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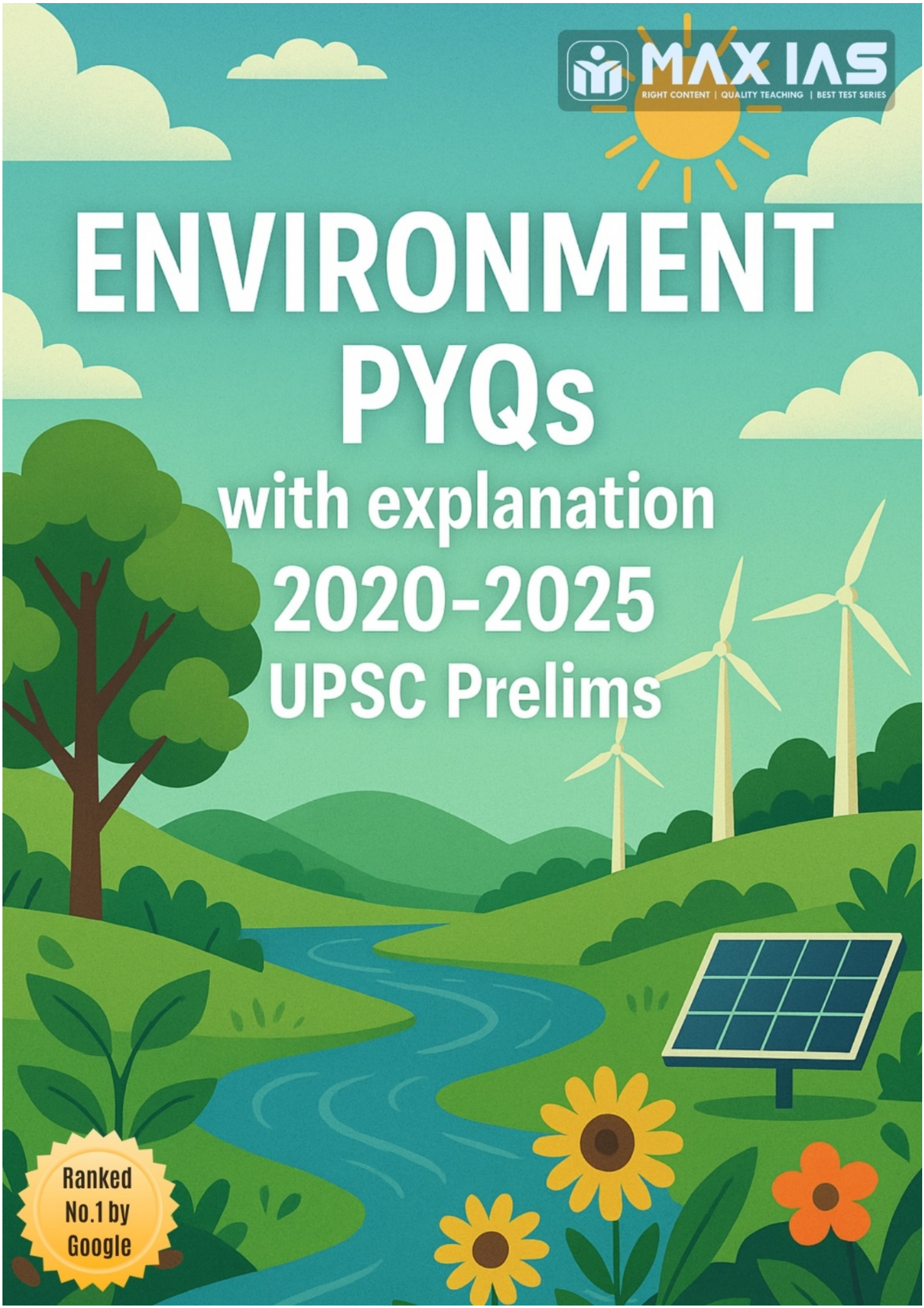
ENVIRONMENT PYQs

with explanation 2020-2025

UPSC Prelims



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Author: Kranti Pavel (Director), MAX IAS, New Delhi

Emai-id. Email: info@maxias.in

6 Year Solved UPSC Prelims Environment PYQs With Explanation 2020- 2025

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2025

Solved UPSC Prelims Environment PYQs With Explanation 2025

1.Consider the following statements:

Statement I: Studies indicate that carbon dioxide emissions from cement industry account for more than 5% of global carbon emissions.

Statement II: Silica-bearing clay is mixed with limestone while manufacturing cement.

Statement III: Limestone is converted into lime during clinker production for cement manufacturing.

Which one of the following is correct in respect of the above statements?

(a) Both Statement II and Statement III are correct and both of them explain Statement I

(b) Both Statement II and Statement III are correct but only one of them explains Statement I

(c) Only one of the Statements II and III is correct and that explains Statement I

(d) Neither Statement II nor Statement III is correct

1.Ans-a

Explanation

Global cement manufacturing produced 1.6 billion metric tonnes of CO_2 in 2022, the latest year for which there are figures – that's about 8% of the world's total CO_2 emissions.

Statement 1 is correct

The cement-making process can be divided into two basic steps:

Clinker (the main constituent of cement) is first made in a kiln with gas up to 2000°C, which heats raw materials such as limestone (calcium carbonate) with small quantities of other materials (e.g. clay) to 1,450°C. During this process, known as calcination, the calcium carbonate (limestone) is transformed into calcium oxide (lime), which then reacts with the other constituents from the raw material to form new minerals, collectively called clinker. This near-molten material is rapidly cooled to a temperature of 100 - 200°C.

Clinker is the primary component in cement and is extremely carbon-intensive, making up 90% of overall emissions from cement.

Clinker is then ground with gypsum and other materials to produce the grey powder known as cement.

Both Statement II and Statement III are correct and both of them explain Statement I

2. Consider the following statements:

Statement I: At the 28th United Nations Climate Change Conference (COP28), India refrained from signing the 'Declaration on Climate and Health'.

Statement II: The COP 28 Declaration on Climate and Health is a binding declaration; and if signed, it becomes mandatory to decarbonize health sector.

Statement III: If India's health sector is decarbonized, the resilience of its health-care system may be compromised.

Which one of the following is correct in respect of the above statements?

(a) Both Statement II and Statement III are correct and both of them explain Statement I

(b) Both Statement II and Statement III are correct but only one of the them explains Statement I

(c) Only one of the Statements II and III is correct and that explains Statement I

(d) Neither Statement II nor Statement III is correct

2.Ans-c

Explanation

The COP28 Declaration on Climate and Health is a **non-binding**, non-negotiated call to action and collective commitment that reflects the concerns and common position of countries on the importance of health within climate discourse and in the COP process

Statement 2 is incorrect

India has refused to sign the COP28 Declaration on Climate and Health, India cited the lack of practicality in curbing greenhouse gases use for cooling in the health sector, as the reason.

India expressed concerns that greenhouse gas reduction for cooling in the health sector could hinder its ability to meet the growing demands for medical services, particularly in remote and underserved areas

Only Statements III is correct and that explains Statement I

3. Consider the following statements: Statement

I: Scientific studies suggest that a shift is taking place in the Earth's rotation and axis.

Statement II: Solar flares and associated coronal mass ejections bombarded the Earth's outermost atmosphere with tremendous amount of energy.

Statement III: As the Earth's polar ice melts, the water tends to move towards the equator.

Which one of the following is correct in respect of the above statements?

(a) Both Statements II and III are correct and both of them explain Statement I

(b) Both Statement II and Statement III are correct but only one of them explains Statement I

(c) Only one of the Statement II and III is correct and that explains Statement I

(d) Neither Statement II nor Statement III is correct

3.Ans-b

Explanation

Climate change is causing significant shifts in Earth's rotation and axis . As polar ice melts and water flows towards the equator, it's altering the planet's mass distribution and slowing its rotation, leading to slightly longer days

Statements 1 & 3 are correct

Solar flares are huge explosions of electromagnetic radiation from the Sun. A flare appears as a sudden, intense brightening of a region on the Sun, lasting several minutes to hours.

Flares and solar eruptions can impact radio communications, electric power grids, navigation signals, and pose risks to spacecraft and astronauts.

Although solar flares can bombard Earth's outermost atmosphere with tremendous amounts of energy, most of that energy is reflected back into space by the Earth's magnetic field or radiated back to space as heat by the thermosphere.

Statement 2 is correct, but does not explain statement 1

4.Consider the following statements:

Statement I: Article 6 of the Paris Agreement on climate change is frequently discussed in global discussions on sustainable development and climate change.

Statement II: Article 6 of the Paris Agreement on climate change sets out the principles of carbon markets.

Statement III: Article 6 of the Paris Agreement on climate change intends to promote inter-country non-market strategies to reach their climate targets.

Which one of the following is correct in respect of the above statements?

(a) Both Statement II and Statement III are correct and both of them explain Statement I

(b) Both Statement II and Statement III are correct but only one of them explains Statement I

(c) Only one of the Statements II and III is correct and that explains Statement I

(d) Neither Statement II nor Statement III is correct

4.Ans-a

Explanation

Article 6 of the Paris Agreement sets out the principles for carbon markets.

Article 6.2 It enables countries to make mutual agreements that permit them to **generate and transfer emission reduction units—known as Internationally Transferred Mitigation Outcomes (ITMOs).**

Article 6.4 establishes a global carbon market overseen by the UN body called "Article 6.4 Supervisory Body". It's a multilateral mechanism that replaces the old Clean Development Mechanism, thus effectively **establishing an international carbon market** within the scope of the Paris Agreement.

Article 6.8 Non-market mechanisms refer to strategies that are not based on offset markets or emissions trading and include ways other than utilizing carbon markets for cooperation to reduce

emissions and fulfil NDCs. **These may include technology transfer, capacity building, policy support, mitigation and adaptation finance**.
Advocates of NMAs have often argued that marketbased approaches under Article 6.2 and 6.4 do not serve any purpose on mitigation as offsetting does not seek to achieve overall emission reductions. Meanwhile, if any mitigation action has to be supported through cooperative action, it could only come through non-market approaches.
Both statements 2 &3 are correct and both of them explain Statement I

5.Which one of the following launched the 'Nature Solutions Finance Hub for Asia and the Pacific'?
(a) The Asian Development Bank (ADB)
(b) The Asian Infrastructure Investment Bank (AIIB)
(c) The New Development Bank (NDB)
(d) The International Bank for Reconstruction and Development (IBRD)

5.Ans-a
Explanation
The Asian Development Bank (ADB) launched a Nature Solutions Finance Hub for Asia and the Pacific at COP28, which aims to attract at least $2 billion into investment programs that incorporate nature-based solutions, particularly focused on capital markets and other sources of private capital.

6. With reference to 'Direct Air Capture', an emerging technology, which of the following statements is/are correct?
I. It can be used as a way of carbon sequestration.
II. It can be a valuable approach for plastic production and in food processing.
III. In aviation, it can be a source of carbon for combining with hydrogen to create synthetic low-carbon fuel.
Select the correct answer using the code given below.
(a) I and II only
(b) III only
(c) I, II and III
(d) None of the above statements is correct

6.Ans-c
Explanation
Direct air capture is a technology that uses chemical reactions to pull carbon dioxide out of air. When air moves over these chemicals, they selectively react with and trap CO2, allowing the other components of air to pass through.
Hence statement 1 is correct

The captured CO2 can be used as a feedstock for various carbon-based materials. It can be used in the production of cement, plastics, carbon fibers, and other industrial applications.
The captured carbon dioxide is able to be used in industrial processes, from carbonating drinks through to the manufacture of synthetic fuel
Hence statements 2 and 3 are correct

7. Regarding Peacock tarantula (Gooty tarantula), consider the following statements:
I. It is an omnivorous crustacean.
II. Its natural habitat in India is only limited to some forest areas.
III. In its natural habitat, it is an arboreal species.
Which of the statements given above is/are correct?
(a) I only
(b) I and III
(c) II only
(d) II and III

7.Ans-d
Explanation
Peacock tarantula (Gooty tarantula) belongs to **Arachnida , its not a crustacean**
Hence statement 1 is correct
The gooty sapphire ornamental tarantula (Poecilotheria metallica), known for its striking blue coloration, is a highly sought-after species in the global invertebrate pet market, this tarantula is renowned for its vivid metallic blue body, contrasting black markings, and orange or red accents on its legs.
Its naturally found in Seshachalam Biosphere Reserve in the Eastern Ghats of India
In 1899, it was found in a railway timber yard in Gooty, Andhra Pradesh. Hence the name Gooty Tarantula
Hence statements 2 and 3 are correct
The genus Poecilotheria belongs to the family Theraphosidae and is made up of arboreal species of spiders, which are known to occur in India and Sri Lanka. The genus is represented by eight species in India and seven in Sri Lanka.

8.Consider the following statements:
I. Carbon dioxide (CO2) emissions in India are less than 0.5 t CO2/ capita.
II. In terms of CO2 emissions from fuel combustion, India ranks second in Asia-Pacific region.
III. Electricity and heat producers are the largest source of CO2 emissions in India.
Which of the statements given above is/are correct?
(a) I and III only
(b) II only

(c) II and III only
(d) I, II and III

8.Ans-c

Explanation

CO2 emissions per capita in India 1.776tCO2 / Capita
Hence statement 1 is incorrect

In terms of CO2 emissions from fuel combustion, India ranks second in Asia-Pacific region after China.
Hence statement 2 is correct

CO2 emissions by sector, India
Electricity and Heat producers - 53%
Transport -13%
Industry sector -24%
Residential - 4%
Hence statement 3 is correct

9.Consider the following pairs:

Plant Description

I. Cassava : Woody shrub
I. Ginger : Herb with pseudostem
III. Malabar spinach : Herbaceous climber
IV. Mint : Annual shrub
V. Papaya : Woody shrub

How many of the above pairs are correctly matched?
(a) Only two
(b) Only three
(c) Only four
(d) All the five

9.Ans-b

Explanation

Cassava : Manihot esculenta Crantz. (Euphorbiaceae) also called Cassava, manioc, yuca, balinghoy, mogo, mandioca, kamoteng kahoy, tapioca is a perennial **woody shrub** in the Euphorbiaceae (spurge family) native to South America but now grown in tropical and subtropical areas worldwide for the edible starchy roots (tubers), which are a major food source in the developing world. This food plant is also medicinally used to treat hypertension, headache, and other pains, irritable bowel syndrome and fever
Hence 1st pair is correctly matched

Ginger: The ginger plant is an erect **herbaceous** perennial growing from one to three feet in height. The stem is surrounded by the sheathing bases of the two-ranked leaves. The plant is erect, **aerial shoots (pseudostem)** with leaves, and an underground stem (rhizome). The fleshy and fibrous roots of ginger have indefinite growth from the base of the sprouts.
Hence 2nd pair is correctly matched

Malabar spinach: Malabar spinach, Basella alba, is a **herbaceous** green leafy vegetable. This fast-growing plant is a soft-stemmed, **twining vine** that can grow up to 10 feet long as an annual (longer as a perennial) but generally remains smaller in most gardens.
Hence 3rd pair is correctly matched

Mint : Mint is a **herbaceous plant** of the family Lamiaceae. It is distributed worldwide. The herb as a whole, its essential oils, or major chemical constituents are used for their flavor in various types of foods, confectionary, food preservatives, and antimicrobial agents to control the food-borne pathogens besides their usage in cosmetics and healthcare
Hence 4th pair is incorrectly matched

Papaya : Papayas are fast growing, **woody , tree-like plants.** It is a large **herbaceous plant**, usually with a single, straight trunk which can reach to 30 feet.
Hence 5th pair is incorrectly matched

10.With reference to the planet Earth, consider the following statements:
I. Rain forests produce more oxygen than that produced by oceans.
II. Marine phytoplankton and photo-synthetic bacteria produce about 50% of world's oxygen.
III. Well-oxygenated surface water contains several folds higher oxygen than that in atmospheric air.
Which of the statements given above is/are correct?
(a) I and II
(b) II only
(c) I and III
(d) None of the above statements is correct

10.Ans-b
Explanation
The ocean generates 50 percent of the oxygen we need, absorbs 30 percent of all carbon dioxide emissions and captures 90 percent of the excess heat generated by these emissions. It is not just 'the lungs of the planet' but also its largest 'carbon sink' – a vital buffer against the impacts of climate change.
Hence statement 1 is incorrect

Scientists estimate that roughly half of the oxygen production on Earth comes from the ocean. The majority of this production is from **oceanic plankton — drifting plants, algae, and some bacteria that can photosynthesize.** One particular species, Prochlorococcus, is the smallest photosynthetic organism on Earth. But this little bacteria produces up to 20% of the oxygen in our entire biosphere.
Hence statement 2 is correct

Well-oxygenated surface water may only contain around 8 mg O2/l, while the air contains 210 mg O2/l.
The oxygen content in ocean water is highest at the surface for two primary reasons: this is where oxygen from the atmosphere dissolves into the ocean, and it is also the location where oxygen is produced by phytoplankton during photosynthesis. While respiration occurs in surface waters as well, the rate of oxygen production through photosynthesis exceeds the rate of oxygen consumption via respiration. It is important to note that despite the higher levels of dissolved oxygen at the surface, the concentration of oxygen in water is still significantly lower than that found in the air.
Hence statement 3 is incorrect

11. Which organization has enacted the Nature Restoration Law (NRL) to tackle climate change and biodiversity loss?
(a) The European Union
(b) The World Bank
(c) The Organization for Economic Cooperation and Development
(d) The Food and Agriculture Organization

11.Ans-a
Explanation
The Nature Restoration Regulation is the first continent-wide, comprehensive law of its kind. It is a key element of the EU Biodiversity Strategy, which sets binding targets to restore degraded ecosystems, in particular those with the most potential to capture and store carbon and to prevent and reduce the impact of natural disasters.

12.Consider the following statements :
Statement I: Of the two major ethanol producers in the world, i.e., Brazil and the United States of America, the former produces more ethanol than the latter.
Statement II: Unlike in the United States of America where corn is the principal feedstock for ethanol production, sugarcane is the principal feedstock for ethanol production in Brazil.
Which one of the following is correct in respect of the above statements?
(a) Both Statement I and Statement II are correct and Statement II explains Statement I
(b) Both Statement I and Statement II are correct but Statement II doesnot explain Statement I
(c) Statement I is correct but Statement II is not correct
(d) Statement I is not correct but Statement II is correct

12.Ans-d

Explanation

United States is the world's largest producer of ethanol, having produced over 15 billion gallons in 2021 and 2022. Together, the United States and Brazil produce 80% of the world's ethanol. The vast majority of U.S. ethanol is produced from corn, while Brazil primarily uses sugarcane.

Hence statement 1 is incorrect & statement 2 is correct

13.The World Bank warned that India could become one of the first places where wet-bulb temperatures routinely exceed 35°C. Which of the following statements best reflect(s) the implication of the above-said report?

I. Peninsular India will most likely suffer from flooding, tropical cyclones and droughts.

II. The survival of animals including humans will be affected as shedding of their body heat through perspiration becomes difficult.

Select the correct answer using the code given below.

(a) I only

(b) II only

(c) Both I and II

(d) Neither I nor II

13.Ans-c

Explanation

A report by the World Bank cautioned that India could become one of the first places in the world where wet-bulb temperatures could soar past the survivability threshold of 35°C

What is wet bulb temperature ?

Wet bulb temperature is a meteorological term used to describe the lowest temperature that can be reached by evaporating water into the air at constant pressure. It is measured by covering a thermometer bulb with a wet cloth and letting the water evaporate. As the water evaporates, it cools the thermometer, showing the wet bulb temperature.

This temperature helps measure humidity and understand how much water can evaporate into the air, affecting things like comfort, farming and weather patterns.

A wet-bulb temperature of 35 degrees Celsius is suggested as the maximum safe limit, according to a 2010 study. 35 degree Celsius wet-bulb is an upper limit for mammals, including humans .

High heat combined with humidity poses a greater risk to human health than high heat alone because sweat does not evaporate effectively, leading to increased body temperature, heat exhaustion and potentially fatal heatstroke.

Hence statement 2 is correct

Extended periods of heat waves lead to signicant drying of soil over large regions. Aside from the obvious agricultural implications, this can impact the monsoon onset and can negatively affect

agriculture, water security, and even lead to localized flooding, where heavy rain hits dry soil that is unable to absorb it.

Owing to its Peninsular shape surrounded by the Bay of Bengal in the east and the Arabian Sea in the west, the tropical cyclones in India also originate in these two important locations. Though most of the cyclones originate between 10°-15° north latitudes during the monsoon season, yet in case of the Bay of Bengal, cyclones mostly develop during the months of October and November. Here, they originate between 16°-2°° N latitudes and to the west of 92° E. By July the place of origin of these storms shifts to around 18° N latitude and west of 90°E near the Sunderban Delta.
It was mentioned that the energy to the tropical cyclone comes from the latent heat released by the warm moist air. Hence, with the increase in distance from the sea, the force of the cyclone decreases. In India, the force of the cyclone decreases with increase in distance from the Bay of Bengal and the Arabian Sea. So, the coastal areas are often struck by severe cyclonic storms with an average velocity of 180 km/h. Often, this results in abnormal rise in the sea level known as Storm Surge.
Hence statement 2 is correct

2024

Previous Year UPSC Environment Questions With Explanation 2024

There were 15 Questions from Environment in 2024, of which

- **5 Questions were related to Climate Change**
- **5 Questions were related to Environmental ecology**
- **5 Questions were related to Bio-Diversity**

The examiner covered areas such as the Basics of Climate Change, Global Climate Issues, Climate Change Initiatives, Alternate and Sustainable Fuels, the Basics of the Environmental ecology, the basics of biodiversity, Biodiversity in India, and Global Biodiversity and Environment Organisations.
The level of the questions was moderate.
Questions were aimed to test the basic and applied sections of Environmental ecology , Bio-Diversity.

1. One of the following regions has the world's largest tropical peatland, which holds about three years worth of global carbon emissions from fossil fuels; and the possible destruction of which can exert detrimental effect on the global climate. Which one of the following denotes that region?
(a) Amazon Basin
(b) Congo Basin
(c) Kikori Basin
(d) Rio de la Plata Basin

1. Ans: b
Explanation:
The Congo Basin is home to the world's largest tropical peatlands, along with Brazil and Indonesia.
The peat swamp forest of the Congo Basin stores around 29 billion tons of carbon – approximately equivalent to three years' worth of global greenhouse gas emissions – while the Basin as a whole absorbs nearly 1.5 billion tons of carbon dioxide a year.
The Basin stretches across six countries- Cameroon, Central African Republic, Democratic Republic of the Congo, Congo, Equatorial Guinea and Gabon.
Region's Ba'Aka people are among the most well known representatives of an ancient hunter-gatherer lifestyle.
The Congo Basin is extremely rich in wood, oil and minerals such as diamonds, gold and coltan (used to make cell phones.

The Congo Basin is the world's largest carbon sink.
Hence, option b is correct.

2. With reference to perfluoroalkyl and polyfluoroalkyl substances (PFAS) that are used in making many consumer products, consider the following statements:
1. PFAS are found to be widespread in drinking water, food and food packaging materials.
2. PFAS are not easily degraded in the environment.
3. Persistent exposure to PFAS, can lead to bioaccumulation in animal bodies.
Which of the statements given above are correct?
(a) 1 and 2 only
(b) 2 and 3 only·
(c) 1 and 3 only
(d) 1, 2 and 3

2. Ans: d
Explanation:
Perfluoroalkyl substances (PFASs) are substances commonly used in the production of various everyday objects, including among others kitchen dishes, cosmetics, or clothes. They penetrate to the environment and living organisms causing disturbances in the functioning of many internal organs and systems.
Per- and polyfluoroalkyl substances (PFAS) are a complex & ever-expanding group of manufactured chemicals widely used in everyday products. **They are called 'Forever Chemicals' due to their non-degradability, long-term environmental persistence, and accumulation potential.**
Hence, statement 2 is correct.

PFAS are used in many things we use daily and have extensive industrial and consumer applications, including non-stick cookware, **food packaging**, cleaning solutions, fire-fighting foam, stain/water resistant fabrics, and personal care items.
PFAS compounds are considered 'Contaminants of Emerging Concern' as exposure to these has been associated with adverse human health issues such as reduced immune response, hormonal imbalances, low birth weight, etc., and even carcinogenic.
The presence of PFAS in drinking water due to the various environmental and health issues described above and in the environment is an urgent global public health issue that needs tremendous attention.
PFAS are used in the aerospace, automotive, construction, and electronics industries.
Over time, PFAS may leak into the soil, water, and air.
Statement 1 is correct.
People are most likely exposed to these chemicals by consuming PFAS-contaminated water or food, using products made with PFAS, or breathing air containing PFAS.

Multiple health effects associated with PFAS exposure have been identified and are supported by different scientific studies. Concerns about the public health impact of PFAS have arisen for the following reasons:

- Widespread occurrence: Studies find PFAS in the blood and urine of people, and scientists want to know if it causes health problems.
- Numerous exposures: PFAS are used in hundreds of products globally, with many opportunities for human exposure.
- Growing numbers: PFAS are a group of nearly 15,000 synthetic chemicals, according to a chemicals database (CompTox) maintained by the U.S. Environmental Protection Agency.
- Persistent: PFAS remain in the environment for an unknown amount of time.
- **Bioaccumulation: People may encounter different PFAS chemicals in various ways. Over time, people may take in more of the chemicals than they excrete, a process that leads to bioaccumulation in bodies.**

Statement 3 is correct.

3. Consider the following statements:

Statement-I: The Indian Flying Fox is placed under the "vermin" category in the Wild Life (Protection) Act, 1972.

Statement II: The Indian Flying Fox feeds on the blood of other animals.

Which one of the following is correct in respect of the above statements?

(a) Both Statement-I and Statement-II are correct and Statement-II explains Statement-I

(b) Both Statement-I and Statement-II are correct, but Statement-II does not explain Statement-I

(c) Statement-I is correct, but Statement-II is incorrect

(d) Statement-I is incorrect, but Statement-II is correct

3. Ans: c * UPSC dropped this question

Explanation:

Vermin are wild animals or birds that destroy plants or food, or attack farm animals and birds

Wildlife Protection Act defines vermin - "vermin" means any wild animal specified in Schedule V.

SCHEDULE V of Wild Life Protection Act consists of

1. Common crow
2. **Fruit bats**
4. Mice
5. Rats

Hence, statement 1 is correct.

The flying fox, **also known as fruit bats** or Pteropus gigante is listed as a 'vermin' in the Indian Wildlife (Protection) Act 1972, due to its **destructive tendencies towards fruit farms.**

The Indian flying fox is one of the largest species of bats in the world. Its wing length is 1.2-1.5m. It survives only on fruits.

Hence, statement 2 is incorrect.

4. The organisms "Cicada, Froghopper and Pond skater" are:
(a) Birds
(b) Fish
(c) Insects
(d) Reptiles

4. Ans: c
Explanation:
Cicada, froghopper and pond skater all belong to the **category of insects.**

Hence, option c is correct.

5. Consider the following statements:
Statement-I: Many chewing gums found in the market are considered a source of environmental pollution.
Statement-II: Many chewing gums contain plastic as gum base.
Which one of the following is correct in respect of the above statements?
(a) Both Statement-I and Statement-II are correct and Statement-II explains Statement-I
(b) Both Statement-I and Statement-II are correct, but Statement-II does not explain Statement-I
(c) Statement-I is correct, but Statement-II is incorrect
(d) Statement-I is incorrect, but Statement-II is correct

5. Ans: a
Explanation:
The earliest forms of gum were plant-based resins extracted from trees**, most of the sticks we chew today are composed of synthetic petroleum derivatives – plastics**. They include; butyl rubber, polythyene and polyvinyl acetate, which are also used in diesel, plastic bags and glue, respectively. **These ingredients are often disguised under the name "gum base" on labels, and these plastics provide gum with chewiness.**
Chewing gum contributes 100,000 tonnes of plastic pollution annually. An estimated 80-90% of chewing gum is not disposed of properly, making it the one of the most littered items on streets Due to its plastic contents, chewing gum is non-biodegradable

Both statements 1 & 2 are correct, and statement 2 correctly explains statement 1.

6. Consider the following pairs:

	Country	*Animals found in its natural habitat*
I.	Brazil	Indri
2.	Indonesia	Elk
3.	Madagascar	Bonobo

How many of the pairs given above are correctly matched?
(a) Only one
(b) Only two
(c) All three
(d) None

6. Ans: d
Explanation:
Indris are the largest lemurs in the world. Like all lemurs, indris (Indri indri) are endemic to the island of **Madagascar rainforests.**
Elk, (Cervus elaphus canadensis), the largest and most advanced subspecies of red deer (Cervus elaphus), **found in North America and in high mountains of Central Asia**. It is a member of the deer family.
Wild bonobos can only be **found in forests south of the Congo River in the Democratic Republic of Congo (DRC).** Bonobos and chimpanzees look very similar and both share 98.7% of their DNA with humans—making the two species our closest living relatives. Bonobos are usually a bit smaller, leaner, and darker than chimpanzees.
None of the pairs are correctly matched, Hence, option d is correct.

7. Consider the following statements:
1. Lions do not have a particular breeding season.
2. Unlike most other big cats, cheetahs do not roar.
3. Unlike male lions, male leopards do not proclaim their territory by scent marking.
Which of the statements given above are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

7. Ans: a
Explanation:
There is **no fixed breeding season**, though the preponderance of mating appears to occur in winter.

The Gir National Park spread across 1,412 sq km, was recently closed from June 16 to October 15 as part of lions mating season.
Hence, statement 1 is correct.

Unlike other big cats, including lions, tigers, leopards, and jaguars, **cheetahs don't roar.** They growl when there is danger, and usually only chirp, purr and meow.
Hence, statement 2 is correct.

Scent marking allows carnivores to communicate with each other by leaving their scent at prominent landmarks such as termite mounds and large trees in savannah ecosystems. **These carnivores deposit their scent via scratching, rubbing, urinating, or defecating and often return to the same sites.**
Such olfactory cues are used to **mark territory**, advertise dominance or reproductive status, and alert predators.
Lions, Leopards and cheetahs will also 'Sharpen their claws' on the bark of a tree. Along with keeping their claws in good condition, there are glands in between their digits that leave their scent behind. The same glands deposit scent onto the ground and grass when the animal scratches their feet through the grass.

A male leopard locates and elicits response from a female in estrus, using scent marks and vocalisations.
Hence, statement 3 is incorrect.

8. Consider the following:
1. Battery storage
2. Biomass generators
3. Fuel cells
4. Rooftop solar photovoltaic units

How many of the above are considered "Distributed Energy Resources"?
(a) Only one
(b) Only two
(c) Only three
(d) All four

8. Ans: d
Explanation:
Distributed energy resources are small, modular, energy generation and storage technologies that provide electric capacity or energy where you need it.
DER systems can be made up of one or more primary technologies—such as internal combustion engines, combustion turbines, fuel cells, photovoltaics, wind turbines, and batteries

DER technologies include wind turbines, photovoltaics (PV), fuel cells, microturbines, reciprocating engines, combustion turbines, cogeneration, and energy storage systems.

Examples of distributed energy resources that can be installed include:

- **rooftop solar photovoltaic units**
- wind generating units
- **battery storage**
- batteries in electric vehicles used to export power back to the grid
- combined heat and power units, or tri-generation units that also utilise waste heat to provide cooling
- **biomass generators**, which are fuelled with waste gas or industrial and agricultural by-products.
- open and closed cycle gas turbines
- reciprocating engines (diesel, oil)
- hydro and mini-hydro schemes
- **fuel cells.**

Hence, option d is correct. `

9. Which one of the following shows a unique relationship with an insect that has coevolved with it and that is the only insect that can pollinate this tree?

(a) Fig
(b) Mahua
(c) Sandalwood
(d) Silk cotton

9. Ans: a

Explanation:

Figs have an obligate mutualism with tiny fig-pollinating wasps (family Agaonidae). Female wasps enter receptive syconia, where they pollinate female flowers. They also lay eggs in some flowers, where their larvae induce galls. Some weeks later, the wasp offspring emerge from their galls into the syconium, just as the male flowers have matured their pollen sacs. The new generation of female wasps leave the syconium through holes made by the males and carry pollen to receptive syconia elsewhere. This symbiosis is exploited by many species of fig-parasitic wasps. Most of them do not enter the syconium or contribute to pollination but use long ovipositors to inject eggs through the fig wall so that their larvae can feed on either fig flowers or other wasps.

Their interaction dominates the lives of both and, as each relies on the other for reproduction, Figs are selected to raise some seeds (female function) and some wasps (male function as pollen vectors); however, wasps are selected to maximise their own offspring production, with no regard for seed production. **This leads to the coevolution of various fig and wasp traits.**

Hence, option a is correct.

10. Which one of the following is the exhaust pipe emission from Fuel Cell Electric Vehicles, powered by hydrogen?

(a) Hydrogen peroxide
(b) Hydronium
(c) Oxygen
(d) Water vapour

10. Ans: d

Explanation:

FUEL CELL ELECTRIC VEHICLE

A fuel cell uses the chemical energy of hydrogen or other fuels to cleanly and efficiently produce electricity. If hydrogen is the fuel, the only products are **electricity, water, and heat.**
Fuel cell electric vehicles (FCEVs) powered by hydrogen are more efficient than conventional internal combustion engine vehicles.
Hence, option d is correct.

11. Recently, the term "pumped-storage hydropower" is actually and appropriately discussed in the context of which one of the following?

(a) Irrigation of terraced crop fields
(b) Lift irrigation of cereal crops
(c) Long-duration energy storage
(d) Rainwater harvesting system

11. Ans: c

Explanation:

PUMP STORAGE HYDROPOWER

Pumped storage hydropower (PSH) is **a type of hydroelectric energy storage.** It is a configuration of two water reservoirs at different elevations that can generate power as water moves down from one to the other (discharge), passing through a turbine.
Pumped storage hydropower plants store electricity by pumping water up from a lower reservoir to an upper reservoir and then releasing it through turbines when power is needed. They represent 30% of net hydropower additions through 2030 according to the IEA forecast.
The increasing need in many markets for system flexibility and storage to facilitate the integration of larger shares of variable renewables drives record growth of pumped storage projects between 2021 and 2030.
Hence, option c is correct.

12. "Membrane Bioreactors" are often discussed in the context of:

(a) Assisted reproductive technologies
(b) Drug delivery nanotechnologies

(c) Vaccine production technologies
(d) Wastewater treatment technologies

12. Ans: d

Explanation:

Membrane Bioreactors (MBRs), have the advantage of combining a suspended growth biological reactor with solids removal via filtration. The membranes can be designed for and operated in small spaces and with high removal efficiency of contaminants such as nitrogen, phosphorus, bacteria, biochemical oxygen demand, and total suspended solids.

The membrane filtration system in effect can replace the secondary clarifier and sand filters in a typical activated sludge treatment system.
Membrane filtration allows a higher biomass concentration to be maintained, thereby allowing smaller bioreactors to be used. Membrane filtration involves the flow of water-containing pollutants across a membrane. Water permeates through the membrane into a separate channel for recovery. Because of the cross-flow movement of water and waste constituents, materials left behind do not accumulate at the membrane surface but are carried out of the system for later recovery or disposal. The water passing through the membrane is called the permeate, while the water with the more concentrated materials is called the concentrate or retentate.

A **MEMBRANE BIOREACTOR (MBR)** process combines a microfiltration or ultrafiltration membrane unit with a suspended growth bioreactor and is now widely used in both municipal and industrial **Wastewater Treatment Plants.**
Hence, option d is correct.

13. Consider the following materials:
1. Agricultural residues
2. Corn grain
3. Wastewater treatment sludge
4. Wood mill waste

Which of the above can be used as feedstock for producing Sustainable Aviation Fuel?
(a) 1 and 2 only
(b) 3 and 4 only
(c) 1, 2, 3 and 4
(d) 1, 3 and 4 only

13. Ans: c

Explanation:

Menu of Sustainable feedstock for producing Sustainable Aviation Fuel are:

1. **Corn grain**

2. Oil seeds
3. Algae
4. Other fats, oils, and greases
5. **Agricultural residues**
6. Forestry residues
7. **Wood mill waste**
8. Municipal solid waste streams
9. Wet wastes (manures, **wastewater treatment sludge**)
10. Dedicated energy crops.

Hence, option c is correct.

14. According to the Environmental Protection Agency (EPA), which one of the following is the largest source of sulphur dioxide emissions?
(a) Locomotives using fossil fuels
(b) Ships using fossil fuels
(c) Extraction of metals from ores
(d) Power plants using fossil fuels

14. Ans: d
Explanation:
According to EPA, the largest source of SO2 in the atmosphere is the **burning of fossil fuels by power plants** and other industrial facilities. Smaller sources of SO2 emissions include: industrial processes such as extracting metal from ore; natural sources such as volcanoes; and locomotives, ships and other vehicles and heavy equipment that burn fuel with a high sulfur content.
Hence, option d is correct.

15. Consider the following statements:
Statement I: India does not import apples from the United States of America.
Statement II: In India, the law prohibits the import of Genetically Modified food without the approval of the competent authority.
Which one of the following is correct in respect of the above statements?
(a) Both Statement-I and Statement-II are correct and Statement-II explains Statement-I
(b) Both Statement-I and Statement-II are correct, but Statement-II does not explain Statement-I
(c) Statement-I is correct, but Statement-II is incorrect
(d) Statement-I is incorrect, but Statement-II is correct

15. Ans: d
Explanation:
In June 2023 Indian Government removed an additional 20% duty was imposed on US apples in 2019. An additional 20% duty was imposed on US apples in 2019 in response to USA's measure to

increase tariffs on certain steel and aluminium products. There is no reduction on the Most Favoured Nation (MFN) duty on apples which is still applicable on all imported apples, including on the USA at 50%.

The market share of the US apples was taken by other countries due to the imposition of additional retaliatory duty on US apples. This is reflected as the import of apples from countries other than the US increased from US$ 160 million in FY 2018-19 to US$ 290 million in FY 2022-23. Turkey, Italy, Chile, Iran and New Zealand are other top exporters to India of apples which took the market share of the US.

The import policy of Genetically Modified Food, Feed, Genetically Modified Organism (GMOs) and Living Modified Organisms (LMOs) has been notified by the Directorate General of Foreign Trade under General Notes regarding Import Policy in ITC (HS) 2012, Schedule-1 (Import Policy). As per the policy, import of GM food requires prior approval of the Genetic Engineering Approval Committee (GEAC) constituted by the Ministry of Environment Forest and Climate Change.

Further, the Customs Act, 1962 is the basic statute which governs /regulates entry/exit of different categories of goods into or outside the country. Various allied laws and regulations also apply. It is the responsibility of the Customs to ensure that all the imported/ exported goods fulfil the prescribed legal and procedural requirements laid down under the Customs act, 1962 and allied laws including payment of the duties leviable, if any.

Import of food products is regulated under the Food Safety and Standards Act (FSSAI), 2006. Indian Customs can clear food products including Genetically Modified(GM) food products only after necessary approval/No Objection Certificate(NOC) by FSSAI. FSSAI has informed that no genetically modified food has been cleared for import through the FSSAI locations.

Statement-I is incorrect, but Statement-II is correct.

2023

Previous Year UPSC Environment Questions With Explanation 2023

There were 18 Questions from Environment in 2023, of which

- **5 Questions were related to Climate Change**
- **6 Questions were related to Environmental Ecology**
- **7 Questions were related to Bio-Diversity**

The examiner covered areas such as the Basics of Climate Change, Global Climate Issues,, Alternate and Sustainable Fuels, the Basics of the Environment, the basics of Biodiversity, Biodiversity in India, and Global Biodiversity..
The level of the questions was moderate.
Questions were aimed to test the basic and applied sections of Environment, Bio-Diversity and Climate Change.

1. Which one of the following is the best example of repeated falls in sea level, giving rise to present-day extensive marshland?
(a) Bhitarkanika Mangroves
(b) Marakkanam Salt Pans
(c) Naupada Swamp
(d) Rann of Kutch

1. Ans: d
Explanation:
Marshland

- A marsh is a type of wetland, an area of land where water covers ground for long periods of time. Unlike swamps, which are dominated by trees, marshes are usually treeless and dominated by grasses and other herbaceous plants.
- There are three types of marshes: tidal salt marshes, tidal freshwater marshes, and inland freshwater marshes.

Mangroves

- Mangroves are a group of trees and shrubs that live in the coastal intertidal zone. . There are about 80 different species of mangrove trees. All mangrove trees grow in areas with low-oxygen soil, where slow-moving waters allow fine sediments to accumulate. Mangroves are coastal swamps bordering major deltas of the country. Mangrove forests only grow at

tropical and subtropical latitudes near the equator because they cannot withstand freezing temperature

- The largest amount of mangrove coverage can be found in Indonesia.
- Odisha's Bhitarkanika National Park, th**e second-largest mangrove** forest in India after the Sundarbans, is known for a successful saltwater crocodile conservation programme.

Salt Pan

- **A salt pan** is formed when pools of seawater evaporate more quickly than they can be replenished by rainfall. During this evaporation process, the minerals and salt ions that were dissolved in the water are left behind, creating a mineral-rich landscape.
- Salt is often the most prevalent mineral in this region, forming a hard white crust on the surface as it accumulates over thousands of years..

- Natural salt pans are different from the man-made salt pans used in solar salt production
- Marakkanam is the ancient port town, located at about 120 km from Chennai. The Marakkanam salt pans are spread over an area of 4,000 acres and is one of the largest producers of salt in Tamil Nadu.
- Nationally, some 60,000 acres have been demarcated as salt pan lands, spread across Maharashtra, Andhra Pradesh, Tamil Nadu, Odisha, Gujarat, and Karnataka. Andhra Pradesh (20,716 acres) boasts the largest expanse of such land, followed by Tamil Nadu (17,095 acres) and Maharashtra (12,662 acres).
- **Naupada swamps** is in Andhra Pradesh. It is a complex of wetlands consisting of swamps, mud and salt meadows and creek. It is a transitional zone between terrestrial and marine ecosystems and many permanent shallow marine waters on the coastal lines.

Rann of Kutch

Rann comes from a Hindi word meaning desert, and the region is famous for its marshy salt flats which become snow white when the summer monsoon flood waters dry up. These inhospitable lowlands are resource-rich with minerals and natural gas deposits. **Rann of Kutch is the best example of repeated falls in sea level.**

Hence option d is correct.

2. Consider the following statements:

Statement-I: Marsupials are not naturally found in India.

Statement-II: Marsupials can thrive only in montane grasslands with no predators.

Which one of the following is correct in respect of the above statements?

(a) Both Statement-I and Statement-II are correct and Statement-II is the correct explanation for Statement-I

(b) Both Statement-I and Statement-II are correct and Statement-II is not the correct explanation for Statement-II

(c) Statement-I is correct but Statement-II is incorrect·

(d) Statement-II is incorrect but Statement-II is correct.

2. Ans: c

Explanation:

Marsupials are mammals whose young are born incompletely developed. They develop inside a pouch on the mother's belly. They give live birth, but they do not have long gestation times like placental mammals. Instead, they give birth very early and the young animal, essentially a helpless embryo. The forelimbs however are developed, and the toes are armed with sharp, curved claws. They use these claws to make the journey to the pouch.

Population:

Today, most marsupials are found in Central and South America (around 70 species) and Australasia (around 200 species).

Habitat: Most Australian marsupials **live in dry scrub or desert habitat.** In **South America, marsupials live in forests or tropical rainforests.** Marsupials can live in any part of the forest habitat, from the trees to the forest floor where, like the wombat, they burrow underground.

Hence, option c is correct.

3. Invasive Species Specialist (that develops Global Invasive Species Database) belongs to which one of the following organisations?

(a) The International Union for Conservation of Nature
(b) The United Nations Environment Programme
(c) The United Nations World Commission for Environment and Development
(d) The WorldWide Fund for Nature

3. Ans: a

Explanation:

Invasive Species Specialist Group (ISSG)

- The **Global Invasive Species Database** is managed **by the IUCN Species Survival Commissio**n I**nvasive Species Specialist Group (ISSG)** and the **Global Register of Introduced and Invasive Species is an ISSG led initiative**. The I**nvasive Species Specialist Group (ISSG) aims to reduce threats** to natural ecosystems and the native species. The ISSG p**romotes and facilitates the exchange of invasive species information and knowledg**e.
- The IUCN Red List of Threatened Species also holds information on the impacts of invasive alien species (IAS)

Hence, option a is correct.

4. Consider the following fauna:

1. Lion-tailed Macaque
2. Malabar Civet
3. Sambar Deer

How many of the above are generally nocturnal or most active after sunset?

(a) Only one
(b) Only two
(c) All three
(d) None

4. Ans: a

Explanation:

Nocturnal animals become more active at night to hunt, mate, or avoid heat and predators.
Nocturnal animals have evolved physical traits that let them to be active in the dark .

- The eyes get bigger and the pupils widen.
- Animals like owls and large cats have specialized hearing to hunt at night.
- Many nocturnal animals have a good sense of smell and often communicate with scent marking.

Sambar Deer

- Of the seven species of deer found in South Asia, the sambar is the largest.
- Only males have antlers, which in adults, have three tines on each side, and are shed annually.
- Males grow spike antlers in their second year, and their second set of antlers usually has small brow tines. Mature stags have six-tine antlers, and irregularities are rare.
- The sambar is distributed from the Philippine Islands in the east, through Indonesia, southern China, Indo-China, Thailand and Myanmar, to India in the west.
- It is distributed throughout India, except in the arid and desert regions of western India. The sambar has been introduced in several countries outside its geographical range.
- The sambar utilises areas with moderate-to-steep slopes. The sambar subsists on a wider variety of plants than any other ungulate in India and this si largely due to the varied habitats it uses.
- The diet can be broadly classified into browse (eating leaves) and grass.
- The basic social unit of the sambar is the maternal family group: adult female, calf and yearling.
- Sambar deer are more active during the night than day, nocturnal movement , this movement varies with seasons and is greater in spring, summer and autumn.
- ***Crepuscular activity was found to be high in all seasons.*** Maximum movement occur in the morning between 4 am to 8 am and in the evening between 6pm to 10pm.

Lion-tailed macaque

- Lion-tailed macaque is the the most primitive of all extant Asian macaques.
- The lion-tailed m macaque is considered direct descendant of Macaca paleoindica, the first macaque to reach Asia, nearly five million years ago.
- The lion-tailed macaque is endemic to the tropical rainforest (also called wet evergreen forest)of the Western Ghats in peninsular India.

- ***They are a diurnal and arboreal species, and active during day time.***
- The lion-tailed macaque feeds on fruits, seeds , nectar as well as on invertebrates and small vertebrates so largely it is omnivores.
- Like other macaques lion-tailed macaque live in social groups. Most of the groups in undisturbed forests have only one adult male, with 6 or 7 adult females and one subadult male, the remaining being immatures.

Malabar Civet

- ***It is considered mostly nocturnal.***
- It is one of the rarest and most elusive mammals in the world.
- In the **Western Ghats alone there are four species of civets**, namely the **common palm civet, brown palm civet, the small Indian civet and Malabar civet**.

Hence, option a is correct.

5. Which of the following organisms perform waggle dance for others of their kin to indicate the direction and the distance to a source of their food?

(a) Butterflies
(b) Dragonflies
(c) Honey Bees
(d) Wasps

5. Ans: c

Explanation:

Astonishingly, honeybees possess one of the most complicated examples of nonhuman communication.

Honey bees use a complex form of spatial referential communication. Their waggle dance communicates to nestmates the direction, distance, and quality of a resource by encoding celestial cues, retinal optic flow, and relative food value into motion and sound within the nest.

Hence, option c is correct.

6. Consider the following statements:

1. Some mushrooms have medicinal properties.
2. Some mushrooms have psychoactive properties.
3. Some mushrooms have insecticidal properties.
4. Some mushrooms have bioluminescent properties.

How many of the above statements are correct?

(a) Only one
(b) Only two
(c) Only three
(d) All four

6. Ans: d

Explanation:

About Mushroom:

Mushrooms are a lot like plants, but they lack chlorophyll and have to take nutrients from other materials. **Mushrooms are neither plants nor animals**.

They constitute their own kingdom: the Fungi. These include the familiar mushroom-forming species, as well as yeasts, molds, smuts, and rusts.

Mushrooms usually don't last very long. Once they've shed their spores, they collapse and deteriorate.

Oyster mushroom possesses medicinal properties and health-promoting effects.

Hence Statement 1 is correct.

An active compound known as **hericenones that's found in Lion's Mane** mushroom promote neuron projections, extending and connecting to other neurons. This means these components can st**imulate the growth and repair of nerve cells, also known as neurons**. They may protect against dementia, relieve mild depression, anxiety and speed up recovery from nervous system injuries. They could further treat and protect against neurodegenerative cognitive disorders such as Alzheimer's disease.

Hence Statement 2 is correct.

Cordyceps militaris has several beneficial effects and it is used for **multiple medicinal purposes.** It acts as an antitumor, antiproliferative, antimetastatic, i**nsecticidal, and antibacterial compound.**

Hence Statement 3 is correct.

The new species — named **Roridomyces phyllostachydis** — first sighted at night near a stream in Meghalaya's Mawlynnong in East Khasi Hills district. It is **one among the 97 known species of bioluminescent fungi** in the world. In the case of f**ungi, the luminescence comes from the enzyme, luciferase.**

Hence Statement 4 is correct.

7. Consider the following statements regarding the Indian squirrels:

1. They build nests by making burrows in the ground.
2. They store their food materials like nuts and seeds in the ground.
3. They are omnivorous.

How many of the above statements are correct?

(a) Only one
(b) Only two
(c) All three
(d) None

7. Ans: b

Explanation:

About Indian Squirrel:

- The squirrel family includes tree squirrels, ground squirrels, chipmunks, marmots (including woodchucks), flying squirrels, and prairie dogs amongst other rodents.
- Indian **squirrel is a very adaptable species.** It is **active during the day (diurnal animal) and semi-arboreal**.
- Indian p**alm squirrel is an omnivore.** Its diet is mostly based on the fruit and n**uts, but it also consumes eggs, small birds, larvae and insects.**
- Indian **squirrels build nests in the treetops using the grass and branches.**
- In deciduous forests **squirrels scatter-hoard seeds and nuts in shallow pits** just below leaf litter.
- In this process squirrels will store hundreds of nuts and fruits per individual, some may germinate in this process.Individual squirrels remember precise location of their stored nuts.

Only Statement 2 and 3 are correct and 1is incorrect.

8. Consider the following statements:

1. Some microorganisms can grow in environments with temperature above the boiling point of water.
2. Some microorganisms can grow in environments with temperature below the freezing point of water.
3. Some microorganisms can grow in a highly acidic environment with a pH below 3.

How many of the above statements are correct?

(a) Only one
(b) Only two
(c) All three
(d) None

8. Ans: c

Explanation:

Thermophilic microorganisms have the capacity to **grow at elevated temperatures** sometimes exceeding the boiling point of water. The record is presently held by a hyperthermophilic Archaea, close to *Pyrodictium occultum*, known as strain 121 that still grows at 121 °C.

Hence Statement 1 is correct.

The microorganisms live in every part of the biosphere, and some of them are even capable of growing at low temperatures, including those below the freezing point. Most of the microorganisms are well able to grow down to 0°-2°C.

Hence Statement 2 is correct.

Acidophiles are microorganisms that show optimal growth in highly acidic environments. These are of two types. The extreme acidophiles dwell in environments with a pH value <3, and moderate acidophiles grow optimally in conditions having pH values ranging between 3 and 5.
Hence Statement 3 is correct.

9. Which one of the following makes a tool with a stick to scrape insects from a hole in a tree or a log of wood?

(a) Fishing cat
(b) Orangutan
(c) Otter
(d) Sloth bear

9. Ans: b
Explanation:
About Orangutans:

- The name orangutan means **"man of the forest" in the Malay language.** In the lowland forests in which they reside, orangutans live solitary existences.
- They feast on wild fruits like lychees, mangosteens, and figs, and slurp water from holes in trees. They make nests in trees of vegetation to sleep at night and rest during the day.
- Orangutans have been observed in the wild **using simple tools like sticks to collect insects and leaves to shield them from the elements**. They are renowned for having the ability to use tools, a unique trait among non-human animals.
- Orangutans can make two separate sounds at the same time, just like songbirds and human beatboxers.
- There are **three species of orangutan - the Bornean, Sumatran and Tapanuli** - which differ a little in appearance and behavior. The Bornean and Sumatran species have shaggy reddish fur, Sumatran orangutans have longer facial hair.
- **All three orangutan species are considered critically endangered.**
- Orangutans are the world's largest tree-climbing mammals.
- Orangutans are known as gardeners of the forest. They play a vital role in seed dispersal and in maintaining the health of the forest ecosystem, which is important for people and a host of other animals, including tigers, Asian elephants and Sumatran rhinos.
- Orangutans are found only in the rain forests of the Southeast Asian islands of Borneo and Sumatra. They spend nearly their entire lives in trees—swinging in tree tops and building nests for sleep.
- Fruit makes up about 60% of the orangutan's diet, including lychees, mangosteens, mangoes, and figs. They also eat young leaves and shoots, insects, soil, tree bark, and occasionally eggs and small vertebrates

About Sloth Bear:

- India has **four species of bears : Asiatic Black, Sloth, Sun and Himalayan Brown Bear. Bear belong to the order of Carnivora.** They are **omnivorous animals** who have a varied diet ranging from meat to fruit and are also known to scavenge on dead animals.
- All Indian Bear species are listed under **Appendix I in CITES and Schedule I of the Wildlife (Protection) Act, 1972**. This provides complete protection to the species from hunting and trade.
- The **Asiatic Black Bear** is classed by the **IUCN as a vulnerable species**.
- The **Sun Bear** is mostly distributed in South-East Asia. In India it occurs in the North-eastern region, though it is not common. It is **the smallest of the eight bear species found across the globe.** IUCN lists the Sun Bear as Vulnerable.
- The **Sloth Bear is endemic to the Indian subcontinent and occurs in India, Nepal, Bhutan and Sri Lanka.** The Sloth Bear is unique among the bear species in being **adapted to 'myrmecophagy',** i.e to **eating ants and termites, which form a large proportion of its diet.** This bear species is killed for their gall bladder.
- **IUCN lists the Sloth Bear as Vulnerable.**
- Himalayan brown bear is **"critically endangered".**

About Fishing Cats:

- About twice the size of a typical house cat, the fishing cat is a feline with a powerful build and stocky legs. It is an adept swimmer and enters water frequently to prey on fish as its name suggests. It is known to even dive to catch fish.
- **Wetlands are the favorite habitats of the fishing cat**. In India, fis**hing cats are mainly found in the mangrove forests of the Sundarbans, on the foothills of the Himalayas along the Ganga and Brahmaputra river valleys and in the Western Ghat**s.
- The **fishing cat is nocturnal a**nd apart from fish also preys on frogs, crustaceans, snakes, birds, and scavenges on carcasses of larger animals.
- The **fishing cat is listed as Endangered on the IUCN Red List**, which means that it faces a high threat of extinction in the wild.
- The Convention on International Trade in Endangered Species (CITES) lists the fishing cat on Appendix II part of Article IV of CITES, which governs international trade in this species.
- In India, the **fishing cat is included in Schedule I of the Indian Wildlife (Protection) Act, 1972** and thereby protected from hunting.

About Otters:

- Otters are members of the **mammalian family called *Mustelidae***. They are **shy and have elusive habits,** adapting to a variety of habitats ranging from marine to freshwater environments.
- Otters are invariably associated **with water, with a few exceptions**.
- African clawless Otter found in Central Equatorial Africa, are l**east adapted aquatically**.
- O**tters are mainly active around dawn and dusk, being, what is known as, crepuscular.**

- Otters are found the world over, **except in Australia, New Zealand, Madagascar, and other oceanic islands.**
- **India is home to 3 of the 13 species of otters found worldwide.**
- These are - E**urasian Otter**; **Smooth-coated Otter and Small-clawed otter.** The **Small-clawed Otter (*Aonyx cinereus*) is the smallest**.
- Fish forms the primary food item, although their diet is supplemented with rodents, snakes, amphibians, small mammals, and even young fledgling birds.
- **Otters, as high-order carnivores at the top of their small niche eco-systems, metabolise poison slowly,** storing it in their fatty tissues until they need to draw on these energy reserves. There is no evidence that chemical poisons kill otters.
- Sea Otters often keep their favorite rock with them, using it to smash open the hard shell of a clam or mussel that pried out of the waters, and they'll do it all while still floating on their backs.
- In India, the nomadic hunting tribes such as Gilhara, Badiya and Jogis are known to regularly kill otters for their skin and flesh.

10. Consider the following:
1. Aerosols
2. Foam agents
3. Fire retardants
4. Lubricants

In the making of how many of the above are Hydrofluorocarbons used?
(a) Only one
(b) Only two
(c) Only three
(d) All four

10. Ans: c

Explanation:

Only in the making of the first three Hydrofluorocarbons (HFCs) are used.

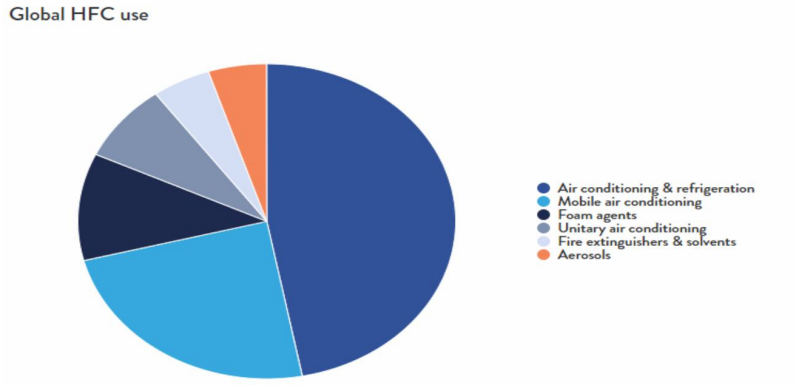
About Hydrofluorocarbons (HFCs)

These are a group of synthetic gases primarily used for cooling and refrigeration. Many HFCs are very powerful, short-lived climate pollutants with an average **atmospheric lifetime of 15 years.**

HFCs are **entirely human-made**. They are primarily produced for use in refrigeration, air-conditioning, insulating foams and aerosol propellants, with minor uses as solvents and for fire protection. ***(Hence1,2,3 are correct) .***

However, while HFCs have an ozone depletion potential of zero, they are potent greenhouse gases, and thus their manufacture and use became increasingly regulated in the 21st century.

As refrigerants, HFCs are used in a wide variety of cooling systems, from r**efrigerators and freezers** to automotive air-conditioning units. HFCs are also used as blowing agents in the production of polymer foams; as firefighting agents (having replaced halons); as solvents in cleaning products for plastics and metals and in plasma etching for semiconductor technology; and as propellants in metred-dose inhalers prescribed for the treatment of asthma.



Lubricating oils are composed of **80–90% petroleum hydrocarbon** distillate with 10–20% additives to impart specific properties to the oil. The petroleum hydrocarbon distillate generally consists of paraffinic or naphthenic compounds. **They do not involve use of HFCs in their making**. They are made from hydrocarbons.***(Hence 4 is wrong)***

About Hydrocarbons:

- Hydrocarbon is a class of **organic chemical compounds composed only of the elements carbon (C) and hydrogen (H)**.
- The carbon atoms join together to form the framework of the compound, and the hydrogen atoms attach to them in many different configurations.
- Hydrocarbons are the **principal constituents of petroleum and natural gas.**
- **They serve as fuels and lubricants** as well as raw materials for the production of plastics, fibres, rubbers, solvents, explosives, and industrial chemicals.

11. Consider the following statements:

Once the Central Government notifies an area as a 'Community Reserve'

1. The Chief Wildlife Warden of the State becomes the governing authority of such forest
2. Hunting is not allowed in such area
3. People of such area are allowed to collect non-timber forest produce
4. People of such area are allowed traditional agricultural practices

How many of the above statements are correct?

(a) Only one
(b) Only two
(c) Only three
(d) All four

11. Ans: b

Explanation:

As per section 36C of Wildlife Protection Act 1972 the State Government may declare any private or community land as community reserve where the community or an individual has volunteered to conserve wild life and its habitat for protecting fauna, flora, t**raditional conservation and cultural conservation values and practices.** Such land should not be comprised within a National Park, sanctuary or a conservation reserve.

Section 36Dof the WLP Act says that the State Government shall constitute a **Community Reserve management committee, which shall be the authority responsible for conserving, maintaining and managing the community reserve**.

- The **committee shall be the competent authority** to prepare and implement the management plan for the community reserve and to take steps to ensure the protection of wild life and its habitat in the reserve.
- The committee shall elect a Chairman who shall also be the **Honorary Wild Life Warden on the community reserve**.
- The committee shall regulate its own procedure including the quorum.

Hence Statement 1 is incorrect.

After a forest has been made into a community reserve, **people cannot hunt there, not they can use it for agricultural practices, leave alone jhum cultivation.**
Hence Statement 2 is correct and 4 is incorrect.

CR reserves allow for extraction of natural resources, the levels of which are governed by a multi-stakeholder Reserve Management Committee. Therefore, **people are allowed to collect non-timber forest produce.**
Hence Statement 3 is correct.

12. Consider the following statements regarding mercury pollution:
1. Gold mining activity is a source of mercury pollution in the world.
2. Coal-based thermal power plants cause mercury pollution.
3. There is no known safe level of exposure to mercury.

How many of the above statements are correct?
(a) Only one
(b) Only two
(c) All three
(d) None

12. Ans: b

Expalanation:

Mercury

Mercury is highly toxic to human health, posing a particular threat to the development of the child in utero and early in life. It occurs naturally and exists in various forms: elemental (or metallic); inorganic (for example, mercuric chloride); and organic (for example, methylmercury and ethylmercury). These forms all have different toxicities, with different implications for health and for measures to prevent exposure.

Elemental mercury is a liquid that vaporizes readily. It can stay for up to a year in the atmosphere, where it can be transported and deposited globally. It ultimately settles in the sediment of lakes, rivers or bays, where it is transformed into methylmercury, absorbed by phytoplankton, ingested by zooplankton and fish, and accumulates especially in long-lived predatory species, such as sharks and swordfish .

Mercury releases

• Natural: volcanic activity, weathering of rocks, water movements, biological processes.

• Human activities: mercury-added products; manufacturing processes in which mercury or mercury compounds are used; **artisanal and small-scale gold mining; coalfired power plants**; coal-fired industrial boilers; smelting and roasting processes used in the production of non-ferrous metals; waste incineration facilities; cement clinker production facilities.

• Remobilization of legacy sources: mercury in soil, sediment, water, landfill, waste

Hence Statement 1& 2 are correct.

WHO guidance values: provisional tolerable weekly intake

Joint FAO/WHO Expert Committee on Food Additives (JECFA) established a tolerable intake of µg/kg body weight per week for dietary exposure to methylmercury & inorganic mercury.

Hence Statement 3 is incorrect.

The Minamata Convention on Mercury, which entered in to force in 2017, implemented guidelines, which includes banning new mercury mines and phasing-out existing ones; regulating the use of mercury in artisanal and small-scale gold mining, certain industrial processes and the production of everyday items such as certain Compact fluorescent lamps, batteries and teeth fillings; as well as controlling the emissions of mercury as a by-product from a range of industrial sectors including coal burning.

13 .With reference to green hydrogen, consider the following statements:

1. It can be used directly as a fuel for internal combustion.
2. It can be blended with natural gas and used as fuel for heat or power generation.
3. It can be used in the hydrogen fuel cell to run vehicles.

How many of the above statements are correct?

(a) Only one
(b) Only two
(c) All three
(d) None

13.Ans: c

Expalantion:

Hydrogen-powered engines

There are two technologies: hydrogen Fuel Cell Electric Vehicles (FCEVs) and Hydrogen Internal Combustion Engines (H2ICE).

A hydrogen engine(HCE) is an engine that uses hydrogen (H2) as fuel and burns hydrogen in an internal combustion engine. It is a modified gasoline-powered engine but doesnot emit any carbon based product.

Since the earliest attempt at developing a hydrogen engine was reported by Reverend W. Cecil in 1820, hydrogen engines are not a recent invention. However adoption was passive due to high hydrogen costs and safet concerns with HCEs.

Hence Statement 1 is correct.

FCEVs generate electricity from hydrogen in a device known as a fuel cell that is used to power the electric motor. Therefore, fuel cell receive energy via electrochemical processes.

Hydrogen has a wide flammability range in comparison with all other fuels. As a result, hydrogen can be blended with a wide range of fuel-air mixtures. **H**ydrogen can be used in power plants as a fuel by either **blending it with natural gas or alone in specialised turbines, or it can be used in fuel cells, (which consume H_2 and O_2), to generate electricity (power), heat and using hydrogen in these sectors reduce their carbon emissions**.

Hence Statement 2 and 3 are correct.

14 . Consider the following statements:

Statement I: The soil in tropical rainforests is rich in nutrients.

Statement II: The high temperature and moisture of tropical rainforests cause dead organic matter in the soil to decompose quickly.

Which one of the following is correct in respect of the above statements?

(a) Both Statement I and Statement II are correct and Statement II is the correct explanation for Statement I
(b) Both Statement-I and Statement-II are correct and Statement-II is not the correct explanation for Statement-I
(c) Statement I is correct but Statement II is incorrect
(d) Statement I is incorrect but Statement II is correct

14. Ans: d

Explanation:

It is a misconception that tropical soils are rich in nutrients. Initially, soil in its untouched state contains a thick mantle of Humus, making the soil fairly fertile due to the heavy leaf fall and decomposition of leaves by bacteria. But once the humus is used and natural vegetative cover is removed, the torrential downpours in these tropical rainforests soon wash out most of the soil nutrients. Thus, **the soil deteriorates rapidly with subsequent soil erosion and soil impoverishment.**

Hence, statement 1 is incorrect.

Factors effecting decomposition

Organic matter decomposition is influenced by climatic conditions such as high temperature, sun exposure, soil moisture, aeration and soil type. Warm, humid climates have faster decomposition rates, while cool, dry climates have slower rates.

Temperature:

Decomposition rates increase with higher temperatures because microbial activity is generally more rapid in warmer conditions. Decomposing organisms are less active at colder temperatures, resulting in a low rate of decomposition. This is why food is kept in a fridge. As temperatures, increase, soil microorganisms become more active, leading to faster litter turnover and less organic matter accumulation.

Moisture:

Adequate moisture is necessary for microbial activity. Extremely dry or waterlogged conditions microorganisms' activity can reduce and decomposition can be hindered. Moisture is crucial in decomposition, as it aids microbial activity and the breakdown of organic matter. Microorganisms, like bacteria and fungi, require water for metabolic processes and to transport nutrients within decomposing materials. Dry conditions can hinder microbial activity, as microorganisms require specific water levels. Maintaining a balanced moisture level is essential for optimizing decomposition processes, ensuring efficient nutrient cycling and soil fertility.

Soil temperature and moisture content are crucial factors affecting decomposition rates. Warmer temperatures and high moisture levels result in higher rates of decomposition, faster litter turnover, and less organic matter accumulation

The high temperature and moisture of tropical rainforests cause dead organic matter in the soil to decompose more quickly than in other climates, thus releasing and losing its nutrients rapidly.

Hence, statement 2 is correct.

15. Consider the following activities:

1. Spreading finely ground basalt rock on farmlands extensively
2. Increasing the alkalinity of oceans by adding lime.
3. Capturing carbon dioxide released by various industries and pumping it into abandoned subterranean mines in the form of carbonated waters.

How many of the above activities are often considered and discussed for carbon capture and sequestration?

(a) Only one
(b) Only two
(c) All three
(d) None

15.Ans: c

Explanation:

Atmospheric enrichment of GreenHouse Gas can be moderated by either reducing anthropogenic emissions, or sequestering C in plant biomass or the soil or Oceans . Transfer of atmospheric CO2 into other pools with a longer Mean residence time (MRT), in such a manner that it is not re-emitted into the atmosphere in the near future, is called sequestration. Carbon dioxide is the most commonly produced greenhouse gas.

Depending on the processes and technological innovations, there are three main types of C sequestration : (i) those based on the natural process of photosynthesis and conversion of atmospheric CO2 into biomass, soil organic matter or humus and other components of the terrestrial biosphere; (ii) those involving engineering techniques; and (iii) those involving chemical transformations

Geologic carbon sequestration is the process of storing carbon dioxide (CO2) in underground geologic formations. The CO2 is usually pressurized until it becomes a liquid, and then it is injected into porous rock formations in geologic basins.

Biologic carbon sequestration refers to storage of atmospheric carbon in vegetation, soils, woody products, and aquatic environments.

Carbon sequestration techniques

Enhanced rock weathering (ERW)

Involves spreading finely crushed basalt, a natural volcanic rock, on fields to boost the soil's ability to extract CO2 from the air.

Crushed basalt is applied to farmland due to its benefits for soil fertility, soil biology, crop yield and health. This mineral-rich volcanic rock also removes carbon dioxide from the atmosphere through a process called enhanced rock weathering.

Enhanced rock weathering (ERW) is a nature-based method of Carbon Dioxide Removal (CDR) based on a geological process. In the planet's carbon cycle, this process takes hundreds of thousands of years but

Silicate rock or basalt rock, when crushed into a fine powder, and spread on agricultural land then the rock begins weathering straight away, speed up by the increased reactive surface area. The basalt reacts with carbon dioxide to form stable carbonates, effectively storing carbon.

Hence, statement 1 is correct.

Ocean Alkalinity Enhancement

Ocean alkalinization is an approach to carbon removal that involves adding alkaline substances with high pH to seawater to enhance the ocean's natural carbon sink. These substances could include

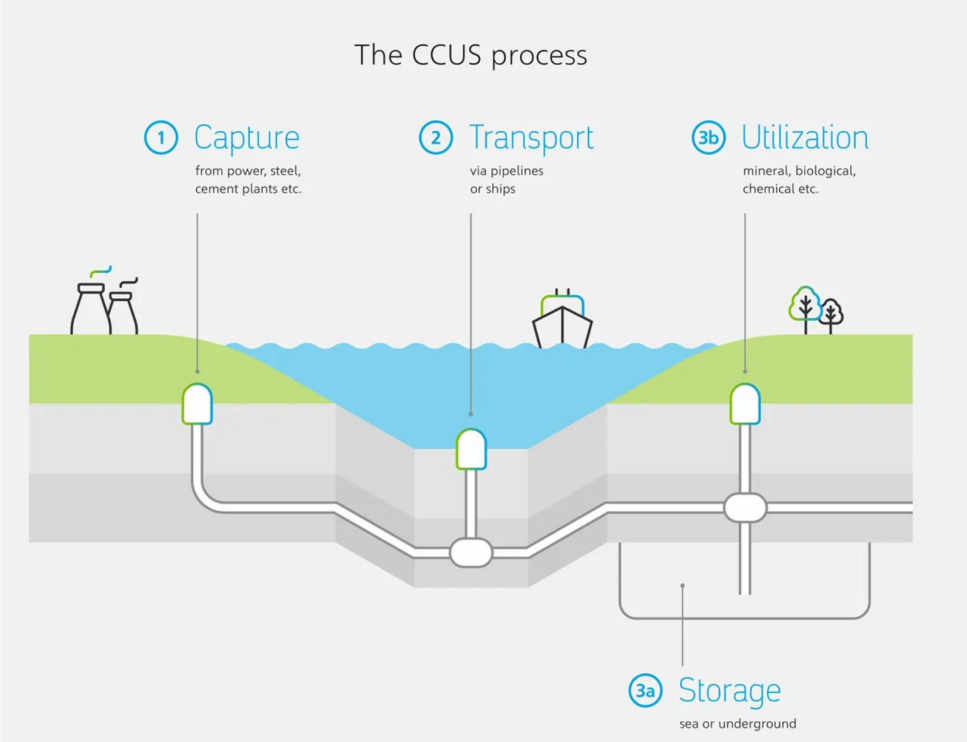
minerals, such as olivine, or artificial substances, such as lime or some industrial byproducts. Adding alkalinity to the ocean removes carbon dioxide (CO_2) from the atmosphere through a series of reactions that convert dissolved CO_2 into stable bicarbonate and carbonate molecules, which in turn causes the ocean to absorb more CO_2 from the air to restore equilibrium.

Hence, statement 2 is correct.

Carbon capture and storage (CCS)

Carbon dioxide emissions from industrial processes are captured and stored underground. Abandoned subterranean mines can serve as suitable storage sites, with the captured carbon dioxide pumped into these locations in the form of carbonated waters.

The process of capturing carbon dioxide (CO_2) and storing it can be condensed into three stages: capture, transportation, and underground injection. Once discharged into rock formations, the CO_2 is stored long-term.



Hence, statement 3 is correct.

Direct Air Capture

Direct air capture encompasses land-based processes that directly remove carbon dioxide from the air via filtration. Carbon dioxide is then transported to storage reservoirs in solid or liquid form, where it is durably stored for hundreds to thousands of years.

Microalgal cultivation

The large-scale farming of seaweed, also known as microalgal cultivation or aquaculture, draws down carbon dioxide from the atmosphere as part of the process of photosynthesis that occurs as the seaweed grows.

Ocean Fertilization

Ocean fertilisation is the addition of nutrients such as iron, nitrogen, and phosphorus to the surface of the ocean to stimulate the growth of phytoplankton that naturally absorb carbon dioxide during photosynthesis.

Coastal Blue Carbon

The process by which coastal blue carbon ecosystems (e.g. seagrass, mangroves, and salt marshes) sequester and store carbon. Coastal blue carbon ecosystems absorb carbon from the atmosphere via photosynthesis.

16. Consider the following statements:

Statement-I: According to the United Nations 'World Water Development Report, 2022', India extracts more than a quarter of the world's groundwater withdrawal each year.

Statement-II: India needs to extract more third quarter of the world's groundwater each year to satisfy the drinking water and sanitation needs of almost 18% of world's population living in its territory.

Which one of the following is correct in respect of the above statements?

(a) Both Statement-I and Statement-II are correct and Statement II is the correct explanation for Statement I

(b) Both Statement-I and Statement-II are correct and Statement-II is not the correct explanation for Statement-I

(c) Statement I is correct but Statement II is incorrect

(d) Statement I is incorrect but Statement II is correct

16. Ans: c

Explanation:

The distribution of water on the Earth's surface is extremely uneven. Only 3% of water on the surface is fresh; the remaining 97% resides in the ocean. Of freshwater, 69% resides in glaciers, 30% underground, and less than 1% is located in lakes, rivers, and swamps.

The United Nations released the 2022 edition of the UN World Water Development Report (WWDR), which focuses on groundwater, aiming to make "the invisible visible." According to the report, 99% of the Earth's running freshwater is groundwater. Among other things, ***the report highlights the overexploitation of this precious resource and why proper management is the need of the hour.***

Country comparison of groundwater-sourced irrigation

Countries with the largest area under irrigation include China (73 Mha), India (70 Mha), the USA (27 Mha) and Pakistan (20 Mha). The proportion of total groundwater abstraction used for irrigation varies significantly in these countries. India, as the largest groundwater user globally, at an estimated 251 km^3 per year abstracted, uses 89% of its groundwater abstraction for irrigation. China is relatively less reliant on groundwater, with an estimated 54% of total groundwater abstraction going into irrigation on average

The United Nations 'World Water Development Report, 2022', notes that India is the largest groundwater user globally with an estimated withdrawal of 251 km^3 per year through an estimated 20 million wells and tube wells. **This accounts for almost 26% of the groundwater extracted globally.** ***Hence, statement 1 is correct.***

About **89% of groundwater is used in India for irrigation. In India, 60% of the electricity** used in the water sector is for groundwater abstraction.

India's water crisis can be largely traced to the expansion of groundwater irrigation, a trajectory set on course by India's food and electricity policy since the late 1970s.

The food policy guaranteeing cheap food to consumers dictates the need to keep input prices low, including the level of electricity tariffs for pumping groundwater.

Reduced electricity tariffs or free electricity to agriculture, as exist in many Indian states, coupled with assured state or government procurement of crops, encourage farmers to grow water-intensive crops, such as sugarcane, including in semi-arid regions with low natural recharge. ***This is responsible for unprecedented groundwater depletion in large parts of India***

Groundwater overwithdrawal in India can be traced to a lack of coherence between water, energy and food policies. Hence, solutions to India's groundwater problems should be positioned within a broader water–energy– food nexus context.

Hence, statement 2 is incorrect.

17. Consider the following statements:

1. In India, the Biodiversity Management Committees are key to the realization of the objectives of the Nagoya Protocol.
2. The Biodiversity Management Committees have important functions in determining access and benefit sharing, including the power to levy collection fees on the access of biological resources within its jurisdiction.

Which of the statements given above is/are correct?

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

17. Ans: c

Explanation:

The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity is an international agreement which aims at sharing the benefits arising from the utilization of genetic resources in a fair and equitable way. It entered into force on 12 October 2014.

The primary responsibility of BMCs is the **preparation of peoples' biodiversity registers (PBRs)** containing comprehensive knowledge on the availability and knowledge of local biological resources, their medicinal, or any other use or associated traditional knowledge.

The BMCs also have important functions **in determining access and benefit-sharing (ABS), including the power to levy collection fees on the access of biological resources within its jurisdiction. BMCs are, thus, key to the realisation of the objectives of the Nagoya Protocol (2010),** negotiated within the CBD.

The enjoining parties have to take measures to ensure that benefits from the utilisation of genetic resources and associated traditional knowledge accrue to indigenous and local communities on mutually agreed terms.

Hence Statement 1 is correct.

Section 41 of Biological Diversity Act 2002- Constitution of Biodiversity Management Committee-

(1) Every local body shall constitute a Biodiversity Management Committee within its area for the purpose of promoting conservation, sustainable use and documentation of biological diversity including preservation of habitats, conservation of land races, folk varieties and cultivars, domesticated stocks and breeds of animals and microorganisms and chronicling of knowledge relating to biological diversity.

(2) The National Biodiversity Authority and the State Biodiversity Boards shall consult the Biodiversity Management Committees while taking any decision relating to the use of biological resources and knowledge associated with resources occurring within the territorial jurisdiction of the Biodiversity Management Committee.

(3) The Biodiversity Management Committe**es may levy charges by way of collection fees from any person for accessing** or co**llecting any biological resource for commercial purposes** from areas falling within its territorial jurisdiction.

Hence Statement 2 is correct.

18. Consider the following heavy industries:

1. Fertilizer plants
2. Oil refineries
3. Steel plants

Green hydrogen is expected to play a significant role in decarbonizing how many of the above industries?
(a) Only one
(b) Only two
(c) All three
(d) None

18. Ans: c
Explanation:
Green hydrogen for decarbonizing steel making
The steel industry contributes 7% of total CO2 emissions worldwide.
Hydrogen can be injected into blast furnaces, where steel is made, thus substituting **coke oven gas** for a clean fuel (green hydrogen). This technology has certain limitations such as the cooling effect of the hydrogen inside the blast furnace and is still being developed.

Green hydrogen for decarbonizing the chemical industry
The chemical industry, with 10% of global energy consumption and 7% of greenhouse gas effect emissions, encompasses many sectors in the modern economy. It represents all activities focused on obtaining and transforming materials and composites by applying chemical processes to them. Although the industry still largely depends on oil, hydrogen is now increasingly used in the manufacture of chemical and intermediate products. Real sustainable transformation will arrive when this hydrogen is completely green.

Green hydrogen for decarbonizing refineries
Refineries are used to convert crude oil into products that are useful to people. Responsible for 4% of world CO2 emissions, this sector produces the likes of petrol, diesel, asphalt, kerosene, liquid gas, oils and other fuels.
One of the main uses of green hydrogen in this sector is as a substitute for fuels and hydrogen of fossil origin in various processes currently performed in refineries and petrochemical plants.
Another promising application in this sector is the development of sustainable fuels for heavy transportation, as in the aviation and maritime transport sectors.
Hence all statements are correct.

2022

Previous Year UPSC Environment Questions With Explanation 2022

There were 19 Questions from Environment in 2022, of which

- **7 Questions were related to Climate Change**
- **9 Questions were related to Environmental Ecology**
- **3 Questions were related to Bio-Diversity**

The examiner covered areas such as the Basics of Environmental Ecology, Basics of Climate Change and Climate Change Organisations, RAMSAR sites, Biodiversity in India, and Acts.
The level of the questions was moderate.
Questions were aimed to test the basic and applied sections of Environment, Bio-Diversity and Climate Change.

1. Among the following crops, which one is the most important anthropogenic source of both methane and nitrous oxide?
(a) Cotton
(b) Rice
(c) Sugarcane
(d) Wheat

1. Ans: b
Explanation:
Rice (*Oryza sativa* L.) is the most widely consumed staple food crop globally, holding particular significance in Asia. The production of rice is crucial for the food safety and national security of certain countries.

However, rice cultivation is also a notable source of greenhouse gas emissions, primarily methane (CH4) and nitrous oxide (N2O). Annual CH4 emissions from rice fields are estimated to contribute approximately 5-19% of global CH4 emissions. Additionally, agricultural N2O emissions surged by nearly 17% between 1990 and 2005, now accounting for 60% of global anthropogenic N2O emissions.

The **flooded conditions created during rice cultivation promote anaerobic environments that favor the production of CH4 by methanogens.** This CH4 can then be oxidized by methanotrophs under aerobic conditions, such as in the rhizosphere and at the soil-water interface. Ultimately, CH4 is released into the atmosphere through soil or water-atmosphere interfaces and via the **rice plant's aerenchyma.**

Nitrogen fertilization and water management practices, such as **alternating wetting and drying, facilitate N2O emissions through nitrification and/or denitrification processes in rice paddies.** When applied correctly, fertilizer and management interventions can significantly help in controlling both CH4 and N2O emissions during rice cultivation.

Notably, different rice varieties exhibit considerable differences in total CH4 and N2O emissions. Thus, selecting rice varieties that yield lower CH4 and N2O emissions may serve as an effective strategy for mitigating greenhouse gas emissions from rice paddies.

Additional Information:

Other Methane emissions result from livestock and other agricultural practices, land use, and by the decay of organic waste in municipal solid waste landfills.

Other Nitrous oxide emissions include agricultural, land use, and industrial activities; combustion of fossil fuels and solid waste; as well as during treatment of wastewater.

Hence, option b is correct.

2. Consider the following pairs:

Wetland/Lake		**Location**
1. Hokera Wetland	:	Punjab
2. Renuka Wetland	:	Himachal Pradesh
3. Rudrasagar Lake	:	Tripura
4. Sasthamkotta	:	Tamil Nadu

How many pairs given above are correctly matched?

(a) Only one pair
(b) Only two pairs
(c) Only three pairs
(d) All four pairs

2. Ans: b

Explanation:

All the four wetlands are designated as Ramsar sites as wetland of international significance.

1. **Hokera Wetland: Jammu & Kashmir-**
    - It is located at the northwest Himalayan biogeographic province of Kashmir, back of **Pir Panchal.**
    - It is a **natural perennial wetland** contiguous to the Jhelum basin. It is the only site with remaining reedbeds of Kashmir.
    - It is pathway of 68 waterfowl species like endangered White-eyed Pochard, coming from Siberia, China, Central Asia, and Northern Europe. It is also an important source of food, spawning ground and nursery for fishes.
    - Typical marshy vegetation complexes inhabit this lake.

2. **Rudrasagar Lake: Tripura-**
    - Also known as Rudijala, it is a lowland sedimentation reservoir in the **northeast hill**s, **fed by three perennial streams (Noacherra, Durlavnaraya cherra, Kemtali cherra) discharging to the River Gomti** (not to be confused with River Gomati of Ganga Basin).
    - The lake is an ideal habitat for IUCN Redlisted **Three-striped Roof Turtle- Kachuga dhongka.**
    - Owing to high rainfall (2500mm) and downstream topography, the wetland is regularly flooded with 4-5 times annual peak, assisting in groundwater recharge.
3. **Sasthamkotta Lake: Kerala-**
    - It is the largest freshwater lake in Kerala.
    - It is spring-fed and the source of drinking water for half a million people in the Kollam district.
    - **The water contains no common salts or other minerals and supports no water plants**; **a larva called "cavaborus" abounds and eliminates bacteria in the water**, thus contributing to its exceptional purity.
4. **Renuka Wetland: Himachal Pradesh-**
    - It is a natural wetland **with freshwater springs and inland subterranean karst formations**.
    - Renuka is oblong shaped wetland flanked by two parallel steep hills running east-west. It is shaped like a sleeping women.
    - Renuka wetland is a perennial water body fed by 21 seasonal streams which are vigorous particularly during the monsoon season. Internal springs of the wetland are the perennial source of water.
    - The underground network of channels in the Limestone and Dolomite formations of the area are possibly conduit to discharge groundwater to the wetland.
    - The climate of the area is of sub-tropical monsoonic type. The average precipitation at Renuka wetland area is 150-199.
    - The soil composition of the region also show a heterogeneous mixture of carbonate rocks, sandstones, shales, siltstone in various proportion. The soil cover is thin due to weatheringl-limited conditions.
    - The wetland is covered with vegetation of sub-tropical forest comprises of Chhal, Sain, Bahera, Harar, Kachnar, Tun, Shisham and Amaltas etc. Natural Sal forest exists in the northern side of the wetland.

Hence, option b is correct.

3. "Climate Action Tracker" which monitors the emission reduction pledges of different countries is a:

(a) Database created by coalition of research organisations
(b) Wing of "International Panel of Climate Change"

(c) Committee under "United Nations Framework Convention on Climate Change"
(d) Agency promoted and financed by United Nations Environment Programme and World Bank

3. Ans: a

Explanation:

The Climate Action Tracker is an independent scientific project that tracks government climate action and **measures it against the globally agreed Paris Agreement's aim** of "holding warming well below 2°C, and pursuing efforts to limit warming to 1.5°C".

A collaboration of two organisations, **Climate Analytics and NewClimate Institute**, the CAT has been providing this independent analysis to policymakers since 2009.

Hence, option a is correct.

4. Consider the following statements:

1. The Climate Group is an international non-profit organisation that drives climate action by building large networks and runs them.
2. The International Energy Agency, in partnership with the Climate Group, launched a global initiative, "EP100".
3. EP100 brings together leading companies committed to driving innovation in energy efficiency and increasing competitiveness while delivering on emission reduction goals.
4. Some Indian companies are members of EP100.
5. The International Energy Agency is the Secretariat to the "Under2 Coalition".

Which of the statements given above are correct?

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

4. Ans: b

Explanation:

The Climate Group is an **international non-profit organisation founded in 2003**, with offices in London, New York, New Delhi, Amsterdam and Beijing. Its network includes over 500 multinational businesses in 175 markets worldwide and work closely with governments at all levels.

The Climate Group is Secretariat to the "Under2 Coalition", which is made up of 167 state and regional governments and has been named one of the international cooperative initiatives with the highest potential for emissions reductions.

Hence, statement 1 is correct & statement 5 is incorrect.

The Climate Group's global EP100 initiative is done in partnership with the **Alliance to Save Energy,** brings together a growing group of energy-smart companies committed to using energy more productively, to lower greenhouse gas emissions and accelerate a clean economy.

Hence, statement 2 is incorrect.

EP100 is a global corporate energy efficiency initiative, led by Climate Group, bringing together over 125 ambitious businesses committed to improving their energy efficiency.
EP100 members are committed to doubling their energy productivity, rolling out energy management systems, or achieving net zero carbon buildings.
Hence, statement 3 is correct.

Mahindra & Mahindra became the first Indian company to join a global energy campaign led by Climate Group.
Hence, statement 4 is correct.

5. "If rainforests and tropical forests are the lungs of the Earth, then surely wetlands function as its kidneys." Which one of the following functions of wetlands best reflects the above statement?
(a) The water cycle in wetlands involves surface runoff, subsoil percolation and evaporation.
(b) Algae form the nutrient base upon which fish, crustaceans, molluscs, birds, reptiles and mammals thrive.
(c) Wetlands play a vital role in maintaining sedimentation balance and soil stabilisation.
(d) Aquatic plants absorb heavy metals and excess nutrients.

5. Ans: d
Explanation:
According to Ramsar convention wetlands are defined as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres".
Significance of Wetlands:

- Wetlands are amongst the Earth's most productive ecosystems. These delicate environments have significant ecologic and economic values.
- Wetlands ecosystems are vital parts of hydrological cycle, highly productive, support rich biodiversity and provide a wide range of ecosystem services such as water storage, **water purification,** flood mitigation, storm buffers, erosion control, aquifer recharge, microclimate regulation, aesthetic enhancement of landscapes while simultaneously supporting many significant recreational, social and cultural activities.
- They have been described both as **"the kidneys of the landscape"**, because of the functions they perform in the **hydrological and chemical cycles, nutrient cycling, their high and long-term capacity to filter pollutants including heavy metals and trap sediments** from the water that flows through them.
- Wetlands store water to ensure supply during dry periods. **Wetlands work like giant sponges.** They store water and then slowly release it and this helps to deal with dry seasons with little rainfall.

- They are called "**biological supermarkets" because of the extensive food webs and rich biodiversity they support.**

Hence, option d is correct.

6. In the context of WHO Air Quality guidelines, consider the following:

1. The 24-hour mean of PM 2.5 should not exceed 15 ug/m^3 and annual mean of PM 2.5 should not exceed 5 µg/m^3.
2. In a year, the highest levels of ozone pollution occur during the periods of inclement weather.
3. PM-10 can penetrate the lung barrier and enter the bloodstream.
4. Excessive ozone in the air can trigger asthma.

Which of the statements given above are correct?

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

6. Ans: b

Explanation:

Table 0.1. Recommended AQG levels and interim targets

Pollutant	Averaging time	Interim target				AQG level
		1	2	3	4	
$PM_{2.5}$, µg/m^3	Annual	35	25	15	10	5
	24-hour[a]	75	50	37.5	25	15
PM_{10}, µg/m^3	Annual	70	50	30	20	15
	24-hour[a]	150	100	75	50	45
O_3, µg/m^3	Peak season[b]	100	70	–	–	60
	8-hour[a]	160	120	–	–	100
NO_2, µg/m^3	Annual	40	30	20	–	10
	24-hour[a]	120	50	–	–	25
SO_2, µg/m^3	24-hour[a]	125	50	–	–	40
CO, mg/m^3	24-hour[a]	7	–	–	–	4

Hence, statement 1 is correct.

In the stratosphere, ozone molecules play an essential role - absorbing ultraviolet radiation from the Sun and shielding Earth from dangerous rays. But in the troposphere, near ground level, ozone molecules are air pollutants.

A small amount of ozone does occur naturally at ground level. **Plants and soil release some**. Some migrates down from the stratosphere. Most of the ozone that is found near the ground **comes from vehicle exhaust and emissions** from factories, power plants, and refineries.

U**nlike most other air pollutants, ozone as apollutant is not directly emitted into the air. Tropospheric ozone is formed by the interaction of sunlight**, **particularly ultraviolet light, with hydrocarbons and nitrogen oxides**, which are emitted by automobile tailpipes and smokestacks. In urban areas, **high ozone levels usually occur during warm summer months**.

Typically, ozone levels reach their peak in mid to late afternoon, after exhaust fumes from morning rush hour have had time to react in sunlight. **A hot, sunny, still day is the perfect environment** for the production of ozone pollution. At the end of the day, as the Sun starts to set, the production of ozone begins to subside. To form, ozone needs sunshine to fuel the chemical reaction. Though ozone is present in **winter as well, the levels are lower owing to low temperatures, as it needs sharp sun to aid its formation.**

Good ozone, bad ozone

Scientists have divided the atmosphere into different layers, each with a name. The layer closest to the ground, where we live and fly in jets, is called the troposphere [TRO-po-sphere]. Above that layer is the stratosphere [STRAT-o-sphere], which goes to about 30 miles high.

Ultraviolet radiation from the Sun causes sunburns and skin cancer. Ozone high in the stratosphere shields us from much of this ultraviolet radiation.- *That's good.*

But at the top of the troposphere, ozone acts as a greenhouse gas and adds to global warming. That's bad.

In the middle region of the troposphere, ozone helps to clean the atmosphere of certain pollutants.- That's good.

But in the atmosphere close to Earth's surface where we live, ozone adds to smog and is hard on plants and animals, including us. That's bad.

Hence, statement 2 is incorrect.

Ozone pollution induces respiratory problems. When it’s inhaled, ozone can damage lung tissues. Ozone is harmful to all types of cells. It can im**pair an athlete's performance, create more frequent attacks for individuals with asthma,** cause eye irritation, chest pain, coughing, nausea, headaches and chest congestion. It can worsen heart disease, bronchitis, and emphysema.

Ozone also **damages materials like rubber, textile dyes, fibers, and certain paints**. These materials can be weakened or degraded by exposure to ozone. Some elastic materials can become brittle and crack, while paints and fabric dyes may fade more quickly.

Hence, statement 4 is correct.

Owing to its reactive nature, Ozone has 1-hour and 8-hour standards compared to particulate matter (PM) which has a 24-hour standard, because even a short-term exposure to the gas can worsen respiratory conditions. These standards are prescribed by the CPCB among one of the twelve (12) pollutants under National Ambient Air Quality Standard (NAAQS), 2009. The ambient air quality standards for Ozone (O3) is prescribed as 100 µg/m3 for 8-hourly monitored value and 180 µg/m3 for 1-hourly monitored value for industrial, residential, rural and ecological sensitive area. As per the NAAQS, the method of measurement of Ozone **(O3) in ambient air is UV photometric, Chemiluminescence, and Chemical method.**

Particulate matter:

PM stands for particulate matter (also called particle pollution): the term for a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, soot, or smoke, are large or dark enough to be seen with the naked eye. Others are so small they can only be detected using an electron microscope.

It has been found that PMs with an aerodynamic diameter smaller than 10 µm have a greater impact on human health. One group of PM identified, **PM2.5, have small diameters,** however large surface areas and may therefore be capable of carrying various toxic stuffs, passing through the filtration of nose hair, reaching the end of the respiratory tract with airflow and accumulate there by diffusion, **damaging other parts of the body through air exchange in the lungs and then entering in the blood stream**. PM2.5 causes asthma, respiratory inflammation, jeopardizes lung functions and even promotes cancers and impact on human respiratory system.

Hence, statement 3 is incorrect.

7. With reference to "Gucchi" sometimes mentioned in the news, consider the following statements:

1. It is a fungus.
2. It grows in some Himalayan forest areas.
3. It is commercially cultivated in the Himalayan foothills of north-eastern India.

Which of the statements given above is/are correct?

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

7. Ans: c

Explanation:

Gucchi is a fungus in the family Morchellaceae of the Ascomycota.

Hence, statement 1 is correct.

Gucchi are mushrooms found on the foothills of the Himalayas. One of the most sought- after edible mushrooms. It is rich in vitamins like riboflavin, fiber, nutrients, iron and phosphorus and is low in carbohydrates, calories, sodium, cholesterol and fat. It is the richest source of Vitamin D.

Apart from its flavour, guchhi also owes its high price to the challenges in cultivation. The mushrooms **cannot be cultivated commercially** as it grows only in wild, in conifer forests across temperate regions, and the foothills in **Himachal Pradesh, Uttarakand, and Jammu and Kashmir**. And it takes months for villagers to collect enough of these mushrooms, dry them and bring them to the market.

Hence, statement 2 is correct & statement 3 is incorrect.

8. With reference to polyethylene terephthalate, the use of which is so widespread in our daily lives, consider the following statements:

1. Its fibres can be blended with wool and cotton fibres to reinforce their properties.
2. Containers made of it can be used to store any alcoholic beverage.
3. Bottles made of it can be recycled into other products.
4. Articles made of it can be easily disposed of by incineration without causing greenhouse gas emissions.

Which of the statements given above are correct?

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

8. Ans: a

Explanation:

Polyethylene Terephthalate(PET) is the most common **thermoplastic polymer** resin of the polyester family. It is used in containers and plastics for liquids and foods. **PET is 100% recyclable, and hence preferred by manufacturers.**

Hence, statement 3 is correct.

PET is steadily **gaining market share as a garment fibre due to its reuse and recycling** and the significant surplus of post-consumer waste in the form of bottles and cans. **Fibres made from PET have outstanding wear resistance**, low moisture absorption and are very durable. Textile applications include blankets, bed sheets, comforters, carpets, cushioning in pillows, upholstery padding and upholstered furniture.

Hence, statement 1 is correct.

Maharashtra government had put a ban on packaging of alcohol in PET (polyethylene terephthalate) bottles because studies have shown that PET leachate leads to contamination of alcohol when stored in it. A toxic substance, antimony, increases when alcohol is stored in PET bottles.

Hence, statement 2 is incorrect.

Polyethylene, like other plastics, is not inert and is known to release additives and other degradation products into the environment throughout its lifetime. "**For example, the additive bisphenol-A** used in the manufacture of many plastic products is leaching as plastics age, and **hydrocarbon gases are produced during high-temperature decomposition (>202°C including incineration).**

Hence, statement 4 is incorrect.

9. Which of the following is not a bird?

(a) Golden Mahseer
(b) Indian Nightjar
(c) Spoonbill
(d) White Ibis

9. Ans: a

Explanation:

Golden Mahseer: It is a fish which typically lives in fast-moving, relatively cold waters, inhabiting hill streams although they've also successfully adapted to introduction in lakes and reservoirs. The golden mahseer is found in the **Himalayan foothills, the Indus, Ganga and Brahmaputra basins as well as in the south of India.** Most of India's golden mahseer are found in **Uttarakhand** state, where it is the official state fish.

Indian Nightjar: Nightjars are small, medium-sized birds with short toes, short beaks, and long feathers. They are nocturnal and live in heathland and young conifer plantations. It is active at night and has a jarring voice (hence, night+jar).

Cryptically-colored nightbird. It is found in a range of wooded habitats, from hilly dry forest to garden edges. Listen for its distinctive song, an accelerating knocking akin to a ping-pong ball dropping and bouncing rapidly on the floor.

Ibis, has about 26 species of medium-sized **wading birds (Wading birds are long-legged birds with long bills.** They have long legs to wade through shallow water without getting wet, and long toes to support them when standing in mud or sand).

They constitute the **family of Threskiornithidae, which also includes the spoonbills and ibises.** They **occur in all warm regions except on South Pacific islands.** They wade in shallow lagoons, lakes, bays, and marshes and use their slender, down-curved bills to feed on small fishes and soft mollusks. It **has a loud call and is noisy when breeding. It builds its nest most often on the top of a large tree or palm.**

Spoonbill: Spoonbill are most easily distinguished from Ibises through the shape of their bill which is long and flat and wider at the end. The eyes are positioned to provide spoonbills with binocular vision, although while foraging tactile senses are important. Nostrils are located near the base of the bill so that the bird can breathe while the bill is submerged in the water.

Hence, option a is correct.

10. Which of the following are nitrogen-fixing plants?1. Alfalfa
2. Amaranth
3. Chickpea
4. Clover
5. Purslane (Kulfa)
6. Spinach

Select the correct answer using the code given below:

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

10. Ans: a

Explanation:

Nitrogen fixation is a process that implies the transformation of the relatively non-reactive atmospheric N2 into its more reactive compounds (nitrates, nitrites, or ammonia).

The list of nitrogen-fixing plants for agriculture is quite versatile and includes:

1. **Beans**: fava (aka faba), alfalfa, green beans, runner beans, field beans, sweet beans, peanuts (aka groundnuts), soybeans, cream beans, black-eyed beans, or purple-hulled beans, lupins, lentils, cowpeas, chickpeas.
2. **Vetches**: hairy, American, wood, tufted.
3. **Clovers**: white, red, crimson, Silver River.

Hence, option a is correct.

11. "Biorock technology" is talked about in which one of the following situations?

(a) Restoration of damaged coral reefs

(b) Development of building materials using plant residues

(c) Identification of areas for exploration/extraction of shale gas

(d) Providing salt licks for wild animals in forests/protected areas

11. Ans: a

Explanation:

Biorock is the name given to the substance formed by **electro accumulation of minerals dissolved in seawater on steel structures** that are lowered onto the sea bed and are connected to a power source, in this case solar panels that float on the surface.

The technology works by passing a small amount of electrical current through electrodes in the water. When a positively charged anode and negatively charged cathode are placed on the seafloor, with an electric current flowing between them, calcium ions combine with carbonate ions and adhere to the structure (cathode). This results in calcium carbonate formation. Coral larvae adhere to the $CaCO_3$ and grow quickly.

The Zoological Survey of India (ZSI), with help from Gujarat's forest department, is attempting for the first time a process to restore coral reefs using **biorock or mineral accretion technology**.

Hence, option a is correct.

12. The "Miyawaki method" is well known for the:

(a) Promotion of commercial farming in arid and semi-arid areas

(b) Development of gardens using genetically modified flora

(c) Creation of mini forests in urban areas

(d) Harvesting wind energy on coastal areas and on sea surfaces

12. Ans: c

Explanation:

Miyawaki Method: Named after Japanese botanist Akira Miyawaki, this method involves planting two to four different types of indigenous trees within every square metre. In this method, the trees become self-sustaining and they grow to their full length within three years.

The methodology was developed in the 1970s, with the basic objective to densify green cover within a small parcel of land. Unlike commercial forestry, in Miyawaki Forestry, **only native varieties of plants are selected in specific ratios and sequences**, creating multilayer, maintenance-free forests, and **100 percent self-sustainable ecosystems.**

Miyawaki uses only local species. The forests blend with the local ecosystem, last longer, and can exist in **urban spaces**.

Hence, option c is correct.

13. Consider the following statements:

1. The India Sanitation Coalition is a platform to promote sustainable sanitation and is funded by the Government of India and the World Health Organisation.
2. The National Institute of Urban Affairs is an apex body of the Ministry of Housing and Urban Affairs in the Government of India and provides innovative solutions to address the challenges of Urban India.

Which of the statements given above is/are correct?

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

13. Ans: d

Explanation:

India Sanitation Coalition (ISC), launched in June 2015, at Federation of Indian Chamber Commerce and Industry (FICCI), enables and supports safe and sustainable sanitation by bringing multiple organisations on a common platform through a range of catalytic actions.

The ISC has NGOs, donors, corporates, foundations, trusts and government as partners, working together to create larger impact.

Hence, statement 1 is incorrect.

The National Institute of Urban Affairs (NIUA) is India's leading national think tank on urban planning and development. As a hub for generation and dissemination of cutting-edge research in the urban sector, **NIUA seeks to provide innovative solutions to address the challenges of a fast urbanising India**, and pave the way for more inclusive and sustainable cities of the future.

NIUA was established as a**n autonomous body in 1976** under the **aegis of the Ministry of Housing and Urban Affairs (MoHUA). Then the institute was registered as a society under the Societies Registration Act XXI of 1860.** Since then, it has worked closely with the Ministry of Housing and Urban Affairs, alongside other government and civil sectors, to identify key areas of research, and address the lacunae in urban policy and planning.

Hence, statement 2 is incorrect.

14. Which one of the following has been constituted under the Environment (Protection) Act, 1986?
(a) Central Water Commission
(b) Central Ground Water Board
(c) Central Ground Water Authority
(d) National Water Development Agency

14. Ans: c
Explanation:
Central Ground Water Authority (CGWA) has been constituted under Section 3 (3) of the Environment (Protection) Act, 1986 to regulate, control, development and management of groundwater resources in the country and to issue regulatory directions for the purpose.
Hence Option a is correct.

Central Water Commission is a premier Technical Organization of India in the field of Water Resources. It is presently functioning as an attached office of the Ministry of Jal Shakti, Department of Water Resources, River Development and Ganga Rejuvenation, Government of India.

Central Ground Water Board (CGWB) is a scientific department under Department of Water Resources, RD & GR, Ministry of Jal Shakti, Government of India. It is a multidisciplinary Scientific Organization with a mandate to "Develop and disseminate technologies for Scientific and Sustainable development and management of India's Ground Water Resources, including monitoring exploration, assessment and augmentation.

The National Water Development Agency (NWDA) was set up in July 1982 as Autonomous Society under the Societies Registration Act 1860. Its functions include:

- To carry out surveys and investigations related to Peninsular and Himalayan river system
- To explore the feasibility of intra-states links and preparation of Detailed Project Report (DPR) of river link proposals under National Perspective Plan (NPP)
- To implement various components of projects of PM Krishi Sinchayee Yojana.

Hence, option c is correct.

15. Which one of the following statements best describes the 'Polar Code'?
(a) It is the international code of safety for ships operating in polar waters.
(b) It is the agreement of the countries around the North Pole regarding the demarcation of their territories in the polar region.
(c) It is a set of norms to be followed by the countries whose scientists undertake research studies in the North Pole and South Pole.
(d) It is a trade and security agreement of the member countries of the Arctic Council.

15. Ans: a

Explanation:

International Maritime Organization's International Code for Ships Operating in Polar Waters **(Polar Code)** is mandatory under both the **International Convention for the Safety of Life at Sea (SOLAS)** and the **International Convention for the Prevention of Pollution from Ships (MARPOL)**.

The Polar Code covers the full range of design, construction, equipment, operational, training, search and rescue and environmental protection **matters relevant to ships** operating in the inhospitable waters surrounding the two poles.

The Polar Code entered into force on 1 January 2017.

The Polar Code includes **mandatory and recommendatory** measures covering **safety part** and **pollution prevention**. The Code will require ships intending to operating in the defined waters of the Antarctic and Arctic to apply for a Polar Ship Certificate. The issuance of a certificate would require an assessment, taking into account the anticipated range of operating conditions and hazards the ship may encounter in the polar waters.

Hence, option a is correct.

16. Which one of the following best describes the term "greenwashing"?

(a) Conveying a false impression that a company's products are eco-friendly and environmentally sound

(b) Non-inclusion of ecological/ environmental costs in the Annual Financial Statements of a country

(c) Ignoring the disastrous ecological consequences while infrastructure undertaking development

(d) Making mandatory provisions for environmental costs in a government project/programme

16. Ans: a

Explanation:

Greenwashing refers to misleading the general public into believing that companies, sovereigns or civic administrators are doing more for the environment than they actually are. This may involve making a product or policy seem more environmentally friendly or less damaging than it is in reality. The term was coined by environmentalist **Jay Westerveld in 1986**.

Greenwashing manifests itself in several ways – some more obvious than others. Tactics include:

1. Claiming to be on track to reduce emissions when no credible plan is in place.
2. Being vague or non-specific about a company's operations.
3. Misleading labels such as "green" or "eco-friendly," which do not have standard definitions.
4. Implying that a minor improvement has a major impact.
5. Emphasizing a single environmental attribute while ignoring other impacts.
6. Claiming to avoid illegal or non-standard practices that are irrelevant to a product.
7. Communicating the sustainability attributes of a product in isolation of activities, e.g. a garment made from recycled materials that is produced in a high-emitting factory.

According to draft guidelines by Department of Consumer Affairs, penalty will be issued for misleading advertisement for 'Greenwashing' (including usage of other terms like 'cruelty free', 'eco-conscious' etc) by company, which will be governed as per Consumer Protection Act, 2019. Similar guidelines were issued by Advertisements Standard Council of India.

Hence, option a is correct.

17. With reference to Indian laws about wildlife protection, consider the following statements :

1. Wild animals are the sole property of the government.
2. When a wild animal is declared protected, such animal is entitled for equal protection whether it is found in protected areas or outside.
3. Apprehension of a protected wild animal becoming a danger to human life is sufficient ground for its capture or killing.

Which of the statements given above is/are correct?

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

17. Ans: b

Explanation:

Section 11. **Hunting of wild animals to be permitted in certain cases.**

(a) The Chief Wild Life Warden may, if ***he is satisfied that*** any wild animal specified in Schedule I has become dangerous to human life or is so disabled or diseased as to be beyond recovery, by Order in writing and stating the reasons therefor, permit any person to hunt such animal or cause such animal to be hunted .

Here the satisfaction of Chief Wild Life Warden matters but not apprehension . Mere apprehension or fear that a wild animal could endanger human life is not a ground for capture or killing.

Hence, statement 3 is incorrect .

Section 39 - **Wild animals, etc.,** ***to be Government property.***

wild animal, other than vermin, which is hunted under section 11 , kept or bred in captivity or hunted shall be the property of the State Government, and, wheresuch animal is hunted in a sanctuary or National Park declared by the Central Government, shall be the property of the Central Government.

So wild animals can be the property of government if hunted or bred in captivity but not the property of the government/ private party when they are in wild .

Hence, statement 1 is incorrect .

The law governing the subject of wildlife, the Wildlife (Protection) Act, 1972, does not discriminate between animals found in protected areas and outside. It provides for equal protection for wild animals irrespective of where they are found.

Hence, statement 2 is correct .

18. Certain species of which one of the following organisms are well known as cultivators of fungi?
(a) Ant
(b) Cockroach
(c) Crab
(d) Spider

18. Ans: a
Explanation:
Ants belonging to a South American group had switched from a hunter-gatherer lifestyle to subsistence farming of fungi that grew on decomposing, woody plant matter some 55 to 60 million years ago, shortly after the dinosaurs died out.
There are leaf cutter ants who grow fungus on these leaves, and feed this fungus, and not the leaves to their larvae.
Some ants also use 'aphids', a type of insect to get milk like sugary liquid.
Other cultivators of fungi are termites, ambrosia beetles and marsh periwinkles.
Hence, option a is correct.

19. Consider the following:
1. Carbon monoxide
2. Nitrogen oxide
3. Ozone
4. Sulphur dioxide

Excess of which of the above in the environment is/are cause (s) of acid rain?
(a) 1, 2 and 3
(b) 2 and 4 only
(c) 4 only
(d) 1, 3 and 4

19. Ans: b
Explanation:
Acid rain results when **sulfur dioxide (SO2)** and **nitrogen oxides (NOX)** are emitted into the atmosphere and transported by wind and air currents. The SO2 and NOX react with **water, oxygen and other chemicals** to form **sulfuric and nitric acids**. These then mix with water and other materials before falling to the ground.
While a small portion of the SO2 and NOX that cause acid rain is from n**atural sources such as volcanoes**, most of it comes from the **burning of fossil fuels**. The major sources of SO2 and NOX in the atmosphere are:

- Burning of fossil fuels to generate electricity. Two thirds of SO2 and one fourth of NOX in the atmosphere come from electric power generators.
- Vehicles and heavy equipment.

- Manufacturing, oil refineries and other industries.

Hence carbon monoxide and ozone are not involved in the formation of acid rain.
Hence, option b is correct.

2021

Previous Year UPSC Environment Questions With Explanation 2021

There were 19 Questions from Environment in 2021, of which

- **8 Questions were related to Climate Change**
- **8 Questions were related to Environmental Ecology**
- **3 Questions were related to Bio-Diversity**

The examiner covered areas such as the Basics of Environmental Ecology, Basics of Climate Change and Climate declaration, Basics of Biodiversity
The level of the questions was moderate.
Questions were aimed to test the basicunderstanding of the subject.

1. Consider the following statements:
1. Right to the City is an agreed human right and the UN-Habitat monitors the commitments made by each country in this regard.
2. Right to the City' gives every occupant of the city the right to reclaim public spaces and public participation in the city.
3. 'Right to the City' means that the State cannot deny any public service or facility to the unauthorized colonies in the city.
Which of the statements given above is/are correct?
(a) 1 only
(b) 3 only
(c) 1 and 2
(d) 2 and 3

1. Ans: d
Explanation:
The right to the city is a new paradigm that provides an **alternative framework to re- think cities and human settlements on the basis of the principles of social justice, equity, democracy and sustainability.**
It is the **right of all inhabitants (present and future; permanent and temporary)** to **use, occupy, produce, govern and enjoy** just, inclusive, safe and sustainable cities, villages and settlements defined as common goods.
Right to the city is not an agreed human right.
Hence, statement 1 is incorrect.

It envisions the effective fulfillment of all internationally agreed Human Rights and Sustainable Development Goals, while dealing specifically with a dimension of urban problems that classic human rights' standards do not tackle: namely, spatial exclusion, its causes and consequences. **At the same time, it provides a territorial approach that can enhance policy pertinence and coherence.**

In this regard, it claims for (i) the social function of the city; (ii) **quality public spaces;** (iii) sustainable and inclusive rural-urban linkages; (iv) inclusive economies; (v)**inclusive citizenship**; (vi) **enhanced political participation;** (vii) **non-discrimination;** (viii) gender equality; and (ix) cultural diversity.
Hence, statements 2 and 3 are correct.

2. Which one of the following is used in preparing a natural mosquito repellent?
(a) Congress grass
(b) Elephant grass
(c) Lemongrass
(d) Nut grass

2. Ans: c
Explanation:
Natural barrier against mosquitoes:

- Lavender
- Marigold (or Calendula Officinalis)
- Lemongrass (Cymbopogon citratus)
- Aromatic herbs such as mint, basil, rosemary, savory, lemon balm
- Pelargonium and geranium
- as well as eucalyptus, catmint, petunia, nasturtium, etc.

About Lemongrass-

- Lemongrass commonly known as "East Indian Lemongrass" is a perennial and multicut aromatic grass. It is the source of Lemongrass oil, a good source of natural citral, which is used s a basic raw material for synthesis of a number of useful aromatic compounds and Vitamin- A. It is a main ingredient in soaps, deodorants and cosmetics. Its use as a bio-pesticide has not yet been fully tapped.
- Lemongrass oil is used in aromatherapy to reduce stress, anxiety and depression.
- Lemongrass leaves are the most commonly found plants in India. **The lemongrass oil helps to get rid of mosquitoes.** In addition to this, it is also used as cat, dog and even elephant repellant.
- It is widely distributed worldwide and most especially in tropical and subtropical countries. It flourishes in a wide variety of soils ranging from rich loams to poor laterite.The lemongrass cultivation has prevented soil erosion on hilly slopes.
- From being one of the largest importers of lemongrass till just a years back India became the **largest exporter of it now**.

Hence, option c is correct.

3. Consider the following kinds of organisms:
1. Copepods
2. Cyanobacteria
3. Diatoms
4. Foraminifera

Which of the above are primary producers in the food chains of oceans?
a) 1 and 2
b) 2 and 3
c) 3 and 4
d) 1 and 4

3. Ans: b

Explanation:

The marine biome is the largest worldwide, covering three-quarters of the Earth's surface. About 15% of all the species living on Earth, containing almost 300,000 species, are marine dwellers. The marine ecosystem consists of a series of interconnected producers and consumers.

Copepods

Copepods feed on microscopic algae and in turn serve as food for millions of other invertebrates and fish. The Copepoda are an incredibly numerous group of crustaceans. There are approximately 9000 species with an average size range of 0.5 to 15 mm. The largest copepods are parasitic ones that can reach as much as 25 cm in length.
There are currently 10 groups of copepods. Most members of seven of those groups are parasites on other invertebrates or fish.

Cyanobacteria: Cyanobacteria are aquatic and photosynthetic, that is, they live in the water, and can manufacture their own food. Because they are bacteria, they are quite small and usually unicellular, though they often grow in colonies large enough to see. They have the distinction of being the oldest known fossils, more than 3.5 billion years old.

They are also important providers of nitrogen fertilizer in the cultivation of rice and beans.
The cyanobacteria have also been tremendously important in shaping the course of evolution and ecological change throughout earth's history. The oxygen atmosphere that we depend on was generated by numerous cyanobacteria during the Archaean and Proterozoic Eras. Before that time, the atmosphere had a very different chemistry, unsuitable for life as we know it today.
The other great contribution of the cyanobacteria is the origin of plants. The chloroplast with which plants make food for themselves is actually a cyanobacterium living within the plant's cells.
Sometime in the late Proterozoic, or in the early Cambrian, cyanobacteria began to take up residence within certain eukaryote cells, making food for the eukaryote host in return for a home. This event is known as endosymbiosis, and is also the origin of the eukaryotic mitochondrion.
Because they are photosynthetic and aquatic, cyanobacteria are often called "blue-green algae". This name is convenient for talking about organisms in the water that make their own food, but does not reflect any relationship between the cyanobacteria and other organisms called algae. Cyanobacteria are relatives of the bacteria, not eukaryotes, and it is only the chloroplast in eukaryotic algae to which the cyanobacteria are related.

Diatoms are abundant in both freshwater and marine ecosystems; it is estimated that 20% to 25% of all organic carbon fixation on the planet (transformation of carbon dioxide and water into sugars, using light energy) is carried out by diatoms.
This is possible because they contain chlorophyll. Diatoms are thus a major food resource for marine and freshwater microorganisms and animal larvae, and are a major source of atmospheric oxygen. Diatoms are a major component of plankton, free-floating microorganisms of marine or freshwater environments. Not all diatoms float freely though; many cling to surfaces such as aquatic plants, molluscs, crustaceans, and even turtles. Whales may carry dense growths of diatoms on their skin. Some may even be found in soils or on moist mosses.

Foraminifera
Foraminifera are single-celled organisms (protists) with shells or tests (a technical term for internal shells). They are abundant as fossils for the last 540 million years. The shells are commonly divided into chambers that are added during growth.
Depending on the species, the shell may be made of organic compounds, sand grains or other particles cemented together, or crystalline $CaCO_3$ (calcite or aragonite).
Fully grown individuals range in size from about 100 micrometers to almost 20 centimeters long.
Some have a symbiotic relationship with algae, which they "farm" inside their shells. Other species eat foods ranging from dissolved organic molecules, bacteria, diatoms and other single-celled algae, to small animals such as copepods. They catch their food with a network of thin pseudopodia (called reticulopodia) that extend from one or more apertures in the shell. Benthic (bottom-dwelling) foraminifera also use their pseudopodia for locomotion.
Hence, option b is correct.

4. In nature, which of the following is/are most likely to be found surviving on a surface without soil?
1. Fern
2. Lichen
3. Moss
4. Mushroom

Select the correct answer using the code given below.
(a) 1 and 4 Only
(b) 2 Only
(c) 2 and 3
(d) 1, 3 and 4

4. Ans: c
Explanation:
Algae, lichens, liverworts, and moss are often in nature found growing in damp or shady places in the garden on plants, soil and hard surfaces, they even can grow without soil.

Lichens:
Lichens are a complex life form that is a symbiotic partnership of two separate organisms, a fungus and an alga. The dominant partner is the fungus, which gives the lichen the majority of its characteristics, from its thallus shape to its fruiting bodies. The alga can be either a green alga or a blue-green alga, otherwise known as cyanobacteria. Many lichens will have both types of algae.

What are fungi?

- Fungi are a diverse group of organisms that are in their own kingdom (Fungi), separate from plants. Fungi do not contain chlorophyll or any other means of producing their own food so they rely on other organisms for nutrition. Fungi are widely known for their role in the decomposition of organic matter. They are also necessary for the survival of the ecosystem around them, such as partnering with plants and trees for nutrients and survival.
- other kingdom (Protista) separate from plants and fungi. There are several types of algae: green, brown, red, gold. They can survive in salt water and in freshwater on their own, and in any environment when part of a lichen relationship.
- Although cyanobacteria are called blue-green algae, they are actually bacteria, and are part of the bacteria kingdom, Monera. The "blue" in the common name refers to the fact that they need to live in water, and "green algae" refers to their photosynthetic abilities, like green algae.

Lichens, do not have any roots, stems or leaves and their chloroplasts are contained only in the algae on the top surface of the lichen.
Important function of lichens is that they provide a mode of survival in harsh environments, lichens directly benefit humans is through their ability to absorb everything in their atmosphere, especially pollutants. Lichens can provide us with valuable information about the environment around us. Any heavy metals or carbon or sulfur or other pollutants in the atmosphere are absorbed into the lichen thallus.
Lichens can be seen hanging off of trees or clinging to rocks.

Mosses:

- **Mosses are very primitive,** the ancestors of the trees , **they have plant-like structures that look like and function like leaves, stems and roots. They have chloroplasts throughout their entire bodies and can photosynthesize from all sides of their structures.**
-
- Mosses along with lichens are the first organisms to colonise rocks and hence, are of great ecological importance. They decompose rocks making the substrate suitable for the growth of higher plants

Ferns

- Ferns are plants that do not have flowers. Ferns generally reproduce by producing spores. Similar to flowering plants, ferns have roots, stems and leaves.
- However, unlike flowering plants, ferns do not have flowers or seeds; instead, they usually reproduce sexually by tiny spores or sometimes can reproduce vegetatively
- **The ferns are an ancient lineage of plants, dating back to at least the Devonian. They include three living groups -- Marattiales, Ophioglossales, and leptosporangiate ferns -- as well as a couple of extinct groups.**
- **Ferns are plants that do not have flowers. Ferns generally reproduce by producing spores. Similar to flowering plants, ferns have roots, stems and leaves. However, unlike flowering plants, ferns do not have flowers or seeds; instead, they usually reproduce sexually by tiny spores or sometimes can reproduce vegetatively.**

Mushrooms

- **Mushrooms are the reproductive structures (fruiting bodies) of organisms that otherwise live as** microscopic threads of cells in various substrates such as soil, wood, or living tissues of associated plants.
- **The threadlike cells (hyphae) in mass are referred to as the mycelium.** Fruiting bodies are produced from the mycelium to carry out sexual reproduction-the formation and release of spores.
- Spores allow fungi to disperse and survive until conditions are right for germination and establishing a new colony.
- Fungi generally are classified as pathogens, saprobes, and mutualists .
- Pathogens attack and often kill living tissues and may kill the host organism .
- A true saprobe lives only on dead organic matter such as heartwood of standing trees, woody debris, or fallen leaves .
- saprobes decompose the organic layers of the forest floor: stems, branches, and leaves.
- . The genera Aleuria, Clitocybe, Collybia, Marasmius, Morchella, Mycena, Naemataloma, Phoiiota, and Scutellinia represent some of the variety of saprobes
- Fungi interact with many soil organisms, including bacteria, other fungi, nematodes, microarthropods, and insects. They serve as prey to and predators of organisms in these group .
- A large portion of the total forest ecosystem biomass resides in the living fungi, which rapidly die and recycle their nutrients to the soil . This great fungal component not only recycles nutrients but also captures significant amounts of forest nutrients, which reduces leaching loss from the system.
- Mutuatlism
- Third major group of fungi, the mutuatists, live in intimate association with plants and interact in various ways that, in this instance, benefit both partners, hence, mutuatistic symbiosis. Among fungi, the predominant mutualistic symbiosis in forests takes place with plant roots producing structures called mycorrhizae.
- **Mycorrhiza literally translates as "fungus-root"**
- The mycorrhizal fungus basically serves as an extension of the plant root system, exploring soil far beyond the reach of the roots and transporting water and nutrients to the roots. The uptake of phosphorus and nitrogen are especially critical functions of mycorrhizal fungi, which can release bound forms of these nutrients otherwise unavailable to the roots. In return, the plant is the primary energy source for the fungus, providing simple sugars and vitamins produced in photosynthesis and transported to the roots and then the fungus.
- Mycorrhizal fungi are less capable of decomposing complex carbon molecules from organic debris than are saprobes. This dependency of fungi on their hosts for growth and survival is critical to mushroom production by mycorrhizal fungi.

Hence, option c is correct.

5. Consider the following statements:

Statement 1: The United Nations Capital Development Fund (UNCDF) and the Arbor Day Foundation have recently recognized Hyderabad as 2020 Tree City of the World.

Statement 2: Hyderabad was selected for the recognition for a year following its commitment to grow and maintain the urban forests.

Which one of the following is correct in respect of the above statements?

a) Both Statement 1 and Statement 2 are correct and Statement 2 is the correct explanation of Statement 1
b)Both Statement 1 and Statement 2 are correct and Statement 2 is not the correct explanation of Statement 1
c) Statement 1 is correct but Statement 2 is not correct
d) Statement 1 is not correct but Statement 2 is correct

5. Ans: d
Explanation:
The Tree Cities of the World programme is an international effort to recognise cities and towns committed to ensuring that their urban forests and trees are properly maintained, sustainably managed, and duly celebrated.
The F**ood and Agriculture Organization of the United Nations and the Arbor Day Foundation have developed this programm**e to celebrate greener cities and towns worldwide.

Hyderabad has become the only city in India to be recognised as a 'Tree City of the World' by the Arbor Day Foundation and the Food and Agriculture Organization (FAO) of the United Nations not the United Nations Capital Development Fund (UNCDF).
***Hence, statement 1 is incorrect* & statement 2 is correct**.

6. 'R2 Code of Practices' constitutes a tool available for promoting the adoption of
(a) environmentally responsible practices in electronics recycling industry
(b) ecological management of 'wetlands of International Importance' under the Ramsar Convention
(c) sustainable practices in the cultivation of agricultural crops in degraded lands
(d) 'Environmental Impact Assessment' in the exploitation of natural resources

6. Ans: a
Explanation:
"Responsible Recycling practices for Use in Accredited Certifications Programs" (R2) Practices: To Recognize the need for comprehensive best-practices to address the **operational and environmental challenges in electronics recycling and repair**,

In **2008, the R2 Practices were released and repair and recycling facilities began to get certified**.
The original R2 Practices went through its first major revision in 2013 and released a second upgrade, R2v3, in 2020.
Sustainable Electronics Recycling International (SERI) was established as a non-profit organization in 2014 to succeed R2 Solutions with a mission that extends beyond the R2 Standard.
Hence, option a is correct.

7. Why is there a concern about copper smelting plants?
1. They may release lethal quantities of carbon monoxide into environment.
2. The copper slag can cause the leaching of some heavy metals into environment.
3. They may release sulphur dioxide as a pollutant.
Select the correct answer using the codes given below.
(a) 1 and 2 Only
(b) 2 and 3 Only
(c) 1 and 3 Only

(d) 1, 2 and 3

7. Ans: b

Explanation:

Copper Smelting:

During the extraction of the copper from the cuprous oxide, it can be easily reduced from the oxides of copper ore to directly metal by heating with coke. The reducing agent in this process could be carbon, carbon monoxide and carbon dioxide as well. Therefore, the carbon monoxide produced by heating copper ore with oxygen again as a reducing agent. Hence the **CO2 and CO emission from copper industries are bare minimum** when compared to other metal production as per MoEF document on greenhouse gas emission inventory.

Hence, statement 1 is incorrect.

Copper smelting causes air, water and land pollution. **The process releases sulphur dioxide gas, a known pollutant that causes respiratory ailments.**

The smelting process also **releases radon, iron, manganese, lead, arsenic, nitrates and fluorides, which reach the water sources and the soil through the industrial slag.**

Hence, statements 2 and 3 are correct.

8. With reference to furnace oil, consider the following statements:

1. It is a product of oil refineries.
2. Some industries use it to generate power.
3. Its use causes sulphur emissions into the Environment.

Which of the statements given above are correct?

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

8. Ans: d

Explanation:

Furnace oil is also called fuel oil, heavy oil (because it is heavier than petrol or naptha), marine fuel, bunker oil, or gas oil. The furnace fuel primarily consists of **residues from crude oil distillation**. Furnace oil is **obtained from the flammable liquids acquired from crude oil** and is also named kerosene.

Furnace Oil is one of the cheapest fuels available for industrial use. It is a by-product of petroleum refineries. While processing the Crude Oil, FO (Furnace Oil) is one of the products along with other petroleum fuels like High Speed Diesel, Petrol etc.

Hence, statement 1 is correct.

Uses of Furnace Oil are :

- As **fuel for Power Generation** in DG Sets
- As **fuel** for Boilers/ Furnaces/ Air preheater/ Any other Heaters
- **Fuel** for Bunkering
- **Fuel/ Feedstock** in Fertilizer Plants

Hence, statement 2 is correct.

Burning of Furnace oil produces sulphur dioxide (SO2), methane, carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) emissions.
Hence, statement 3 is correct.

9. What is blue carbon?
a) Carbon captured by oceans and coastal ecosystems
b) Carbon sequestered in forest biomass and agricultural soils
c) Carbon contained in petroleum and natural gas.
d) Carbon present in atmosphere

9. Ans: a
Explanation:
Blue carbon is the carbon stored in coastal and marine ecosystems. Coastal ecosystems including **mangroves, tidal marshes and seagrass meadows** sequester and store more carbon per unit area than terrestrial forests and are now being recognised for their role in mitigating climate change.
Hence, option a is correct.

10. Consider the following animals:
1. Hedgehog
2. Marmot
3. Pangolin
To reduce the chance of being captured by predators, which of the above organisms rolls up/roll up and protects/ protect its/their vulnerable parts?
(a) 1 and 2
(b) 2 only
(c) 3 only
(d)1 and 3

10. Ans: d
Explanation:
Reason for rolling up by organisms:

- For some animals, the first and only way to defend themselves is to hide. Rolling into a ball-like shape presents the harder and sometimes more dangerous part of their body to their predator to protect their vulnerable part.
- Hedgehogs while coming back down on surfaces curl inward and drop down, the fall is cushioned by their exterior.
- Certain animals are unable to migrate as the season change. This puts them at risk of harsh elements during the colder and drier months. To preserve themselves, they curl into a ball shape to wait the weather out.

The armadillo, pangolin, hedgehog, chiton, Armadillo Girdled Lizard, Golden Wheel Spider, and Isopods are common animals that **roll into a ball**. However, that list extends longer to include **some unlikely creatures like spiders and aquatic animals.**

Hedgehogs

- In hedgehog, the ear pinna is large, zygomatic arc is present and robust, occiput is flat or concave. The bullae are incomplete, tympanic bones form an annulus, the first and second molars are quadrate and low cusped. The testes are ventral but non-scrotal. The dorsum of the hedgehog is covered with stout spines, the venture is furred, and the tail is very reduced.
- Indian long-eared hedgehog is an endemic species in the region distributed in the arid zones of northwest India (east to Agra, north to Jammu, south as far as Pune) and Pakistan (west to Indus).
- Indian Hedgehog and Madras Hedgehog are species endemic to South Asian and distributed in the arid zone of Pakistan and northwest India from the Indus river to the east in Agra, and south to Kathiwar peninsula and even recorded from the south Indian states of Tamil Nadu and Kerala.

Marmots

- Marmots are relatively **large ground squirrels**.Two species of marmots (comprising 15 species worldwide) occur in South Asia, in the alpine and cold desert regions of higher Himalaya and Trans-Himalaya in India, Nepal and Pakistan.
- They are burrowing squirrels that live in holes in the ground. They are stout with a squat build, a short to moderate-sized bushy tail, and small ears. Unlike of the solitary territorial tree squirrels, they live in large colonies and are social animals. They live in burrows that have several entrances, excavated in well drained soil.
- They have a long hibernation period, sleeping upto nine months in a year, though may emerge briefly during spells of mild weather. They typically emerge in spring.
- Their food includes roots, leaves, grasses, herbs, forbs and sedges. Their anti-predatory behavious is well-documented, they utter a whistling scream to warn other individuals of the colony, and run into their shelter.

Pangolins

- The pangolins are scaly anteaters survive as a single family and are distributed in the Old World Tropic.
- Pangolins aree myrmecophagus, specialised for feeding on ants and termites. The long claws and powerful limb muscles allow them to dig into termite mounds and also to construct burrows. The teeth are absent and tongue is extremely long .
- **When attacked pangolins roll into a ball and make their scales erect.** Yet another method of defence employed is the erection of well-directed jets of an ill-smelling liquid from the naal region.
- Most species are terrestrial and nocturnal, while retaining the ability to climb trees. It may use tree cavities as well as burrows to nest. Normally quadrupedal, pangolins when running assume a bipedal gait with the tail acting as a counterbalance.
- They are considered as **habitat engineers as they dig soil to live** and feed helping soil aeration and mineral fixation. The abandoned burrows act as shelter for many fossorial animals.

Hence, option d is correct.

11. With reference to the 'New York Declaration on Forests'. Which of the following statements are correct?
1. It was first endorsed at the United Nations Climate Summit in 2014.
2. It endorses a global timeline to end the loss of forests.
3. It is a legally binding international declaration.
4. It is endorsed by governments, big companies, and indigenous communities.
5. India was one of the signatories at its inception.
Select the Correct answer using the code given below.
(a) 1, 2 and 4
(b) 1, 3 and 5
(c) 3 and 4
(d) 2 and 5

11. Ans: a
Explanation:
The New York Declaration on Forests (NYDF) is a political declaration calling for global action to protect and restore forests. NYDF was first endorsed at the United Nations Climate Summit in September 2014.
Hence, statement 1 is correct.

New York Declaration on Forests (NYDF) emphasises on ten goals which includ include halting natural forest loss by 2030, restoring 350 million hectares of degraded landscapes and forestlands, improving governance, increasing forest finance, and reducing emissions from deforestation and forest degradation as part of a post-2020 global climate agreement.
Hence, statement 2 is correct.

The New York Declaration on Forests (NYDF) **is a voluntary and non-binding international declarati**on to take action to halt global deforestation.
Hence, statement 3 is incorrect.

It has presently over 200 endorsers – including national governments, subnational governments, companies, indigenous groups, financial institutions and NGOs. These endorsers have committed to doing their part to achieve the NYDF goals and follow its accompanying action agenda.
Hence, statement 4 is correct.

Presently, India has not signed the New York Declaration on Forests (NYDF).
Hence, statement 5 is incorrect.

12. Magnetite particles, suspected to cause neurodegenerative problems, are generated as environmental pollutants from which of the following?
1. Brakes of motor vehicles
2. Engines of motor vehicles
3. Microwave stoves within homes
4. Power plants
5. Telephone lines
Select the correct answer using the code given below

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

12. Ans: b

Explanation:

Magnetite Particles:

- Magnetite are the biologically and anthropologically formed nanoparticles of the strongly magnetic mineral.
- These particles can also originate from different sources, including fossil fuel combustion in **motor vehicle emissions, lubricating oil, vehicle brake abrasion, abrasion and corrosion of vehicle engines, coal burning, and waste burning, iron impurities in burning fuel—especially diesel—and indoor sources such as printer toners, and leaky stoves.**
- The use of **coal for industrial applications such as coking in the production of steel and in power plants** is indicated to be a major source of spherical magnetic combustion-associated magnetite fine particles and nanoparticle environmental pollution.
- These particles were first detected in the human brain over 20 years ago. Given their toxicity, abundance in roadside air, and nanoscale dimensions, traffic-derived magnetite pollution nanoparticles may constitute a chronic and pernicious neurotoxicant.
- As many of the airborne magnetite pollution particles are <200 nm in diameter, they can enter the brain directly through the olfactory nerve and by crossing the damaged olfactory unit. Magnetite can have potentially large impacts on the brain due to its unique combination of redox activity, surface charge, and strongly magnetic behavior. Therefore magnetite particles have been seen as contaminants in the environment.

Hence , option b is correct.

13. Which one of the following is a filter feeder?

a) Catfish
b) Octopus
c) Oyster
d) Pelican

13. Ans: c

Explanation:

Filter feeders:

- Filter feeders are aquatic animals that obtain food by straining particles and small organisms out of water. They do this by moving through the water or taking advantage of water moving by them. Filter feeders typically pass water over a specialized filtering structure.
- They use various filamentous structures to capture food particles from the water, such as **bristles, cilia, or tentacles**, by creating feeding currents or acting as sieves to intercept particles from suspension passing through.
- **Oysters** are filter feeders, b**elong to mollusks that remove plankton, bacteria and toxins from the water and even increase ecosystem health.**

- They can **remove excess nitrogen and nitrates from water and incorporate it into their shells and tissue**.
- Near oyster reefs, the water is often clearer.
- Some other filter feeders in nature include **mussels, clams, krills, baleen whales, mollusks, sponges, flamingos, a few species of ducks and geese, manta rays, whale sharks (the largest fish in the world) and basking sharks.**

Hence, option c is correct.

14. In the case of which one of the following biogeochemical cycles, the weathering of rocks is the main source of release of nutrients to enter the cycle?
(a) carbon cycle
(b) Nitrogen cycle
(c) Phosphorus Cycle
(d) Sulphur Cycle

14. Ans: c
Explanation:
Phosphorus is a major constituent of biological membranes, nucleic acids and cellular energy transfer systems. Many animals also need large quantities of this element to make shells, bones and teeth. P is the eleventh most abundant element in the Earth's crust.

The Phosphorus Cycle

- It is the biogeochemical cycle that describes the transformation and translocation of phosphorus in soil, water, and living and dead organic material.
- Phosphorus additions to soil occur due to additions of inorganic and organic (manure) fertilizer and the degradation and decomposition of organic (plant and animal) material.
- **The natural reservoir of phosphorus lies in the rocks, fossils, etc. which contains phosphorus in the form of phosphates.which is excavated by manfor using it as Fertiliser.**
- Export of P from soil occurs mainly through plant uptake. When rocks are weathered, minute amounts of these phosphates dissolve in soil solution and are absorbed by the roots of the plants. Herbivores and other animals obtain this element from plants.
- Phosphorus may also be exported from soil via surface runoff and erosion or subsurface loss through leaching. A good proportion of phosphates moving with surface run-off reaches the oceans and are lost into the dep sediments.
- Sea birds also play an important role in phosphorus cycling. They eat sea fishes which phosphorus rich and the droppings or excreta of the birds return the phosphorus on land. The Guano deposits on the coast of Peru are very rich sources of phosphorus.
- The waste products and the dead organisms are decomposed by phosphate-solubilising bacteria releasing phosphorus back into the soil.
- **Unlike carbon cycle, there is no respiratory release of phosphorus into atmosphere.**

In the Sulphur cycle, the ocean represents a major reservoir of sulfur on Earth, with large quantities in the form of dissolved sulfate and sedimentary minerals (e.g., gypsum and pyrite).
Hence, option c is correct.

15. Which of the following are detritivores?
1. Earthworms
2. Jellyfish
3. Millipedes
4. Seahorses
5. Woodlice

Select the correct answer using the code given below.
(a)1, 2 and 4 Only
(b) 2, 3, 4 and 5 Only
(c) 1, 3 and 5 Only
(d) 1, 2, 3, 4 and 5

15. Ans: c

Explanation:

Two groups of organisms responsible for the decomposition of dead organic matter (detritus): bacteria and fungi are called decomposers, while animals that consume dead matter are known as detrivores.

Detritivores play a crucial role in the biogeochemical processes of soil and nutrient cycling through their consumptive and burrowing activities. In a food web nutrients are recycled in the end by decomposers. Decomposers work at every level, setting free nutrients that form an essential part of the total food web.

Detritivores

- A detritivore is a heterotrophic organism, which obtains its nutrition by feeding on or consuming detritus (plus any associated bacteria and fungi). Detritus is the organic matter made up of dead plant and animal material.
- Detritivores may also obtain nutrition by **coprophagy,** which is a feeding strategy involving the consumption of feces.
- Detritivores are often i**nvertebrate insects such as mites, beetles, butterflies and flies; mollusks such as slugs and snails; or soil-dwelling earthworms, millipedes and woodlice.**
- Examples of detritivores in **marine environments are crustaceans such as crabs and lobsters, echinoderms such as sea stars or sea cucumbers.**
- Many of these marine detritivores occupy a similar niche to terrestrial soil-dwellers, living on or within the seabed known as the benthos. These organisms are often called **"bottom-feeders"**.

Millipedes are arthropods and, unlike insects, **do not have three clearly defined body sections**, each with a pair of legs. Millipedes are worm-like animals with numerous body segments and legs, **feed on decaying plant matter** and are found in moist environments, as they cannot survive long in dry conditions.

Earthworms are important organisms in soil communities and are **known for sustaining the life of the soil.** They are used as a model organism in environmental risk assessment of chemicals and soil toxicology. Soil provides physical and nutritive support to the agriculture system by regulating biogeochemical cycles, nutrient cycle, **waste degradation, organic matter degradation etc.**

Woodlice (also called sow bugs, pill bugs and slaters) are terrestrial isopods (class of Crustacea) which have invaded terrestrial habitats from aquatic environments. Most species can still tolerate submersion in water saturated with O2. They can r**emove heavy metals such as cadmium, arsenic and lead by ionising it**, so preventing metal ions leaching in to groundwater.
Their **diet consists mostly of decaying organic materials such as leaf litter, decayed wood, fungi, and bacterial mats.**
Hence, option c is correct.

16. The 'Common Carbon Metric', supported by UNEP, has been developed for
(a) assessing the carbon footprint of building operations around the world
(b) enabling commercial farming entities around the world to enter carbon emission trading
(c) enabling governments to assess the overall carbon footprint caused by their countries
(d) assessing the overall carbon foot-print caused by the use of fossil fuels by the world in a unit time

16. Ans: a
Explanation:
The Common Carbon Metric is the **calculation used to define measurement, reporting, and verification for GHG emissions associated with the operation of buildings** types of particular climate regions.
This sector represents 40% of the world's energy consumption and related 1/3rd of global greenhouse gas (GHG) emissions.
The CCM is d**eveloped by the United Nations Environment Program's Sustainable Buildings & Climate Initiative (UNEP-SBCI).**
Hence, option a is correct.

17. Which of the following have species that can establish a symbiotic relationship with other organisms?
1. Cnidarians
2. Fungi
3. Protozoa
Select the correct answer using the codes given below.
(a) 1 and 2 Only
(b) 2 and 3 Only
(c) 1 and 3 Only
(d) 1, 2 and 3

17. Ans: d
Explanation:
The term symbiosis was coined in 1879 by Heinrich Anton de Bary, a German mycologist, who defined it as: "the living together of unequally named organisms". In this broad sense symbiosis includes all kinds of close biological relationships between species, hence spanning a continuum between pathogenic and mutualistic phenomena.

The term symbiosis is derived from the Greek word for living together, symbiosis refers to a close and prolonged association between 2 or more organisms of different species that may last for the lifetime of 1 or all partners.
Symbiosis is prolonged associations between organisms often widely separated phylogenetically. **Symbioses can be mutualistic (all partners benefiting), commensalistic (one benefiting and the others unharmed), or parasitic.**

Symbiosis in Cnidarians:
Symbiosis between invertebrates and photosynthetic partners are abundant in the marine environment, with the best known being the **mutualism between members of the phylum Cnidaria (e.g., hard and soft corals, sea anemones, jellyfish, and hydrocorals) and dinoflagellate algae of the genus zooxanthellae.** These dinoflagellates typically reside within the cells of the host cnidarian's gastrodermis.

Symbiotic relationship of fungi:
Fungi have several mutualistic relationships with other organisms.

- **Symbiosis of fungi and plants:** A **mycorrhiza is a mutualistic relationship between a fungus and a plant.** The fungus grows in or on the plant roots. The fungus benefits from the easy access to food made by the plant. The plant benefits because the fungus puts out mycelia that helps absorb water and nutrients like phosphorus and nitrogen.
- **Symbiosis of Fungi and Algae:** A **lichen is an organism that results from a mutualistic relationship between a fungus and a green alga or a fungus and a cynabacterium.** The photosynthesizer benefits from the water and nutrients absorbed by the fungus. Lichens are often pioneer species in primary ecological succession.
- **Symbiosis of Fungi and insects:** Some fungi have mutualistic relationships with insect**s.** For example: **Leafcutter ants grow fungi on beds of leaves in their nests.** The fungi get a protected place to live. The ants feed the fungi to their larvae. **Ambrosia beetles bore holes in tree bark and "plant" fungal spores in the holes.** The holes in the bark give the fungi an ideal place to grow. The **beetles harvest fungi from their "garden."**

Symbiosis in Protozoa :
Protozoa are a diverse group o**f unicellular eukaryotic organisms**. **Termites have a mutualistic relationship with protists that live in the insects' gut.** Th**e termite benefits from the ability of the protists to digest cellulose.** The termite itself cannot do this without the protozoa, it would not be able to obtain energy from its food (cellulose from the wood it chews and eats). The p**rotozoa benefit by having a protective environment and a constant supply of food from the wood-chewing actions of the termite.**
The protists benefit from the enzymes provided by their bacterial endosymbionts, while the bacteria benefit from a doubly protective environment and a constant source of nutrients from two hosts.
Hence, option d is correct.

18. How is permaculture farming different from conventional chemical farming?
1. Permaculture Farming discourages monocultural practices but in conventional chemical farming, monoculture practices are pre-dominant.

2. Conventional chemical farming can cause increase in soil salinity but the occurrence of such phenomenon is not observed in permaculture farming.
3. Conventional chemical farming is easily possible in semi-arid regions but permaculture farming is not so easily possible in such regions.
4. Practice of mulching is very important in permaculture farming but not necessarily so in conventional chemical farming.

Select the correct answer using the codes given below.

a. 1 and 3
b. 1, 2 and 4
c. 4 Only
d. 2 and 3

18. Ans: b

Explanation:

Permaculture as a concept and a movement emerged from combining the words "permanent" and "agriculture." It was first developed by Bill Mollison and David Holmgren in 1978. **It is a polyculture system that supports the diversity of beneficial species** like in crop-livestock-agroforestry. There are no fixed methods in permaculture. It follows the principle of producing no waste mimicking the natural pattern of exchange and cycling of matter and energy wherein the output of one element is used as an input for another.

In a semi-arid landscape, local species that thrive under dry conditions can be planted. In cases of heavy rainfall areas, the crops which soak water are harvested. Thus, a permaculture farm is more sustainable in the face of climate change. That means Permaculture can be effective in harsh climatic conditions like that of Semi-arid regions.
Hence, statement 3 is incorrect.

The practice of permaculture involves ecosystem-centric activities such as restoring the natural nutrient balance of land, ensuring healthy water levels and soil diversity, **preventing soil salinity**, generating abundance and diversity of food, and accounting for all inputs and outputs to build a self-sufficient ecosystem ultimately.
Hence, statement 2 is correct.

Permaculture systems, in contrast to monoculture, provide a **rich tapestry of plant life** that supports a variety of colours, textures, and flavours. This ensures a constant supply of food by **reducing the susceptibility of a single crop failing**. The interaction of various species creates a balanced habitat in which each component contributes, from providing shade to attracting beneficial insects.
Hence, statement 1 is correct.

These systems naturally require less labour for maintenance because of **smart companion planting, mulching, and creative design**. Mulching is a gardening technique that involves covering topsoil with plant material. This material can include leaves, grass, twigs, straw, wood chips, hay, or bark. It helps in preserving moisture, improving soil structure, preventing soil erosion, regulating soil temperature, and enhancing soil organisms.

Permaculture strengthens agricultural resilience by naturally controlling insect outbreaks and lowering the need for chem ical interventions.

By practicing permaculture farming, the aim is to rewild natural scapes to abundance, build **landscape resilience, regenerate soil health, and grow food forests for communities who wish to be in harmony with nature while fulfilling their lifestyle needs.**
Hence, statement 4 is correct.

19. In the context of India's preparation for Climate-smart Agriculture, consider the following statements:
1.The 'Climate-Smart Village' approach in India is a part of a project led by the Climate Change, Agriculture and Food Security (CCAFS), an international research programme.
2. The project of CCAFS is carried out under the Consultative Group on International Agricultural Research (CGIAR) headquartered in France.
3. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in India is one of the CGIAR's research centres.
Which of the statements given above are correct?
(a) 1 and 2 Only
(b) 2 and 3 Only
(c) 1 and 3 Only
(d) 1, 2 and 3

19. Ans: d
Explanation:
Climate-smart agriculture (CSA) is an **integrative approach to address these interlinked challenges of food security and climate change**, that explicitly aims for three objectives:

1. Sustainably increasing agricultural productivity
2. Adapting and building resilience of agricultural and food security systems
3. Reducing greenhouse gas emissions from agriculture (including crops, livestock and fisheries)

Climate-Smart Villages (CSVs), is a participatory international research program of CGIAR which includes participation from sites ranging from village to district level at which portfolios of CSA interventions are tested in a globally comparable manner with farmers, development agencies and the private sector. The **CSV project launched in 2011 with 15 climate-smart villages in West Africa, East Africa and South Asia.** Additional villages are now being chosen in Latin America and Southeast Asia. **The project is led by Climate Change, Agriculture and Food Security (CCAFS).**
Hence, statement 1 is correct.

It is carried out **under the Consultative Group on International Agricultural Research (CGIAR)** which seeks to address the increasing challenge of global warming and declining food security on agricultural practices. **CGIAR is headquartered in France.**
Hence, statement 2 is correct.

About CGIAR:
CGIAR Research Centers are non-profit research organizations conducting innovative research. Home to more than 9,000 scientists, researchers, technicians and staff, the Centers work to transform food, land and water systems in a climate crisis.
CGIAR Research center in India is the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in Patancheru, Telangana. CCAFS and CGIAR centers together are engaging with

national and sub-national stakeholders including policymakers, NGOs and civil society groups, research organizations, farmers groups and private sector for promotion of climate-smart agriculture in India.

Hence, statement 3 is correct.

2020

Previous Year UPSC Environment Questions With Explanation 2020

There were 17 Questions from Environment in 2020, of which

- **4 Questions were related to Climate Change**
- **5 Questions were related to Environmental Ecology**
- **8 Questions were related to Bio-Diversity**

The examiner covered areas such as the Basics of Biodiversity and distribution of biodiversity Basics of Environmental Ecology and Basics of Climate Change.
The level of the questions was moderate.
Questions were aimed to test the basic understanding of the subject and map based knowledge.

1. Which of the following are the reasons/factors for exposure to benzene pollution?
1. Automobile exhaust
2. Tobacco smoke
3. Wood burning
4. Using varnished wooden furniture
5. Using products made of polyurethane

Select the correct answer using the code given below :
(a) 1, 2 and 3 only
(b) 2 and 4 only
(c) 1, 3 and 4 only
(d) 1, 2, 3, 4 and 5

1. Ans: a
Explanation:
Benzene is a naturally occurring colourless liquid at room temperature (25 oC) and pressure (760 mm Hg). It has a characteristic aromatic odour, a relatively low boiling point (80.1oC) and high vapour pressure, which causes it to evaporate rapidly at room temperature.
Benzene is released into the environment from both natural and man-made sources, although the later is the most significant source.
Benzene in air exists predominantly in the vapour phase, with residence time varying between few hours to a few days depending on the environment and climate.
Degradation of benzene in air occurs mainly by reaction with hydroxyl, alkoxy and peroxy radicals.
Toluene and Xylene are also present in most of the sources along with Benzene.
Benzene is a highly volatile aromatic compound usually component of mineral oil, petrol, coking plant and other products. Benzene is extensively utilized as industrial solvent in manufacturing of lacquers varnishes and paint.

Benzene escapes from mineral oil and petrol during storage, transport, loading, unloading or during filling of petrol in motor vehicles. High concentration of Benzene are encountered in the vicinity of petrol filling stations, fuel tank storage sites, coking plant in the vicinity of refineries.
Major Benzene emission originates from the motor vehicles .
Sources of BTX Emission
Transport :

- (I) Vehicular Pollution : a) Vehicular exhaust b) Fuel filling station c) Fuel adulteration
- (II) Railways
- (III) Airways

Industries

- (I). Major industrial units (Refinery, Petrochemical etc)
- (II). Industrial estates
- (III). Medium scale chemical industries

Domestic Emissions

- (I). Domestic combustion units
- (II). Commercial combustion units

Emissions from combustion sources:

- Medical waste incinerators
- Sewage sludge incinerators
- Hazardous waste incinerators
- External combustion solid, liquid and gaseous fuels in stationary sources heat and power generation Stationery internal combustion
- Secondary lead smelting Iron and Steel foundries
- Portland cement production Hot-mix ashalt production
- Open burning of biomass, scrap tires

About 50% of benzene is absorbed by inhalation & absorption of it via skin is limited. The high lipophilicity and low water solubility of benzene favour its distribution to fat-rich tissues. Benzene distributed by blood accumulates in fat-rich tissues like adipose tissue bone marrow & liver.
Polyurethane is a plastic material, which exists in various forms. It can be tailored to be either rigid or flexible, and is the material of choice for a broad range of end-user applications such as:

- insulation of refrigerators and freezers
- building insulation
- cushioning for furniture
- mattresses
- car parts
- coatings
- adhesives
- rollers and tyres
- composite wood panels
- shoe soles
- sportswear

Hence, option a is correct.

2. With reference to Indian elephants, consider the following statements :
1. The leader of an elephant group is female.
2. The maximum gestation period can be 22 months.

3. An elephant can normally go on calving till the age of 40 years only.
4. Among the States in India, the highest elephant population is in Kerala.

Which of the statements given above is/are correct?

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

2. Ans: a

Explanation:

Elephants are the largest land mammals on earth and have distinctly massive bodies, large ears, and long trunks. Two genetically different African species exist: the savanna elephant and the forest elephant, with a number of characteristics that differentiate them both. The African savanna elephant is the largest elephant species, while the Asian forest elephant and the African forest elephant are of a comparable, smaller size.

About Indian Elephant:

- Both female and male may live 55-60 years in wild and 70 years in captivity. **The mean age of first calving ranged between 18 and 20 years and the females are known to breed up to an age of 55 years**. The active reproductive phase in cow elephants is about 40 years.
- **Gestation usually lasts 18-22 months, the longest of any mammal, with a minimum of 17 months and maximum of 24 months.** Normally one calf is born, though there are occasional records of twins and rarely triplets.
- In Indian elephants, the family groups are the basic social units, and they vary in number from two to seven. **These family groups are formed along matriarchal lines and are usually led and coordinated by an older cow**. Several groups may join to form a herd, several herds a clan and several clans a population
- In wild it is known to occupy a variety of vegetation types. In India, they are distributed from thorn scrub to dry and moist deciduous forests in the south, sal forests in the north, alluvial flood plains in West Bengal and Assam and evergreen forests in the northeast and south.
- Within Asia, although elephants occur in 13 countries, India holds more than 60% wild elephant populations of the globe.
- **Karnataka with 6,399 elephants in its forest the highest population of elephants in the wild in India.**

State	Population
Karnataka	6049
Assam	5719
Kerala	5706

Hence, statements 1 and 2 are correct and 3 and 4 are incorrect.

3. Which of the following Protected Areas are located in the Cauvery basin ?

1. Nagarhole National Park
2. Papikonda National Park

3. Sathyamangalam Tiger Reserve
4. Wayanad Wildlife Sanctuary

Select the correct answer using the code given below:

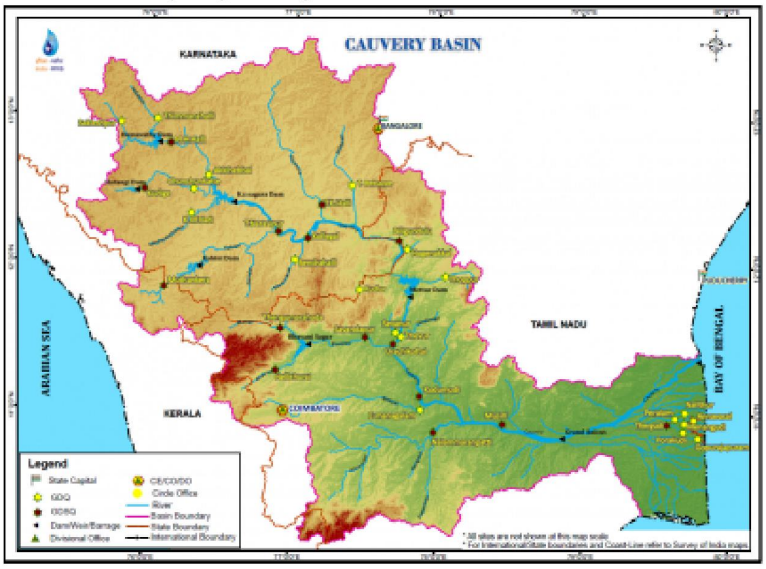
(a) 1 and 2 only
(b) 3 and 4 only
(c) 1, 3 and 4 only
(d) 1, 2 , 3 and 4

3. Ans: c

Explanation:

The Cauvery River is one of the major rivers of the peninsular India. It rises at an elevation of 1,341 m at Talakaveri on the Brahmagiri range near Cherangala village of Kodagu district of Karnataka and drains into the Bay of Bengal.

Its important tributaries joining from left are the Harangi, the Hemavati, the Shimsha and the Arkavati whereas the Lakshmantirtha, the Kabbani, the Suvarnavati, the Bhavani, the Noyil and the Amaravati join from right.



- The Cauvery basin extends over states of Tamil Nadu, Karnataka, Kerala and Union Territory of Puducherry,
- The river Kaveri makes the second biggest waterfall in India, known as **Shivasamudram Falls**

Sathyamangalam Tiger Reserve - Tamil nadu

- Sathyamangalam Tiger Reserve is at the the critical intersection of the Western and Eastern Ghats. It is bordered on the north by the state of Karnataka and on the west by the Nilgiris, which serves as a buffer for the Mudumalai Tiger Reserve.
- Moyar river flows through this which is a perennial water source because the eastern portion of the sanctuary is in the rain shadow region of the Western Ghats and receives little rainfall.
- The Nilgiri-Eastern Ghats Elephant Reserve includes this area as well. The Billigiri Ranganatha Swamy Temple Wildlife Sanctuary, Mudumalai National Park, and Bandipur National Park are four more protected sites connected genetically via SMTR.
- **Moyar River is a tributary of the Bhavani River which then is tributary of Cauvery river.**

Nagarhole National Park - Karnataka

- The national park is named after the **'Nagarahole' (meaning "snake stream" in Kannada), a tiny river that flows through the ecosystem before entering Kabini (tributary of Cauvery river.).**
- The reserve has incredible floral and faunal diversity. It is bounded on the southeastern side by the Bandipur Tiger Reserve and the southwest by the Wayanad Wildlife Sanctuary of Kerala. The Nilgiri Biosphere Reserve also protects the habitat.

Papikonda National Park- Andhra pradesh

- The Papikonda National Park (PNP) is spread in the Eastern Ghats. Its on the banks of the river Godavari and cuts through the Papikonda hill range of Eastern Ghats with an elevation ranging from 150-1,350 m.
- Varied and multifarious streams emanating from PNP make the Papikonda forest vegetation luxuriant. All these constitute to make the area into a typical ecological and geomorphological zone.

Wayanad Wildlife Sanctuary- Kerala

- Wayanad wildlife sanctuary is contiguous to the protected areas of Nagarhole and Bandipur of Karnataka on the north-east.Mudumalai of Tamilnadu on the south –east. Rich in biodiversity, the sanctuary is an integral part of the Nilgiri Biosphere Reserve,
- Bio diversity: The major tree species are Tectona grandis, Terminalia sp, Dalbergia latifolia, Anogeissus latifolia, Grewia tiliaefolia, Adina cordifolia Cirmamum zeylanicum, Pterocarpus marsupium, Vateria indica, Largerstroemia lanceolata, Artocarpus hirsute, Macranga peltata etc.
- Elephant, Gaur, Tiger, Panther,Sambar, Spotted deer, Barking deer, Wild boar, Sloth bear, Nilgiri langur, Bonnet macaque, Common langur, Wild dog, common otter, Malabar giant squirrel etc are the major mammals
- ***It falls in cauvery Basin drained by Cherupuzha, Bavali puzha, Kabani river, Kannaram puzha, Kurichiat puzha, Chedalathu puzha etc***

Hence, option c is correct.

4. With reference to India's biodiversity, Ceylon frogmouth, Coppersmith Barbet, Gray-chinned minivet and White-throated redstart are:

(a) Birds
(b) Primates
(c) Reptiles
(d) Amphibians

4. Ans: a

Explanation:

Ceylon frogmouth, Coppersmith Barbet, Gray-chinned minivet and White-throated redstart are included as SCHEDULE — I species in **Section B (Birds) of Wildlife Protection Act.**

Hence, option a is correct.

5. Which one of the following protected areas is well-known for the conservation of a sub-species of the Indian swamp deer (Barasingha) that thrives well on hard ground and is exclusively graminivorous?

(a) Kanha National Park
(b) Manas National Park
(c) Mudumalai Wildlife Sanctuary
(d) Tal Chhapar Wildlife Sanctuary

5. Ans: a

Explanation:

About Barasingha:

- Barasingha in Hindi means twelve-pointer, indicating a characteristic antler pattern in adult stages. Barasingha is a large, graceful deer, similar in shape and general body plan to other deer species such as red deer and sambar.
- Two distinctly different subspecies of Barasingha have been recognised: ***R.d. duvaucelii,*** **from the alluvial plains on the foot of the Himalaya, and *R.d. branderi* from central India.** The latter subspecies has also been known as 'hard ground barasingha'.
- Barasingha's historic range to extend along marshy areas in the foothills of the Himalaya, all along the Brahmaputra, ganga and Indus basins, from upper Assam to Rohri, along riverbeds in the Sal forests areas of central India, between Ganga and Godavari rivers.
- Now the barasingha is only found in three relatively small areas: one in Kheri, philibhit and Bahraich divisions, including **Dudhwa National Park in Uttar Pradesh**, and the adjacent divisions in southwestern Nepal; another in **Kaziranga and Manas Naitonal Parks in Asssam** few in **Laokhowa Sanctuary(Asssam**); and the other in **Kanha National Park in Madhya Pradesh.**
- The barasingha has a distinct preference for swampy grassland areas. It subsist on grass for their diet showing clear preference for coarse grasses.
- It has a gestation period of 240-250 days and give birth to single young.

Kanha National Park:

- Kanha National Park is nestled in the Maikal range of Satpuras in Madhya Pradesh, the heart of India that forms the central Indian highlands. The national park is also a Tiger reserve.
- The Kanha National park also supports an **endemic population of the hard ground barasingha** (Cervus duvauceli branderi), whose commendable resurrection over the years has become a very inspiring success story in wildlife conservation.
- The **lush green forests of Kanha, composed majorly of Sal** (Shorea Robusta) and other mixed forest trees, supports the growth of rich and varied flora and fauna.

Tal Chhapar Wildlife Sanctuary:

- Tal Chhapar is located on the fringe of the Great Indian Thar Desert and is a unique refuge for the most elegant antelope encountered in India "**The Black Buck".**
- Tal Chhapar sanctuary, with its almost flat tract and interspersed shallow, low-lying areas, has **open grassland with scattered Acacia and Prosopis trees, which give it an appearance of a typical savanna**.
- The sanctuary lies in Sujangarh Tehsil of Churu district in the North-East of Rajasthan.

Manas National Park:

- Manas Wildlife Sanctuary is located in the State of Assam in North-East India, a biodiversity hotspot. Covering an area of 39,100 hectares, it spans the Manas river and is bounded to the north by the forests of Bhutan.
- The site's scenic beauty includes a range of forested hills, **alluvial grasslands and tropical evergreen forests.**

- The site provides critical and viable habitats for rare and endangered species, including tiger, greater one-horned rhino, swamp deer, pygmy hog and Bengal florican. A**mong these pygmy hog, hispid hare and golden langur as well as the endangered Bengal florican are endemic to Manas National Park.**
- The property, has six national and international designations **(i.e. World Heritage Site, National Park, Tiger Reserve (core), Biosphere Reserve (national), Elephant Reserve (core) and Important Bird Area).**
- The **Manas-Beki system is the major river system** flowing through the property and joining the Brahmaputra river further downstream. These and other rivers carry an enormous amount of silt and rock debris.
- The **monsoon and river system form four principal geological habitats: Bhabar savannah, Terai tract, marshlands and riverine tracts.**
- The Manas Wildlife Sanctuary provides h**abitat for 22 of India's most threatened species of mammals.**

Mudumalai National Park

- Located in the western side of Tamil Nadu, the national park lies on the North eastern and North Western slopes of Nilgiris, descending to the Mysore plateau, at the tri-junction of Kerala, Karnataka and Tamil Nadu.
- A part of the Nilgiri Biosphere Reserve, the sanctuary is crusted with other national parks including Bandipur, Nagarhole, Wayanad, Mukurthi and Silent Valley national parks. These parks and reserve forests together are spread across a whopping area of 3300 sq.km of forest land.

Hence, option a is correct.

6. Steel slag can be the material for which of the following?

1. Construction of base road
2. Improvement of agricultural soil
3. Production of cement

Select the correct answer using the code given below:

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

6. Ans: d

Explanation:

Steel Slag:

- The slag produced at **blast furnace during pig iron manufacturing** is called **blast furnace slag.** The slag produced **at steel melting shop is known as steel slag.** To produce steel, removal of excess silicon and carbon from iron is achieved through oxidation by adding limestone and coke.
- **Lower grade ores yield much higher slag fractions, sometimes as high as one tonne of slag per tonne of pig iron produced.**
- **The iron content is the major basic difference between BF slag and steel slag.** In BF slag, FeO is around 0.70%, whereas, in case of steel slag, total iron content varies from 16 to 25%.

- Ferro Scrap Nigam Ltd (FSNL), a wholly owned subsidiary of MSTC Ltd (public sector company) undertakes the recovery and processing of scrap from slag and refuse dumps in the nine steel plants.

Uses of Steel Slag:

- Slag based on their types, has different uses. The air-cooled BF slag is crushed, screened and **used mainly as road metal and bases, asphalt paving, track ballast, landfills and concrete aggregate.**
- The expanded or foamed slag **binds well with cement and is used mainly as aggregate for light weight concrete.**
- Granulated BF slag is used as a pozzolanic material f**or producing portland slag cement**.
- It is also **used for soil conditioning**. BF slag is used in making mineral wool for insulation purposes.
- Steel slag has found use as a barrier material remedy for waste sites where heavy metals tend to leach into the surrounding environment. Steel slag forces the **heavy metals to drop out of solution in water run off because of its high oxide mineral content.**
- Steel slag has been used successfully to **treat acidic water discharges from abandoned mines.**
- It has shown potential for use as a raw mix component up to 10% in the manufacture of **cement clinker.**
- Steel slag can also replace granulated blast furnace slag up to 10% in the manufacture of **Portland Slag Cement.**

Hence, option d is correct.

7. Which of the following are the most likely places to find the musk deer in its natural habitat?

1. Askot Wildlife Sanctuary
2. Gangotri National Park
3. Kishanpur Wildlife Sanctuary
4. Manas National Park

Select the correct answer using the code given below:

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

7. Ans: a

Explanation:

About Musk Deer:

- Musk deer are small solitary forest ruminants that i**nhabit the forested and alpine scrub habitats of mountains in Asia.** It is shy, cryptic and **nocturnal or crepuscular**.
- Musk deer differ from other deer in **not having antlers and facial glands**. They have a gall bladder, caudal gland and **musk gland** which other deer does not possess. The musk has been in use in indigenous medicine since ancient times.
- They have only one pair of teats wheres other have two.
- In India, the **musk deer inhabits forests areas between 2500m and the tree line on the southern side of the Greater Himalayas.** It is reported to occur in and around 23 Protected

Areas located in the states and UT of **Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh.**

- The musk deer are relatively sedentary animals, meeting their requirements for food and cover within their small home ranges in all seasons.

Askot Wildlife sanctuary

- Askot Wildlife Sanctuary (WLS) in Pithoragarh district of Uttarakhand lies at the junction of the Western and Central Himalayas.
- The Sanctuary was notified in July 1986, and covers three major watersheds: Kali, East Dhauli and Goriganga.
- The Sanctuary harbours the typical fauna of Himalayan forests as well as alpine pastures. Some of the rare and endangered species found in the Sanctuary are **Musk Deer, Snow Leopard, Himalayan Tahr, Bharal or Blue Sheep, Goral, Serow, Asiatic Black Bear and Brown Bear.**

Gangotri national park

- **It is the largest (2,390 km^2) Protected Area in the state of Uttarakhand**, it lies in the upper catchments of River Bhagirathi.
- The Gangotri glacier lies at the centre of the Park and gives rise to River Bhagirathi. The Park has a relatively good forest cover and the vegetation types vary from Himalayan Moist Temperate Forests to the Alpine scrub and pastures. The GNP also forms a corridor between Govind National Park in the west and the Kedarnath Wildlife Sanctuary in the south.
- So far, 15 species of mammal and 150 bird species have been documented from the park which includes **Snow leopard, Black bear, Brown bear, Musk deer , Blue sheep or Bharal, Himalayan tahr, Himalayan monal, Koklass and Himalayan Snowcock.**

Kishanpur Wildlife Sanctuary (WLS)

- It is part of the Dudhwa Tiger Reserve near Mailani in Uttar Pradesh. Spread in a compact area of 200 sq Km, it is part of Dudhwa Tiger Reserve, covering **terai forest and meadows**. It is home to Tigers, Leopards, Pythons, Barking Deer, Ghariyal, Wild Boar and Swamp Deers.
- Kishanpur has one of the most **important terai grasslands left in northern India.**
- **It is not the natural habitat for Musk Deer.**

Manas National Park

- The Manas National Park has four principal geological habitats: Bhabar savannah, Terai tract, marshlands and riverine tracts**, therefore Musk Deer is not naturally found in Manas National Park.**
- For more Information Refer Question No-6

Hence, option a is correct.

8. In rural construction, the use of which of the following is preferred for ensuring environmental sustainability or to reduce carbon footprint?

1. Copper slag
2. Cold mix asphalt technology
3. Geotextiles
4. Hot mix asphalt technology
5. Portland cement

Select the correct answer using the code given below:

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

8. Ans: a

Explanation:

Copper slag is a by-product obtained during smelting and refining of copper. The waste copper slag can be used as abrasive tools, road construction, and ballast. One of the greatest potential applications for reusing copper slag is in cement and concrete production.

Asphalt is a mixture of aggregates, binder and filler, used for constructing and maintaining roads, parking areas, railway tracks, ports, airport runways, bicycle lanes, sidewalks and also play- and sport areas. Aggregates used for asphalt mixtures could be **crushed rock, sand, gravel or slags.** Nowadays, certain waste and by-products, such as construction and demolition debris, are being used as aggregates, which increases the sustainability of asphalt.

Hot Mix Asphalt (HMA)

Hot asphalt mixes are generally produced at a temperature between 150 and 180 °C. (**more energy is involved and, consequently, more fumes are produced**)

Warm Mix Asphalt (WMA)

A typical WMA is produced at a temperature around 20 – 40 °C lower than an equivalent Hot Mix Asphalt. **Significantly less energy is involved and, consequently, less fumes are produced** (as rule of thumb, a reduction of 25ºC produces a reduction of 75% of fumes emission). In addition, during the paving operations, the temperature of the material is lower, resulting in improved working conditions for the crew and an earlier opening of the road.

Cold Mix Asphalt

Cold mixes are produced w**ithout heating the aggregate.** This is only possible, **due to the use of bitumen emulsified in water**, which breaks either during compaction or during mixing. Producing the coating of the aggregate. Over the curing time, water evaporates and strength increases. **Cold mixes has the least emissions among all.**

Geotextiles are permeable fabrics made from synthetic or natural fibers. They are designed to be placed in contact with soil or rock to improve their strength and stability. Moreover, they are commonly used to prevent soil erosion, filter water, and separate different layers of soil or rock.

Portland cement is a fine powder, gray or white in color, that consists of a mixture of hydraulic cement materials comprising primarily calcium silicates, aluminates and aluminoferrites. Particulate matter (PM and PM-10), nitrogen oxides (NOx), sulfur dioxide (SO2), carbon monoxide (CO), and CO2 are the primary emissions in the manufacture of portland cement. Small quantities of volatile organic compounds (VOC), ammonia (NH3), chlorine, and hydrogen chloride (HCl), also may be emitted. Emissions may also include residual materials from the fuel and raw materials or products of incomplete combustion that are considered to be hazardous.

Hence, option a is correct.

9. Consider the following statements:
1. Coal ash contains arsenic, lead and mercury.
2. Coal-fired power plants release sulphur dioxide and oxides of nitrogen into the environment.
3. High ash content is observed in Indian coal.
Which of the statements given above is/are correct?
(a) 1 only
(c) 2 and 3 only
(b) 3 only
(d) 1, 2 and 3

9. Ans: d
Explanation:
Coal-based Thermal Power Plants (TPPs) are better responsible for a disproportionately higher share of emissions than the industrial sector **(60 per cent of PM, 45 per cent of SO_2, 30 per cent of NO_2 and 80 per cent of mercury (Hg)).**
Hence, statement 2 is correct.
Coal ash, also referred to as coal combustion residuals or CCRs, is produced primarily from the burning of coal in coal-fired power plants.Coal ash contains lead, arsenic, mercury, cadmium, and uranium. Coal ash includes a number of by-products produced from burning coal, including:

- Fly ash, a very fine, powdery material composed mostly of silica made from the burning of finely ground coal in a boiler.
- Bottom ash, a coarse angular ash particle that is too large to be carried up into the smokestacks so it forms in the bottom of the coal furnace.
- Boiler slag, molten bottom ash from slag tap and cyclone type furnaces that turn into pellets that have a smooth glassy appearance after it is cooled with water.
- Flue gas desulfurization material, a material leftover from the process of reducing sulphur dioxide emissions from a coal-fired boiler that can be a wet sludge consisting of calcium sulfite or calcium sulphate or a dry powdered material that is a mixture of sulphites and sulphates.

Hence, statement 1 is correct.
Coal / Lignite based Thermal Power Generation has been the backbone of power capacity addition in the country. Indian coal is of low grade with ash content of the order of 30-45 % in comparison to imported coals which have a low ash content of the order of 2-15 %. A large quantity of ash is, thus being generated at Coal / Lignite based Thermal Power Stations in the country, which not only requires a large area of precious land for its disposal but is also one of the sources of pollution of both air and water.
Hence, statement 3 is correct.

10. What is the use of biochar in farming?
1. Biochar can be used as a part of the growing medium in vertical farming.
2. When biochar is a part of the growing medium, it promotes the growth of nitrogen-fixing microorganisms.
3. When biochar is a part of the growing medium, it enables the growing medium to retain water for a longer time.
Which of the statements given above is/are correct?
(a) 1 and 2 only
(b) 2 only

(c) 1 and 3 only
(d) 1, 2 and 3

10. Ans: d

Explanation:

Biochar is a charcoal-like product that contains no petroleum. It is made by heating biomass such as herbaceous or woody crop residues, non-salvageable timber and slash, or animal manure, in a contained system.

There are many potential uses for biochar including water treatment, land reclamation, and carbon sequestration.

Biochar may also be used as a soil amendment for two purposes – to improve plant health and to store carbon. It is predicted that at least 50% of the carbon in any piece of waste turned into biochar becomes stable, locking away that carbon for a period of several to hundreds of years, offsetting its contribution as a greenhouse gas in the form of carbon dioxide.

Biochar provides several benefits to the soil by increasing its nutrient contents and water retention capacity. This is due to the cation exchange capacity and porous nature of the biochar, which is essential in promoting plant growth and development

Incorporation of biochar into growing medium has been found to enhance crop yield, increase populations of plant growth-promoting microbes and promote disease suppression.

Inoculating a peat medium with biochar with Rhizobia and mycorrhizal fungi may serve as a potential microbe activator.

Vertical farming generally refers to the growing of crops mostly vegetables, ornamentals, and herbs on stacks of indoor shelves using artificial light and nutrient solutions, without much sunshine and soil. Such farms are not dependent on seasons/controlled environment and have ability to enhance production round the year with little risk of crop failure.

The usage of biochar can be also interesting for the **urban farming industry**. **In fact, green roofs are seen as "privileged areas" for retaining rainwater and reducing the effects of urban heat islands and it is also a part of vertical farming.**

The reported benefits of biochar include:

- Greater uptake of nitrogen (N) stimulating plant growth
- Stimulation of beneficial soil life, including mycorrhizal fungi
- Increased cation exchange capacity (ability the soil's ability to retain nutrients)
- Increased nutrient availability
- Reduced nutrient leaching
- Improved soil porosity
- Greater water retention in soil

Hence, option d is correct.

11. If a particular plant species is placed under Schedule VI of The Wildlife Protection Act, 1972, what is the implication?

(a) A license is required to cultivate that plant.
(b) Such a plant cannot be cultivated under any circumstances.
(c) It is a Genetically Modified crop plant.
(d) Such a plant is invasive and harmful to the ecosystem

11. Ans: a

Explanation:

Section 17C of The Wildlife Protection Act -***Cultivation of specified plants without licence prohibited.***—

(1) No person shall cultivate a specified plant except under and in accordance with a licence granted by the Chief Wild Life Warden or any other officer authorised by the State Government in this behalf:

(2) Every licence granted under this section shall specify the area in which and the conditions, if any, subject to which the licensee shall cultivate a specified plant.

Hence, option a is correct.

12. What is/are the advantages/advantages of zero tillage in agriculture?

1. Sowing of wheat is possible without burning the residue of the previous crop.
2. Without the need for the nursery of rice saplings, direct planting of paddy seeds in the wet soil is possible.
3. Carbon sequestration in the soil is possible.

Select the correct answer using the code given below:

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

12. Ans: d

Explanation:

Tillage is an agriculture land preparation through mechanical agitation which includes digging, stirring and overturning.

Zero tillage is the process where the crop seed will be sown through drillers without prior land preparation and disturbing the soil where previous crop stubbles are present. Zero tillage not only reduce the cost of cultivation it also reduces the soil erosion, crop duration and irrigation requirement and weed effect which is better than tillage. Zero Tillage (ZT) also called No Tillage or Nil Tillage.

Zero tillage proves better for direct-seeded rice, maize, soybean, cotton, pigeonpea, mungbean, clusterbean, pearlmillet during kharif season and wheat, barley, chickpea, mustard and lentil during rabi season.

Wheat sowing after rice can be advanced by 10-12 days by adopting this technique compared to conventionally tilled wheat, and wheat yield reduction caused by late sowing can be avoided.

ZT provides opportunity to escape wheat crop from terminal heat stress.

Zero tillage reduces cost of cultivation by nearly Rs 2,500-3,000/ha through reduction in cost of land preparation, and reduces diesel consumption by 50-60 litres per hectare.

Zero tillage reduces water requirement of crop and the loss of organic carbon by oxidation.

Zero tillage reduces Phalaris minor problem in wheat.

The carbon status of soil is significantly enhanced in surface soil (0-5 cm), particularly under crop residue retention with zero tillage

Advantages of zero tillage

1. Reduction in the crop duration and thereby early cropping can be obtained to get higher yields.

2. Reduction in the cost of inputs for land preparation and therefore a saving of around 80%.
3. Residual moisture can be effectively utilized and number of irrigations can be reduced.
4. Dry matter and organic matter get added to the soil.
5. **Environmentally safe - Greenhouse effect will get reduced due to carbon sequestration.**
6. No tillage reduces the compaction of the soil and reduces the water loss by runoff and prevent soil erosion.
7. As the soil is intact and no disturbance is done, No Till lands have more useful flora and fauna.

Hence, option d is correct.

13. According to India's National Policy on Biofuels, which of the following can be used as raw materials for the production of biofuels?
1. Cassava
2. Damaged wheat grains
3. Groundnut seeds
4. Horse gram
5. Rotten potatoes
6. Sugar beet

Select the correct answer using the code given below:
(a) 1, 2, 5 and 6 only
(b) 1, 3, 4 and 6 only
(c) 2, 3, 4 and 5 only
(d) 1, 2, 3, 4, 5 and 6

13. Ans: a
Explanation:
Biofuels' are fuels produced from renewable resources and used in place of or in blend with, diesel, petrol or other fossil fuels for transport, stationary, portable and other applications .
The Union Cabinet, chaired by the Prime Minister Shri Narendra Modi has approved National Policy on Biofuels – 2018.

The Policy expands the scope of raw material for ethanol production by allowing use of Sugarcane Juice, Sugar containing materials like **Sugar Beet**, Sweet Sorghum, Starch containing materials like Corn, **Cassava, Damaged food grains like wheat,** broken rice, **Rotten Potatoes,** unfit for human consumption for ethanol production.

The Policy categorises biofuels as "Basic Biofuels" viz. First Generation (1G) bioethanol & biodiesel and "Advanced Biofuels"- Second Generation (2G) ethanol, Municipal Solid Waste (MSW) to drop-in fuels, Third Generation (3G) biofuels, bio-CNG etc. to enable extension of appropriate financial and fiscal incentives under each category.
Hence, option a is correct.

14. Which one of the following statements best describes the term 'Social Cost of Carbon'?
(a) It is a measure, in the monetary value of the long-term damage done by a tonne of CO_2 emissions in a given year.

(b) the requirement of fossil fuels for a country to provide goods and services to its citizens, based on the burning of those fuels.
(c) efforts put in by a climate refugee to adapt to live in a new place.
(d) contribution of an individual person to the carbon footprint on the planet Earth.

14. Ans: a

Explanation:

The social cost of carbon dioxide (SC-CO2) **measures the monetized value of the damages to society caused by an incremental metric tonne of CO2 emissions** and is a key metric informing climate policy. Used by governments and other decision-makers in benefit–cost analysis .

Hence, option a is correct.

15. With reference to India's Desert National Park, which of the following statements are correct ?
1. It is spread over two districts.
2. There is no human habitation inside the Park.
3. It is one of the natural habitats of the Great Indian Bustard.

Select the correct answer using the code given below:
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

15. Ans: c

Explanation:

The Desert National Park covering an area of 3,162 sq km was notified in 1980 to conserve the unique biological diversity of this desert ecosystem. **It is the largest protected area of the state, spread over Jaisalmer and Barmer districts.**

Hence, statement 1 is correct.

The great Indian bustard inhabits dry grasslands and scrublands on the Indian subcontinent; its largest populations are found in the Indian state of Rajasthan.

The Desert National park is the most important site for the long-term survival of the Globally Threatened Great Indian Bustard and other endemic fauna and flora.

Hence, statement 3 is correct.

There are 73 villages and also settlements or *Dhanis* existing within the Park. These communities have inhabited this area for hundreds of years and with their rich culture and tradition they are an integral part of this ecosystem.

Hence, statement 2 is incorrect.

16. Consider the following statements :
1. 36% of India's districts are classified as "overexploited" or "critical" by the Central Ground Water Authority (CGWA).
2. CGWA was formed under the Environment (Protection) Act.
3. India has the largest area under groundwater irrigation in the world.

Which of the statements given above is/are correct?
(a) 1 only
(b) 2 and 3 only

(c) 2 only
(d) 1 and 3 only

16. Ans: b

Explanation:

The Central Groundwater Board of India estimates that about 17% of groundwater blocks are overexploited (meaning the rate at which water is extracted exceeds the rate at which the aquifer is able to recharge) while 5% and 14% , respectively, are at critical and semi-critical stages. The situation is particularly alarming in three major regions – north-western, western, and southern peninsular.

Hence, statement 1 is incorrect.

ABOUT CENTRAL GROUND WATER AUTHORITY

Central Ground Water Authority has been constituted under Section 3 (3) of the Environment (Protection) Act, 1986 to regulate and control development and management of groundwater resources in the country.

Hence, statement 2 is correct.

The agriculture sector is the largest consumer of groundwater resources, accounting for 87% of the total annual groundwater extraction, which amounts to 213.29 bcm.

India is the largest user of groundwater in the world. It uses an estimated 230 cubic kilometers of groundwater per year - over a quarter of the global total.

Groundwater resources serve 85% of domestic water supply in rural areas, 45% in urban areas, and over 60% of irrigated agriculture.

Hence, statement 3 is correct.

17. Among the following Tiger Reserves, which one has the largest area under "Critical Tiger Habitat"?

(a) Corbett
(b) Ranthambore
(c) Nagarjunsagar-Srisailam
(d) Sunderbans

17. Ans: c

Explanation:

Tiger Reserves:

Project Tiger was launched by the Government of India in the year 1973 to save the endangered species of tiger in the country. 57 Tiger reserves have been notified until as on January 2025

Tiger reserves with largest area

Name of Tiger Reserve	State	Total Area (in sq km)
Nagarjunsagar Srisailam	Andhra Pradesh	3,296
Manas	Assam	2,837

Guru Ghasidas – Tamor Pingla	Chhattisgarh	2829
Indravati	Chhattisgarh	2,799

Tiger reserves with largest core / critical tiger habitat

Name of Tiger Reserve	State	Area of the core / critical tiger habitat (In Sq. Km.)
Nagarjunsagar Srisailam	Andhra Pradesh	2,595
Amrabad	Telangana	2,166
Guru Ghasidas – Tamor Pingla	Chhattisgarh	2049
Namdapha	Arunachal Pradesh	1,807

Hence, option c is correct.

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