments of the Govt. of India, which are vital in the field of IPRs, as well as in State Governments in coordination with CIPAM.
- Traditional Knowledge Digital Library's (TKDL) ambit to be expanded to include other fields besides Ayurveda, Yoga, Unani & Siddha.
- The Policy recognizes the importance of effective coordination between Patent office and National Biodiversity Authority for speeding up the disposal of patent applications using biological resources and associated Traditional Knowledge.
- Enhancing schemes such as DeitY's Support for International Patent Protection in Electronics and IT (SIPEIT) for assisting smaller firms.
- Commercial Courts set up at appropriate levels will be responsible for adjudicating IP disputes.
- A detailed review of IPR Policy shall be undertaken every five years. Continuous and regular Review will be done by a Committee to be constituted for this purpose under the Secretary, DIPP.

94. Ans. B

Exp: Statement 1 is incorrect: It aims at providing affordable broadband connectivity of 2-20 Mbps to all rural households.

Statement 3 is incorrect: Bharat Broadband Network Limited (BBNL), a special purpose vehicle under the telecom ministry is handling the roll out of optical fibre network under the project.

Bharat Net Project

- Broadband access to every citizen is a key pillar of Digital India.
- Bharat Net has a vision to establish a scalable network by 2017 towards providing affordable broadband connectivity of 2 Mbps to 20 Mbps to all rural households and institutions.
- This project has evolved from the earlier National Optical Fibre Network (NOFN) project of providing 100 Mbps to all gram panchayats (GPs).
- At present, a special purpose vehicle, Bharat Broadband Network Ltd (BBNL), under the telecom ministry is handling the roll out of optical fibre network.
- The first phase envisages providing one lakh gram panchayats with broadband connectivity by laying underground optic fibre cable (OFC) lines have been achieved.
- The second phase will provide connectivity to all 2,50,500 gram panchayats in the country using an optimal mix of underground fiber, fiber over power lines, radio and satellite media. It is to be completed by March 2019. For success in phase-2, which will also involve laying of OFC over electricity poles, the participation of states will be important. This is a new element of the Bharat Net strategy as the mode of connectivity by aerial OFC has several advantages, including lower cost, speedier implementation, easy maintenance and utilization of existing power line infrastructure. The last mile connectivity to citizens was proposed to be provided creating Wi-Fi hotspots in gram panchayats
- In the third phase from 2019 to 2023, state-of-the-art, future-proof network, including fiber between districts and blocks, with ring topology to provide redundancy would be created.
- Bharat Net is being funded through Universal Service Obligation Fund (USOF). The Universal Service Obligation Fund (USOF) was established with the fundamental objective of providing access to 'Basic' telegraph services to people in the rural and remote areas at affordable and reasonable prices. Subsequently the scope was widened to provide subsidy support for enabling access to all types of telegraph services including mobile services, broadband connectivity and creation of infrastructure like OFC in rural and remote areas.

95. Ans. D

Exp: All statements are correct.

Trademarks

- A trademark is a sign capable of distinguishing the goods or services of one enterprise from those of other enterprises. Trademarks are protected by intellectual property rights.
- At the national/regional level, trademark protection can be obtained through registration, by filing an application for registration with the national/regional trademark office and paying the required fees.
- At the international level, there are two options: filing a trademark application with the trademark office of each country in which protection is sought, and the other is to use World Intellectual Property Organization's (WIPO) Madrid System.

There are four types of trademarks:

- Arbitrary or Fanciful Marks: They are made-up words or real words that have no relationship to the good or service supplied. These are the strongest types of marks and are afforded all protection. APPLE as it relates to computer

products is an arbitrary mark, and therefore very strong, because apples have nothing to do with computers.

- Suggestive Marks: They suggest the qualities or attributes of a good or service. These marks differ from descriptive marks in that they do not actually describe the product but merely suggest an attribute that requires some thought or perception on the part of the consumer. GREYHOUND for bus services is a good example.
- Descriptive Marks: They use terms that merely describe the good or service. This might be a mark that utilizes the colour, smell, or ingredients of a good or service. For example, the term SOFT as used to describe towels.
- Generic Marks: They are marks that use common, everyday terms that everybody has the right to use. For example, attempting to use the term CAR for an "automobile" would be generic.
- The Trademark Act in India was enacted in 1999 to amend and consolidate the law relating to trademarks, to provide for registration and better protection of trademarks for goods and services and for the prevention of the use of fraudulent marks.

96. Ans. B

Exp: Statement 2 is incorrect: Almost all of the nuclear reactors built to date are thermal reactors.

Classification of Nuclear Reactors

- Depending upon the average energy of neutrons that sustain the fission chain reaction, reactors can be classified into two types:

Thermal Reactors:

- Almost all of the current reactors which have been built to date use thermal neutrons to sustain the chain reaction.
- These reactors contain neutron moderator that slows neutrons from fission until their kinetic energy is more or less in thermal equilibrium with the atoms in the system.

Fast Reactors:

- Fast reactors contain no neutron moderator and use less-moderating primary coolants, because they use fast neutrons to cause fission in their fuel.
- Thermal neutrons have a far higher cross section (probability) of fissioning the fissile nuclei and a relatively lower probability of neutron capture by uranium-238 (U-238) compared to the faster neutrons that originally result from fission, thus allowing for use of low-enriched uranium. Maintaining a chain reaction in a fast reactor requires the fuel to be more highly enriched in fissile material (about 20% or more) due to the relatively lower probability of fission versus capture by U-238.
- There is also a difference in the number of neutrons produced per fission, which is higher in fast reactors than in thermal reactors.

97. Ans. A

Exp: Statement 2 is incorrect: Soot from forest fires is an example of naturally occurring nanomaterial.

Statement 3 is incorrect: Titanium dioxide nanoparticle is an example of engineered nanomaterial.

Nanomaterial

- Nanomaterial is any organic, inorganic material that presents distinct chemical, physical, and/or electrical properties owing to their ultra-small size, typically in the nano-scale region.

Nanomaterial can be classified into the following categories:

- Natural nanomaterial: These are made by nature through bio-geochemical or mechanical processes, without direct or indirect connection to a human activity

or anthropogenic process. Nanomaterial that are naturally occurring include volcanic ash, soot from forest fires.

- Incidental nanomaterial: These are unintentionally produced as a result of any form of direct or indirect human influence or anthropogenic process. Sources of incidental nanoparticles include vehicle engine exhausts, welding fumes, combustion processes from domestic solid fuel heating and cooking.
- Engineered nanomaterial: A nanomaterial conceived, designed, and intentionally produced by humans. A titanium dioxide nanoparticle is a prominent example of it. It is used in sunscreens due to its ability to block UV radiation while remaining transparent on the skin.

98. Ans. D

Exp: Option (d) is correct

E-Kranti

- E-KRANTI is a national e-governance plan to accelerate e-governance across India.
- Its vision is to: "Ensure government-wide transformation by delivering all government services electronically to citizens via integrated, interoperable systems through multiple modes."

The objectives of 'e-Kranti' are as follows:

- To redefine NeGP with transformational and outcome oriented e-Governance initiatives.
- To enhance the portfolio of citizen centric services.
- To ensure optimum usage of core Information & Communication Technology (ICT).
- To promote rapid replication and integration of eGov applications.
- To leverage emerging technologies.
- To make use of more agile implementation models.
- The thrust areas of the e-Kranti – electronic delivery of services under the Digital India programme are:
- Technology for Education (e-Education), Health (e-Healthcare), Farmers, Financial Inclusion, Planning, Justice, Security, Planning and Cyber Security.

99. Ans. D

Exp: All statements are correct

Nanotechnology in Food Processing

- Nanotechnology offers some exciting potential benefits for the quality and safety of our foods such as:
- Contamination Sensor: Flashlight to reveal the presence of E. coli bacteria.
- Antimicrobial Packaging: Edible food films made with cinnamon or oregano oil, or nanoparticles of zinc, calcium other materials that kill bacteria.
- Improved Food Storage: Nano enhanced barrier keeps oxygen-sensitive foods fresher.
- Enhanced Nutrient Delivery: Nanoencapsulating improves the solubility of vitamins, antioxidants, healthy omega oils and other 'nutraceuticals'.
- Green Packaging: Nano-fibers made from lobster shells or organic corn are both antimicrobial and biodegradable.
- Pesticide Reduction: A cloth saturated with nanofibers slowly releases pesticides, eliminating the need for additional spraying and reducing chemical leakage into the water supply.
- Tracking, Tracing Brand Protection: Nanobarcodes can be created to tag individual products and trace outbreaks.
- Texture: Food spread ability and stability improve with nano-sized crystals and lipids for better low-fat foods.
- Flavor: Trick the tongue with bitter blockers or sweet and salty enhancers.
- Bacteria Identification and Elimination: Nano carbohydrate particles bind with

bacteria so they can be detected and eliminated.

100. Ans. D

Exp: Statement 1 is incorrect: Nuclear Power Corporation of India Limited (NPCIL) is responsible for design, construction, commissioning and operation of nuclear power reactors.

Statement 2 is incorrect: BHAVINI is PSU of Department of Atomic Energy (DAE) which implements Fast Breeder Reactors programme in the country.

Nuclear Power Corporation of India Limited (NPCIL)

- NPCIL is a Public Sector Enterprise under the administrative control of the Department of Atomic Energy (DAE), Government of India.
- The Company was registered as a Public Limited Company under the Companies Act, 1956 in September 1987 with the objectives of operating atomic power plants and implementing atomic power projects for generation of electricity in pursuance of the schemes and programmes of the Government of India under the Atomic Energy Act, 1962.
- NPCIL also has equity participation in BHAVINI, another PSU of Department of Atomic Energy (DAE) which implements Fast Breeder Reactors programme in the country.
- NPCIL is responsible for design, construction, commissioning and operation of nuclear power reactors.
- NPCIL is presently operating 22 commercial nuclear power reactors with an installed capacity of 6780 MW. BHAVINI
- Bharatiya Nabhikiya Vidyut Nigam Limited (BHAVINI) is a Government company under the administrative control of Department of Atomic Energy incorporated on 22nd October 2003 as a Public Limited Company under the Companies Act, 1956 with the objective of constructing and commissioning the first 500 MWe Fast Breeder Reactor at Kalpakkam in Tamil Nadu and to pursue construction, commissioning, operation and maintenance of subsequent Fast Breeder Reactors for generation of electricity in pursuance of the schemes and programmes of Government of India under the provisions of Atomic Energy Act, 1962.