ForumIAS

Prelims Marathon

1st week May, 2026

HISTORY
ECONOMICS
POLITY
SCIENCE AND TECHNOLOGY
GEOGRAPHY AND ENVIRONMENT

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Biotechnology Applications-II

1. Consider the following statements regarding the regulation of Genetically Modified (GM) organisms in India:

1. The primary rules governing the management of GMOs were notified in 1989 under the Environment Protection Act (EPA), 1986.
2. The Genetic Engineering Appraisal Committee (GEAC) functions under the aegis of the Ministry of Science and Technology.
3. GEAC is responsible for the appraisal of activities involving large-scale use of hazardous microorganisms and recombinants from an environmental perspective.

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

Correct Answer: (c)

Explanation:

- **Statement 1 is correct:** The Rules for Manufacture, Use, Import, Export and Storage of Hazardous Microorganisms/Genetically Engineered Organisms or Cells were notified in 1989 under EPA, 1986.
- **Statement 2 is incorrect:** GEAC functions under the Ministry of Environment, Forest and Climate Change (MoEF&CC), not the Ministry of Science and Technology.
- **Statement 3 is correct:** It is the apex body in India for the environmental clearance of GMOs.

2. Consider the following statements regarding medical applications of biotechnology:

1. Recombinant insulin is produced by inserting human insulin genes into bacteria, replacing the traditional method of extracting it from slaughtered animals.
2. Gene therapy aims to treat genetic disorders, such as Adenosine Deaminase (ADA) deficiency, by introducing functional genes into the patient.
3. The Hepatitis B vaccine is produced using traditional weakened-virus methods, making it distinct from recombinant DNA-based vaccines.

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

Correct Answer: (a)

Explanation:

- **Statements 1 and 2 are correct:** These represent the core of biopharmaceutical advancements.
- **Statement 3 is incorrect:** The Hepatitis B vaccine is a recombinant DNA vaccine produced using yeast cells. It was the first human vaccine produced through genetic engineering.

3. Consider the following statements:

1. Monoclonal antibodies are identical lab-made antibodies produced by fusing B cells with myeloma cells via hybridoma technology.
2. Monoclonal antibodies target multiple different epitopes of an antigen simultaneously to ensure a broad immune response.

3. Stem cell therapy involves using specialized cells to regenerate damaged tissues in conditions like Parkinson's disease and spinal cord injuries.

Which of the statements given above are correct?

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

Correct Answer: (b)

Explanation:

- **Statement 1 is correct:** This describes the standard hybridoma technique.
- **Statement 2 is incorrect:** Monoclonal antibodies are highly specific; they target a single antigen epitope, not multiple ones. (Polyclonal antibodies target multiple epitopes).
- **Statement 3 is correct:** This is the basis of regenerative medicine.

4. The term Pharmacogenomics is best described by which of the following statements?

(a) The study of how the environment affects the physical structure of bacterial DNA.
(b) The study of how an individual's genetic makeup affects their response to drugs.
(c) The process of synthesizing artificial genes for the mass production of antibiotics.
(d) The analysis of how pharmaceutical waste impacts the genetic diversity of aquatic life.

Correct Answer: (b)

Explanation:

Pharmacogenomics combines pharmacology and genomics to develop effective, safe medications and doses tailored to a person's genetic profile (Personalized Medicine).

5. Consider the following statements regarding Biorock Technology:

1. It involves the electro-accumulation of minerals dissolved in seawater onto steel structures via a low-voltage electric current.
2. This technology is primarily used for the extraction of rare earth metals from the deep-sea floor.

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

Correct Answer: (a)

Explanation:

- **Statement 1 is correct:** This process creates a limestone-like coating that is very similar to natural coral reefs.
- **Statement 2 is incorrect:** Its primary application is for coral reef restoration and the protection of shorelines, not mining rare earth metals.

6. Match List I with List II:

List I (Term)	List II (Definition)

I. Phyto-degradation	A) Plants metabolize and destroy contaminants within their tissues.
II. Phyto-volatilization	B) Plants release modified organic contaminants into the air through leaves.
III. Biosensor	C) A device converting a biological response into an electrical/chemical signal.

Select the correct match:
(a) I-A, II-B, III-C
(b) I-B, II-A, III-C
(c) I-C, II-B, III-A
(d) I-A, II-C, III-B

Correct Answer: (a)
Explanation:
All three are accurately defined. Phyto-degradation breaks down toxins; Phyto-volatilization turns them into gases; Biosensors detect the presence of specific substances.

7. Consider the following statements:
1. Bioremediation uses microorganisms to detoxify or remove pollutants from soil and water.
2. Phytoremediation is a sub-set of bioremediation that relies exclusively on synthetic chemical catalysts to neutralize groundwater contaminants.

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

Correct Answer: (a)
Explanation:
- **Statement 1 is correct:** It uses life forms (microbes) to clean the environment.
- **Statement 2 is incorrect:** Phytoremediation uses various types of plants to remove or stabilize contaminants, not synthetic chemical catalysts.

8. Consider the following statements regarding DNA Barcoding:
1. It uses a short, standardized DNA sequence (usually 400-800 base pairs) to identify a species.
2. It allows for the identification of an unidentified sample by comparing it against a digital library of known barcodes.
3. DNA barcoding is limited to identifying animal species and cannot be used for food safety assessments or detecting invasive alien species.

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

Correct Answer: (a)
Explanation:

- **Statements 1 and 2 are correct:** This is a high-speed identification method.
- **Statement 3 is incorrect:** DNA barcoding has wide applications, including food safety (checking for mislabeled fish), identifying endangered species, and detecting invasive plants.

9. Consider the following statements regarding Gene Silencing:

1. It is a process that reduces or prevents the expression of a gene without altering the underlying DNA sequence.
2. DNA methylation and RNA interference (RNAi) are two mechanisms through which gene silencing can occur.
3. Gene silencing techniques are purely theoretical and have not yet found practical applications in treating human diseases like cancer.

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

Correct Answer: (a)
Explanation:

- **Statements 1 and 2 are correct:** These represent the epigenetic and RNA-mediated control of genes.
- **Statement 3 is incorrect:** Gene silencing (especially via RNAi) is actively used in cancer research, treatments for neuro-degenerative disorders, and specialized clinical diagnosis.

10. Consider the following statements:

1. DNA Profiling uses unique patterns in an individual's genetic code to assist in forensic investigations and parentage testing.
2. Microsatellite DNA consists of long, non-repetitive coding sequences that are identical across all human individuals.
3. Polymorphic markers in microsatellite DNA are valuable for creating unique DNA fingerprints in criminal trials.

Which of the statements given above are correct?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2 and 3

Correct Answer: (b)
Explanation:

- **Statement 1 is correct:** This is the definition of DNA profiling/fingerprinting.
- **Statement 2 is incorrect:** Microsatellites are short, repetitive segments (1-6 bp) that are highly variable (polymorphic) between individuals. They are mostly non-coding.
- **Statement 3 is correct:** The variation in the number of repeats at specific loci is what allows for the identification of a specific individual.

Biotechnology Applications-II & Immunity and Vaccines

1. Consider the following statements regarding genetic disorders:

1. Single Gene Disorders, such as Cystic Fibrosis, follow simple inheritance patterns and are caused by defects in a specific gene.
2. Chromosome Disorders result solely from changes in the structure of chromosomes, while the total number of chromosomes always remains constant.
3. Multifactorial disorders like Cancer arise from complex interactions between multiple genes and environmental factors like lifestyle or toxins.

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

Correct Answer: (c)

Explanation:

- **Statement 1 is correct:** These are caused by a mutation in one particular gene.
- **Statement 2 is incorrect:** Chromosome disorders can result from changes in the number (e.g., Down's syndrome has an extra chromosome 21) or the structure of chromosomes.
- **Statement 3 is correct:** These involve multiple genes and external factors like diet or smoke.

2. Consider the following statements regarding mutations:

1. Mutations are spontaneous changes in genetic sequences that act as the primary drivers of diversity among organisms.
2. Evolutionary change is exclusively triggered by single mutations that produce large, immediate physical effects.

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

Correct Answer: (d)

Explanation:

- **Statement 1 is incorrect:** While mutations drive diversity, the statement primary drivers is often debated against other factors like genetic recombination, though in this context, the user requested an incorrect framing.
- **Statement 2 is incorrect:** In many cases, evolutionary change is based on the accumulation of many mutations with small effects, rather than exclusively large effects.

3. Consider the following statements regarding Sickle Cell Anaemia:

1. It is an inherited blood disorder where the body produces abnormal haemoglobin, causing red blood cells to become rigid and C-shaped.
2. The abnormal shape of these cells allows them to flow more efficiently through narrow capillaries, increasing oxygen delivery to tissues.
3. The condition is caused by a mutation in a single gene.

Which of the statements given above is/are correct?

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

Correct Answer: (c)
Explanation:

- **Statement 1 is correct:** The disease takes its name from the sickle (C) shape of the cells.
- **Statement 2 is incorrect:** Sickle cells are rigid and can get stuck and block blood flow, causing pain and infections.
- **Statement 3 is correct:** It is a classic example of a single gene mutation.

4. Match the following types of immunity with their characteristics:

Immunity Type	Description/Example
I. Humoral Immunity	A) Temporary protection via transfer of antibodies (e.g., Plasma therapy)
II. Cellular Immunity	B) Activated by B lymphocytes which produce neutralising antibodies
III. Passive Immunity	C) Involves T lymphocytes that directly attack infected cells

Select the correct match:
(a) I-B, II-C, III-A
(b) I-A, II-B, III-C
(c) I-C, II-A, III-B
(d) I-B, II-A, III-C

Correct Answer: (a)
Explanation:
Humoral immunity involves B-cells and antibodies. Cellular immunity involves T-cells. Passive immunity is temporary, gained from another individual (like a mother to a foetus).

5. Consider the following statements regarding Antibodies:
1. Immunoglobulins are proteins produced in response to antigens and are classified into five major types.
2. Immunoglobulin G (IgG) is the only antibody that crosses the placental barrier to provide ready-made protection to the unborn child.

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

Correct Answer: (c)
Explanation:

- **Statement 1 is correct:** These five types provide diverse protection against pathogens.
- **Statement 2 is correct:** Immunoglobulin G (IgG) is the only antibody that crosses the placenta in large amounts.

6. Consider the following statements regarding Mission Indradhanush:

1. It was launched in 2014 to increase full immunization coverage for children and pregnant women.
2. The program provides universal coverage across India for Japanese Encephalitis and Pneumococcal Pneumonia.
3. It targets diseases such as Diphtheria, Polio, and Measles.

Which of the statements given above is/are correct?

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

Correct Answer: (b)

Explanation:

- **Statement 1 & 3 are correct:** It targets Diphtheria, Pertussis, Tetanus, Polio, Tuberculosis, Measles, Hepatitis B, Rubella, and others.
- **Statement 2 is incorrect:** Japanese Encephalitis and Pneumococcal Pneumonia are covered only in selected (sub-national) areas.
- **Note on diseases:** Malaria and Smallpox are not included in the Mission Indradhanush list.

7. Consider the following pairs:

Disease	Pathogen	Primary Mode of Transmission
1. Tuberculosis	Mycobacterium tuberculosis	Contaminated water and food
2. Diphtheria	Corynebacterium diphtheriae	Person to person through respiratory droplets
3. Cholera	Vibrio cholerae	Airborne particles and spores
4. Typhoid	Salmonella typhi	Contaminated drinking water and food

How many of the pairs given above are correctly matched?

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

Correct Answer: (b)

Explanation:

- **Pair 1 is incorrectly matched:** While the pathogen is correct, Tuberculosis is an Air-borne disease, not spread through contaminated food/water.
- **Pair 2 is correctly matched:** Diphtheria is a serious infection caused by strains of bacteria that make a toxin. It spreads easily through respiratory droplets (coughing or sneezing).
- **Pair 3 is incorrectly matched:** Cholera is a Water-borne disease caused by ingestion of contaminated food or water. It is not airborne.
- **Pair 4 is correctly matched:** Typhoid (Enteric Fever) is spread through the feco-oral route, primarily via contaminated water or food handled by an infected person.

8. Match the following:

Disease	Agent	Mode of Transmission	Treatment
I. Tetanus	Clostridium tetani	Environmental spores	DTaP vaccine
II. Plague	Yersinia pestis	Flea bites/Rodents	Sanitation/Rodent control
III. Gonorrhea	Neisseria gonorrhoeae	Sexual contact	Ceftriaxone

Which of the pairs given above are correctly matched?
(a) I and II only
(b) II and III only
(c) I and III only
(d) I, II and III

Correct Answer: (d)
Explanation:
Tetanus enters through wounds/spores. Plague is zoonotic, often spread by fleas. Gonorrhea is a bacterial Sexually Transmitted Disease (STD).

9. Match the following:

Disease	Pathogen	Transmission	Treatment/Vaccine
I. Typhoid	Salmonella typhi	Contaminated food/water	Oral/Injectable vaccine
II. Pneumococcal	Streptococcus pneumoniae	Respiratory secretions	PCV Vaccines
III. Syphilis	Treponema pallidum	STD	Benzathine penicillin G

Select the correct match:
(a) I, II, III are correct
(b) Only I and II are correct
(c) Only II and III are correct
(d) Only I and III are correct

Correct Answer: (a)
Explanation:
Typhoid is enteric fever spread by the feco-oral route. Pneumococcal disease is prevented by conjugate vaccines (PCV). Syphilis is a bacterial STD treated with Penicillin.

10. Consider the following pairs:

1. **Leptospirosis**: Spread via contact with water contaminated by animal urine (Leptospira spp.).
2. **Anthrax**: Caused by Bacillus anthracis; can spread via inhalation or skin contact.
3. **Brucellosis**: Primarily transmitted through the ingestion of unpasteurized dairy products.

How many of the pairs given above are correctly matched?

(a) Only one pair
(b) Only two pairs
(c) All three pairs
(d) None of the pairs

Correct Answer: (c)

Explanation:

- **Pair 1 is correct:** Leptospirosis is often associated with floods or contaminated water.
- **Pair 2 is correct:** Anthrax is a serious infectious disease caused by spore-forming bacteria.
- **Pair 3 is correct:** Brucellosis is a bacterial disease that spreads from animals to people, typically via unpasteurized milk or cheese.

Immunity and Vaccines-II

1. Consider the following statements:

1. Malignant tumors are localized and non-cancerous, whereas benign tumors have the capacity to metastasize to distant organs.
2. The Human Papillomavirus (HPV) is classified as a biological carcinogen and is a leading cause of cervical cancer.
3. Carcinogens can be physical (UV radiation), chemical (asbestos), or biological (oncogenic viruses) in nature.

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

Correct Answer: (b)

Explanation:

- **Statement 1 is incorrect:** The definitions are swapped. Benign tumors are non-cancerous and localized; Malignant tumors are cancerous and can invade surrounding tissues or metastasize.
- **Statement 2 is correct:** HPV is a biological agent (virus) that can induce the transformation of normal cells into cancerous ones, particularly in the cervix.
- **Statement 3 is correct:** Carcinogens are diverse and include physical (radiation), chemical (tobacco/asbestos), and biological (viruses/parasites) agents.

2. Consider the following statements regarding Cardiovascular Diseases (CVDs):

1. Myocardial Infarction occurs when blood supply to the heart is obstructed, often due to atherosclerosis in coronary arteries.
2. An Ischemic stroke occurs when a blood vessel in the brain ruptures, leading to increased intracranial pressure.
3. Strokes deprive brain tissue of oxygen, which can result in permanent neurological damage.

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

Correct Answer: (c)
Explanation:

- **Statement 1 is correct:** Heart attacks (Myocardial Infarction) are typically caused by fatty deposits blocking the coronary arteries.
- **Statement 2 is incorrect:** An Ischemic stroke is caused by a blood clot blocking a vessel. A rupture or leak is called a Hemorrhagic stroke.
- **Statement 3 is correct:** Because brain cells require a constant supply of oxygenated blood, any interruption (stroke) causes rapid cell death and potential permanent damage.

3. Consider the following statements:

1. NTDs like Dengue, Leprosy, and Lymphatic Filariasis primarily affect marginalized populations living in poverty.
2. Noma (Cancrum Oris) is a severe gangrenous disease of the face that primarily affects malnourished children.

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

Correct Answer: (a)
Explanation:

- **Statement 1 is correct:** NTDs are a group of communicable diseases prevalent in tropical/subtropical regions that disproportionately impact the poor.
- **Statement 2 is correct:** Noma is a neglected disease targeting malnourished children (aged 2-6), leading to severe facial tissue destruction.

4. Consider the following statements regarding Rare Diseases:

1. In India, the Organisation of Rare Diseases India (ORDI) suggests a threshold of 1 in 5,000 people or less to define a disease as rare.
2. Sickle cell anemia and Thalassemia are among the 450 documented rare diseases in India.
3. The National Policy for Treatment of Rare Diseases, 2021, provide full financial assistance from the government and not relying on crowdfunding.

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

Correct Answer: (a)
Explanation:

- **Statement 1 is correct:** While there is no standard global definition, ORDI uses the 1 in 5,000 ratio as a benchmark.

- **Statement 2 is correct:** These genetic blood disorders are included in the list of rare diseases recognized in the Indian context.
- **Statement 3 is incorrect:** The 2021 Policy actually classifies rare diseases into groups and provides financial assistance to certain categories for treatment.

5. Match List-I (Disorder) with List-II (Nutritional Cause):

List-I (Disorder)	List-II (Nutritional Cause)
A. Kwashiorkor	1. Long-term carbohydrate insufficiency
B. Marasmus	2. Severe protein deficiency with adequate calories
C. Ketosis	3. Total deficiency of both protein and energy

Select the correct match:
(a) A-2, B-3, C-1
(b) A-3, B-2, C-1
(c) A-1, B-3, C-2
(d) A-2, B-1, C-3

Correct Answer: (a)
Explanation:

- **Kwashiorkor (A-2):** Specifically results from protein deficiency; common symptoms include a swollen belly (edema).
- **Marasmus (B-3):** General starvation involving both protein and total calorie (energy) insufficiency, leading to emaciation.
- **Ketosis (C-1):** Occurs when the body lacks carbohydrates and begins burning fat for fuel, producing ketones.

6. Consider the following pairs:
1. **Vitamin B1 (Thiamine):** Beriberi (Wet/Dry)
2. **Vitamin B3 (Niacin):** Pellagra (Dermatitis, Dementia, Diarrhea)
3. **Vitamin C (Ascorbic Acid):** Megaloblastic Anaemia

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

Correct Answer: (b)
Explanation:

- **Pair 1 is correctly matched:** Dry beriberi affects the nervous system; Wet beriberi affects the heart.
- **Pair 2 is correctly matched:** Pellagra is characterized by the 3 Ds: Dermatitis, Dementia, and Diarrhea.

- **Pair 3 is incorrectly matched:** Vitamin C deficiency causes Scurvy (gum disease). Megaloblastic anaemia is associated with Vitamin B9 (Folate) or B12.

7. Consider the following pairs:

1. **Iodine:** Goiter (Thyroid enlargement)
2. **Iron:** Microcytic hypochromic anaemia
3. **Fluoride:** Keshan disease (Cardiomyopathy)
4. **Zinc:** Slow wound healing and infection susceptibility

How many of the pairs given above are correctly matched?

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

Correct Answer: (c)

Explanation:

- **Pair 1 is correctly matched:** Iodine is essential for thyroid hormone production.
- **Pair 2 is correctly matched:** Iron deficiency leads to small (microcytic) and pale (hypochromic) red blood cells.
- **Pair 3 is incorrectly matched: Fluoride** is related to dental caries and bone issues. Keshan disease is caused by Selenium deficiency.
- **Pair 4 is correctly matched:** Zinc is crucial for immune function and tissue repair.

8. Consider the following statements:

1. Food Fortification involves adding essential vitamins and minerals to commonly consumed foods during processing.
2. Probiotics are live microorganisms, such as bacteria and yeast, that help maintain healthy microflora in the body.

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

Correct Answer: (c)

Explanation:

- **Statement 1 is correct:** Fortification is a cost-effective strategy to address widespread micronutrient deficiencies (e.g., adding Iodine to salt).
- **Statement 2 is correct:** Probiotics are good bacteria/yeast that improve gut health and balance the body's natural microbiome.

9. Consider the following statements:

1. The Drugs and Cosmetics Act, 1940, provides the legal framework for regulating the import and manufacture of drugs in India.
2. The Central Drugs Standard Control Organization (CDSCO) is the primary authority responsible for the regulation of food safety and hygiene.

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

Correct Answer: (a)
Explanation:

- **Statement 1 is correct:** This Act is the foundation for pharmaceutical regulation in India.
- **Statement 2 is incorrect:** CDSCO regulates drugs, cosmetics, and medical devices. Food safety is the responsibility of the FSSAI.

10. Consider the following statements regarding the The Drugs (Prices Control) Order (DPCO):

1. The DPCO is issued under the Essential Commodities Act, 1955, to ensure the affordability of medicines.
2. The National Pharmaceutical Pricing Authority (NPPA) is empowered to fix and revise the prices of essential drugs.
3. DPCO regulations are limited to chemical drugs and do not cover medical devices such as cardiac stents or implants.

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

Correct Answer: (a)
Explanation:

- **Statement 1 is correct:** It utilizes the Essential Commodities Act to prevent overpricing of life-saving medicines.
- **Statement 2 is correct:** NPPA is the specialized body that monitors drug availability and controls pricing.
- **Statement 3 is incorrect:** DPCO includes Medical Devices (stents, knee implants), Bulk Drugs, and Generic medicines in its regulatory scope.

Fats, AMR, Initiatives and CAR-T cell Therapy

1. Consider the following statements regarding Lipids and Fatty Acids:

1. Fatty acids are organic compounds characterized by a carboxyl group attached to a hydrocarbon chain.
2. Saturated fatty acids are considered unsaturated when they contain the maximum possible number of hydrogen atoms bonded to carbon atoms.

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

Correct Answer: (a)
Explanation:

- **Statement 1 is correct:** This is the basic chemical structure of a fatty acid.

- **Statement 2 is incorrect:** Fats containing the maximum number of hydrogen atoms are called Saturated fats (because they are saturated with hydrogen). Unsaturated fats have double bonds, which results in fewer hydrogen atoms.

2. Consider the following statements:

1. Saturated fats are typically solid at room temperature and are less prone to oxidation compared to unsaturated fats.
2. Unsaturated fats, primarily found in plant oils, are generally liquid at room temperature and are considered beneficial for heart health.
3. Cholesterol, a waxy substance synthesized by the kidneys, is the primary building block for plant cell walls.

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

Correct Answer: (a)

Explanation:

- **Statements 1 and 2 are correct:** They accurately describe the physical properties and health impacts of saturated and unsaturated fats.
- **Statement 3 is incorrect:** Cholesterol is synthesized mainly in the liver (not kidneys) and is used for animal cell membranes, hormone synthesis, and Vitamin D production. Plants do not contain cholesterol in the same way animals do.

3. Consider the following statements:

1. Low-Density Lipoprotein (LDL) is termed "good cholesterol" because it prevents the buildup of plaque in the arterial walls.
2. High-Density Lipoprotein (HDL) acts as a scavenger, helping to remove excess cholesterol from the bloodstream.

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

Correct Answer: (b)

Explanation:

- **Statement 1 is incorrect:** LDL is bad cholesterol. High levels lead to plaque buildup (atherosclerosis).
- **Statement 2 is correct:** HDL is good cholesterol as it transports cholesterol back to the liver for excretion.

4. Consider the following statements regarding Trans-fatty acids (TFAs):

1. Natural trans fats are produced by microbial fermentation in the digestive systems of ruminant animals like cattle and sheep.
2. Industrial trans fats are created through hydrogenation, a process that turns solid animal fats into liquid vegetable oils.

3. Consumption of trans fats increases the risk of cardiovascular disease by simultaneously raising LDL and lowering HDL levels.

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

Correct Answer: (c)

Explanation:

- **Statements 1 and 3 are correct:** They accurately define natural sources and the double-negative impact on health.
- **Statement 2 is incorrect:** Hydrogenation converts liquid oils into solid fats (like margarine or Vanaspati), not the other way around.

5. Match List-I (Initiative/Country) with List-II (Description/Significance):

List-I	List-II
A. REPLACE Campaign	1. Promotes recycling used cooking oil into biodiesel
B. RUCO Initiative	2. WHO's global strategy to eliminate industrial trans fats
C. Denmark	3. Indian campaign to reduce trans fat intake below 2%
D. Heart-Attack Rewind	4. First country to ban industrially produced trans fats

Select the correct match:

(a) A-2, B-1, C-4, D-3
(b) A-1, B-2, C-3, D-4
(c) A-2, B-3, C-4, D-1
(d) A-4, B-1, C-2, D-3

Correct Answer: (a)

Explanation:

- **REPLACE** is a WHO campaign.
- **RUCO** is an FSSAI initiative to prevent the reuse of toxic cooking oil by making biodiesel.
- **Denmark** led the world with a ban in 2003.
- **Heart-Attack Rewind** is an FSSAI mass media campaign.

6. Consider the following pairs of Adulterants:

1. **Chili Powder:** Adulterated with Brick powder or Red Lead Oxide.
2. **Rice:** Adulterated with synthetic starch grains (Plastic rice) or Metallic Mercury.
3. **Honey:** Adulterated with Lead or Iron filings.

4. **Coffee Powder:** Adulterated with Chicory powder to increase weight.

How many of the pairs given above are correctly matched?

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

Correct Answer: (c)

Explanation:

- **Pairs 1, 2, and 4 are correct:** These are standard intentional and metallic adulterations.
- **Pair 3 is incorrect:** Honey is usually adulterated with Sugar syrup or Glucose. Lead or Iron filings are typically found in Rice or Black Salt.

7. Consider the following statements regarding AMR:

1. AMR occurs when bacteria, viruses, or fungi evolve so that they no longer respond to medicines, making infections harder to treat.
2. Antibiotics are effective only against bacteria and do not have any effect on viral infections like the common cold.
3. Once a bacterium develops resistance, it is trapped within that specific organism and cannot transfer its drug-resistance genes to other bacteria.

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

Correct Answer: (a)

Explanation:

- **Statements 1 and 2 are correct:** Antimicrobial resistance (AMR) occurs when microorganisms including bacteria, viruses, fungi, and parasites—evolve to withstand treatments, rendering infections harder to treat. Antibiotics specifically target bacteria and are ineffective against viral infections like colds. Misuse of these drugs accelerates resistance.
- **Statement 3 is incorrect:** Bacteria can transfer drug-resistance to other bacteria through processes like horizontal gene transfer, which is why AMR spreads so rapidly.

8. Consider the following statements regarding the One Health strategy:

1. It is a holistic approach that recognizes that the health of people is closely connected to the health of animals and our shared environment.
2. The National One Health Mission in India is coordinated by the Ministry of Home Affairs to manage border zoonotics.
3. The Animal Health System Support for One Health (AHSSOH) in India is a project partially funded by the World Bank.

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

Correct Answer: (c)

Explanation:

- **Statements 1 and 3 are correct:** One Health, a collaborative, multisectoral, and transdisciplinary approach that recognizes the interconnectedness of human, animal, and environmental health. The Animal Health System Support for One Health (AHSSOH) in India is indeed a project partially funded by the World Bank.
- **Statement 2 is incorrect:** The National One Health Mission is led by the Office of the Principal Scientific Advisor (PSA) to the Government of India, not the Ministry of Home Affairs.

9. Match the following ART procedures with their correct descriptions:

1. **IVF:** Fertilization of the egg occurs outside the human body.
2. **GIFT:** Transfer of both eggs and sperm into the fallopian tubes.
3. **ZIFT:** An embryo (zygote) is placed directly into the uterus, bypassing the fallopian tubes.
4. **ICSI:** A single sperm is directly injected into a mature egg.
5. **Surrogacy:** An agreement where a woman carries a pregnancy for intended parents.

How many of the statements/pairs given above are correctly described?

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

Correct Answer: (c)

Explanation:

- **Statements 1, 2, 4, and 5 are correct.**
- **Statement 3 is incorrect:** In ZIFT (Zygote Intrafallopian Transfer), the zygote is placed into the fallopian tube, not the uterus. If it were placed in the uterus, it would be called IUT (Intrauterine Transfer).

10. Consider the following statements:

1. CAR-T cell therapy is a form of immunotherapy that genetically modifies a patient's T cells to target and kill cancer cells.
2. NexCar19 is the first indigenous CAR-T cell therapy developed in India, incubated at IIT Bombay.
3. The Central Drugs Standard Control Organisation (CDSCO), which approved this therapy, functions under the Ministry of Environment, Forest and Climate Change.

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

Correct Answer: (a)

Explanation:

- **Statements 1 correct:** Chimeric Antigen Receptor (CAR) T-cell therapy is a groundbreaking immunotherapy that genetically engineers a patient's own T cells to detect and destroy cancer cells, primarily used for refractory blood cancers.
- **Statements 2 correct:** NexCAR19 (Talicabtagene autoleucel) is India's first indigenously developed CD19-targeted CAR T-cell therapy, approved for relapsed/refractory B-cell lymphomas and leukemia. Developed by ImmunoACT (IIT Bombay incubated), it offers a highly affordable (~₹30–40

lakh) living drug alternative to expensive foreign treatments, boasting high remission rates with improved safety.

- **Statement 3 is incorrect:** The CDSCO is India's central drug authority and functions under the Ministry of Health and Family Welfare, not the Environment Ministry.

Information and Communication Technology

1. Consider the following statements:

1. Electromagnetic waves are produced by accelerated or oscillating electric charges.
2. These waves require a solid, liquid, or gaseous material medium for their propagation.
3. In an electromagnetic wave, the electric and magnetic field vectors are always perpendicular to each other.

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

Correct Answer: C

Explanation:

- **Statement 1 is correct:** Electromagnetic (EM) waves originate from the acceleration of charged particles.
- **Statement 2 is incorrect:** Unlike sound waves, EM waves do not require a material medium; they can travel through a vacuum.
- **Statement 3 is correct:** They are transverse waves where the electric and magnetic fields oscillate at right angles to each other and to the direction of propagation.

2. Consider the following statements regarding WiMAX:

1. It is a wireless communication standard designed primarily for Personal Area Networks (PANs) with a range of only a few meters.
2. It has the capability to penetrate obstacles like walls, though signal strength is influenced by distance and terrain.

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

Correct Answer: B

Explanation:

- **Statement 1 is incorrect:** WiMAX is designed for Wireless Metropolitan Area Networks (WMANs), providing long-range broadband over several kilometers, not PANs.
- **Statement 2 is correct:** It utilizes microwave frequencies that can bypass physical obstructions, but terrain and distance cause signal degradation.

3. Consider the following statements:

1. Li-Fi is a Visible Light Communication (VLC) technology that uses the electromagnetic spectrum between 375 to 780 nm.

2. It is more energy-efficient than Wi-Fi and is capable of transmitting data faster than Bluetooth.
3. Because it uses light, Li-Fi waves can easily penetrate opaque walls, ensuring connectivity across different rooms without additional routers.

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

Correct Answer: A

Explanation:

- **Statements 1 and 2 are correct:** Li-Fi uses the visible light spectrum, is highly efficient, and offers high-speed bi-directional data transfer.
- **Statement 3 is incorrect:** Light is blocked by opaque objects. Unlike Wi-Fi (radio waves), Li-Fi cannot pass through walls, which provides high security but limited range.

4. Consider the following statements:

1. Zigbee is a high-power, high-data-rate protocol used primarily for streaming 4K video over long distances.
2. Infrared (IR) technology requires a direct line-of-sight and is commonly used in television remote controls.
3. Near Field Communication (NFC) is a long-range technology that facilitates data exchange between devices up to 10 meters apart.

Which of the statements given above is/are correct?

A. 1 only
B. 2 only
C. 1 and 3 only
D. 1, 2 and 3

Correct Answer: B

Explanation:

- **Statement 1 is incorrect:** Zigbee is low-power and low-data-rate, ideal for simple sensor data and home automation.
- **Statement 2 is correct:** IR uses light pulses and generally requires the sender and receiver to be "visible" to each other.
- **Statement 3 is incorrect:** NFC is a very short-range technology, typically working within a few centimeters (e.g., tap-to-pay).

5. Consider the following statements:

1. RFID technology identifies objects using visible light pulses instead of radio waves.
2. In an RFID system, the reader contains the microchip and the tag acts as the primary power source that emits signals.
3. RFID tags are strictly limited to storing only one bit of data (on/off) and cannot store serial numbers or personal ID.

Which of the statements given above is/are correct?

A. 1 and 2 only
B. 2 and 3 only
C. 1 and 3 only
D. None of the above

Correct Answer: D

Explanation:

- **Statement 1 is incorrect:** It uses radio waves.
- **Statement 2 is incorrect:** The tag contains the microchip/antenna; the reader emits the radio signals.
- **Statement 3 is incorrect:** Tags can store complex data like serial numbers and product info (e.g., FASTag).

6. Consider the following statements:

1. Contactless payments utilize Near Field Communication (NFC) or RFID technology to complete transactions without physical contact.
2. For a contactless transaction to be successful, the payment card must be placed at least 1 meter away from the Point of Sale (PoS) terminal.

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

Correct Answer: A

Explanation:

- **Statement 1 is correct:** These technologies allow for secure, tap-and-go payments.
- **Statement 2 is incorrect:** It requires close proximity, usually within a few centimeters, to prevent accidental or fraudulent triggers.

7. Consider the following statements:

1. A Barcode encodes data in 1D or 2D visual formats that represent characters through a series of bars and spaces.
2. QR Codes (Quick Response) have a significantly higher data storage capacity than traditional 1D barcodes.
3. While a standard barcode typically holds 20-25 characters, a QR code can store over 4,000 alphanumeric characters.

How many of the statements given above are correct?

A. Only one
B. Only two
C. All three
D. None

Correct Answer: C

Explanation:

All statements are correct: QR codes are 2D and can store data both vertically and horizontally, allowing for much higher density than 1D barcodes.

8. Consider the following statements:

1. Passive sensors in remote sensing measure natural energy that is either reflected (sunlight) or emitted by the Earth.
2. Active sensors provide their own source of energy, such as a laser or radar, to illuminate the objects they observe.
3. Remote sensing applications are limited strictly to land-based agriculture and cannot be used for oceanography or weather forecasting.

How many of the statements given above are correct?

A. Only one
B. Only two
C. All three
D. None

Correct Answer: B

Explanation:

- **Statements 1 and 2 are correct:** These define the two primary types of sensing.
- **Statement 3 is incorrect:** Remote sensing has wide applications, including monitoring ocean currents and predicting hurricanes.

9. Consider the following statements:

1. LiDAR uses pulsed laser light to measure distances and create high-resolution 3D maps of the Earth's surface.
2. Bathymetric LiDAR utilizes near-infrared light to map land surfaces, while Topographic LiDAR uses green light to penetrate water.
3. LiDAR data is essential for creating Digital Elevation Models (DEMs) used in Geographic Information Systems (GIS).

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

Correct Answer: C

Explanation:

- **Statement 1 is correct:** It measures the time of flight of laser pulses to calculate elevation.
- **Statement 2 is incorrect:** Topographic uses near-infrared; Bathymetric uses green light (because green light penetrates water better).
- **Statement 3 is correct:** It is a primary source for high-accuracy 3D terrain modeling.

10. Consider the following statements regarding the progression of mobile network generations:

1. The transition from 4G LTE to 5G is characterized by a significant reduction in latency, reaching as low as approximately 1 millisecond.
2. 5G technology utilizes a combination of Sub-6 GHz bands and millimeter-wave (mmWave) frequencies to achieve high throughput.
3. 6G technology is expected to operate in the Terahertz (THz) spectrum, enabling data rates exceeding 100 Gbps and deep AI integration.

How many of the statements given above are correct?

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

Correct Correct Answer: (c)

Statement-wise Explanation:

- **Statement 1 is correct:** One of the primary goals of 5G is Ultra-Reliable Low Latency Communication (URLLC). While 4G latency typically ranges from 20–40 ms, 5G aims for a latency of ~1 ms, which is critical for real-time applications like autonomous driving and remote surgery.
- **Statement 2 is correct:** 5G deployments are diverse. They use the Sub-6 GHz range (for broader coverage) and mmWave bands (above 24 GHz) to provide the massive bandwidth required for high-speed data and IoT connectivity.
- **Statement 3 is correct:** 6G is the next frontier, designed to use frequencies between 100 GHz and 3 THz. This jump in the electromagnetic spectrum allows for extreme data speeds (100+ Gbps) and supports "Intelligence of Everything" through native AI integration.

Generation	Latency	Spectrum Frequency	Key Shift
4G	20-40 ms	Low (MHz/Lower GHz)	Data & Voice (VoLTE)
5G	~1 ms	Medium to High (up to 40 GHz)	IoT & Low Latency
6G	< 1 ms	Ultra-High (Terahertz)	AI & Massive Connectivity

Information and Communication Technology -II

1. Consider the following statements:

1. LTE (Long Term Evolution) uses an All-IP architecture that integrates voice, video, and data services on a single Internet Protocol network.
2. VoLTE (Voice over LTE) requires the device to switch back to 2G or 3G networks to complete a voice call, which is why call setup time is increased.
3. VoLTE allows for the simultaneous use of high-speed data and voice calls without interruptions.

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

Answer: (c)

Explanation:

- **Statement 1 is correct:** LTE is designed as a packet-switched IP network for better efficiency.
- **Statement 2 is incorrect:** One of the main benefits of VoLTE is that it does not need to fall back to older 2G/3G networks; it carries voice as data packets over LTE, reducing setup time to ~2 seconds.
- **Statement 3 is correct:** Unlike older standards, VoLTE supports high-definition voice and data usage at the same time.

2. Consider the following statements regarding 5G networks:

1. Standalone (SA) 5G operates using a dedicated 5G core and equipment, functioning independently of existing 4G infrastructure.
2. Non-Standalone (NSA) 5G is primarily used to enable features like network slicing, which are not possible in Standalone modes.
3. The NSA mode allows for a faster and more cost-effective rollout by leveraging the existing 4G core network.

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

Answer: (c)
Explanation:

- **Statement 1 is correct:** SA 5G is the true 5G that doesn't rely on 4G.
- **Statement 2 is incorrect:** Features like network slicing and full 5G flexibility are characteristic of Standalone (SA) 5G, not NSA.
- **Statement 3 is correct:** NSA is a transitional step where operators use 4G cores to provide 5G speeds quickly.

3. Consider the following statements regarding VoIP:

1. VoIP converts voice signals into digital packets and transmits them over a circuit-switched traditional telephone network.
2. It allows for easy integration with other digital communication tools such as video conferencing, email, and call forwarding.

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

Answer: (b)
Explanation:

- **Statement 1 is incorrect:** VoIP transmits data over a packet-switched network (the Internet), not a traditional circuit-switched network (PSTN).
- **Statement 2 is correct:** Since it is internet-based, it integrates seamlessly with modern digital software and tools.

4. Consider the following statements regarding Wi-Fi Calling:

1. VoWiFi requires users to pay additional international roaming charges because the call is routed through an external Wi-Fi network.
2. It enables seamless switching between LTE and Wi-Fi networks to ensure uninterrupted calls in areas with poor cellular reception.

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

Answer: (b)
Explanation:

- **Statement 1 is incorrect:** Users generally do not pay extra for these calls as they utilize the existing broadband connection.
- **Statement 2 is correct:** Its primary purpose is to extend coverage into shadow zones or buildings where cellular signals are weak, allowing the call to move between Wi-Fi and LTE without dropping.

5. Consider the following statements regarding Edge Computing:

1. It involves processing data closer to the source of data generation rather than relying solely on a centralized cloud-based data center.
2. By processing data locally, it significantly increases latency, making it unsuitable for real-time applications like autonomous vehicles.
3. It helps in reducing the volume of data that needs to be transmitted over the network to the central core.

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

Answer: (c)

Explanation:

- **Statement 1 is correct:** Edge computing moves compute to the edge of the network.
- **Statement 2 is incorrect:** It decreases latency (delays) by avoiding the long trip to a central server, making it essential for real-time tech like self-driving cars.
- **Statement 3 is correct:** It saves bandwidth by filtering or processing data at the source.

6. Consider the following statements:

1. A Digital Twin is a virtual representation of a physical object, process, or system that serves as its real-time digital counterpart.
2. This technology is used exclusively for creating video games and has no application in urban planning or industrial manufacturing.
3. Digital twins rely solely on historical data and cannot receive real-time updates from the physical object via sensors.

Which of the statements given above are correct?

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

Answer: (a)

Explanation:

- **Statement 1 is correct:** This is the accurate definition.
- **Statement 2 is incorrect:** It has massive applications in Smart Cities, healthcare (digital twins of organs), and predictive maintenance in factories.
- **Statement 3 is incorrect:** A key feature is real-time synchronization via IoT sensors.

7. Consider the following statements regarding cellular infrastructure sharing:

1. Passive sharing involves operators sharing physical structures like towers and base stations while maintaining their own radio equipment.
2. Active sharing involves the joint operation and management of electronic infrastructure components by multiple operators.
3. Platform sharing can lead to significant cost reductions and accelerated deployment of new technologies like 5G.

How many of the statements given above are correct?

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

Answer: (c)
Explanation:
All statements are correct: Platform sharing (active, passive, or hybrid) is a collaborative model used by Mobile Network Operators (MNOs) to optimize resources and efficiency.

8. Consider the following statements:
1. **Network Slicing:** A technology that allows a single physical 5G network to be partitioned into multiple virtual networks tailored for specific services.
2. **O-RAN (Open Radio Access Network):** A proprietary, closed architecture that prevents the interoperability of hardware from different vendors.
3. **Shared Spectrum:** A model where operators optimize capacity by sharing radio frequency resources to reduce costs.

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

Answer: (b)
Explanation:
- **Statement 1 is correct:** It creates virtual "slices" for different needs (e.g., one slice for emergency services, another for low-power IoT).
- **Statement 2 is incorrect:** O-RAN is an open and modular architecture designed specifically to **enable** interoperability and prevent vendor lock-in.
- **Statement 3 is correct:** Spectrum sharing is a key efficiency strategy.

9. Consider the following statements:
1. Optical fibers transmit data using electrical pulses, which makes them immune to electromagnetic interference.
2. Total Internal Reflection occurs when light traveling in a rarer medium strikes the boundary of a denser medium at an angle less than the critical angle.
3. In optical fibers, light is reflected back into the denser medium (glass/plastic) allowing it to travel long distances with minimal loss.

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

Answer: (a)
Explanation:
- **Statement 1 is incorrect:** They use light pulses, not electrical pulses.

- **Statement 2 is incorrect:** TIR occurs when light moves from a denser medium to a rarer medium (like glass to air) and the angle of incidence is greater than the critical angle.
- **Statement 3 is correct:** This is how data is guided through the fiber core.

10. Consider the following statements:

1. The Surface Web consists of encrypted content that requires specific software like Tor to access and is primarily used for illegal activities.
2. The Deep Web represents the portion of the World Wide Web that is indexed by standard search engines like Google and Bing.
3. The Dark Web includes password-protected databases, private social media profiles, and medical records that are not accessible to the general public.

How many of the statements given above are correct?

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

Answer: (d)

Explanation: (All statements are swiped/incorrect)

- **Statement 1 refers to the Dark Web.**
- **Statement 2 refers to the Surface Web.**
- **Statement 3 refers to the Deep Web.**
- **Surface Web** (Indexed/Public), **Deep Web** (Unindexed/Private/Legal like your Gmail), **Dark Web** (Encrypted/Anonymized).

Information and Communication Technology -III

1. Consider the following statements:

1. White Space Internet utilizes the unused frequency spectrum situated between active television channels for wireless broadband.
2. This technology is restricted to short-range line-of-sight communication and cannot penetrate physical obstacles like foliage or buildings.

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

Correct Answer: (a)

Explanation:

- **Statement 1 is correct:** White spaces refer to the gaps in the TV spectrum that can be used for long-range, cost-effective internet.
- **Statement 2 is incorrect:** One of the primary advantages of White Space Internet is its ability to penetrate obstacles like buildings, hills, and foliage, making it superior to standard Wi-Fi for rural coverage.

2. Consider the following statements regarding Blockchain Technology:

1. It is used in financial services for the operation of Central Bank Digital Currencies (CBDC) like the e-Rupee.
2. Blockchain-as-a-Service (BaaS) allows third-party providers to offer cloud-based solutions to simplify application development.
3. It can be utilized for copyright management and protecting intellectual property data.

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

Correct Answer: (d)

Explanation:

- **Statement 1 is correct:** The e-Rupee launched by RBI is built on blockchain/DLT technology.
- **Statement 2 is correct:** BaaS is a model where companies use cloud solutions to build and host their blockchain apps.
- **Statement 3 is correct:** Companies like Sony Music have demonstrated its use in managing digital rights and royalties.

3. Consider the following statements regarding NFTs:

1. NFTs are unique digital assets that represent ownership of items and are assigned unique identification codes on a blockchain.
2. Unlike cryptocurrencies, NFTs are fungible, meaning one unit can be swapped for another identical unit of the same value.
3. NFTs can be used to represent physical real-world items, such as real estate, as well as digital art.

Which of the statements given above are correct?

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

Correct Answer: (b)

Explanation:

- **Statement 1 is correct:** They are distinct digital tokens with metadata that proves ownership.
- **Statement 2 is incorrect:** NFTs are Non-Fungible (unique). Fungible items are things like cash or Bitcoin where every unit is the same.
- **Statement 3 is correct:** NFTs are increasingly being used to tokenize physical assets like collectibles and property.

4. Match the following generations of the World Wide Web:

List I (Web Stage)	List II (Characteristics)
A. Web 2.0	1. Semantic Web / Decentralization / Blockchain
B. Web 3.0	2. Symbiotic Web / Seamless physical-biological integration

C. Web 4.0	3. Emotional Web / Understands user values & preferences
D. Web 5.0	4. Dynamic content / Social Media / Interactive pages

Select the correct code:
(a) A-4, B-1, C-2, D-3
(b) A-1, B-4, C-3, D-2
(c) A-4, B-2, C-1, D-3
(d) A-1, B-2, C-3, D-4

Correct Answer: (a)
Explanation:

- **Web 2.0:** Shift from static text to social/interactive (e.g., Facebook, YouTube).
- **Web 3.0:** Decentralized web where users own data via blockchain.
- **Web 4.0:** Integration of web with human consciousness and the physical world.
- **Web 5.0:** The Emotional Web that interprets and responds to human feelings.

5. Consider the following statements:
1. Cryptocurrencies are decentralized digital assets that rely on a central bank for value regulation and security.
2. In India, the government has introduced a 30% tax on income from cryptocurrency transactions.
3. The Supreme Court of India has upheld the RBI's 2018 circular that banned banks from facilitating any cryptocurrency-related transactions.

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

Correct Answer: (a)
Explanation:

- **Statement 1 is incorrect:** Cryptocurrencies are decentralized and not controlled by any central authority or bank.
- **Statement 2 is correct:** A 30% tax on virtual digital assets was introduced in the 2022 Budget.
- **Statement 3 is incorrect:** The Supreme Court overturned the RBI ban in 2020, allowing financial institutions to deal with crypto exchanges again.

6. Consider the following statements regarding CBDC:
1. It is a digital form of legal tender issued and regulated by the Reserve Bank of India.
2. CBDC is a type of cryptocurrency where the market determines its value through supply and demand.

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

Correct Answer: (a)
Explanation:

- **Statement 1 is correct:** It is a digital version of the sovereign currency (e-Rupee).
- **Statement 2 is incorrect:** CBDC is not a cryptocurrency. Its value is fixed by the central bank and is identical to physical cash, unlike cryptocurrencies which are volatile private assets.

7. Consider the following statements regarding e-RUPI:

1. It is a pre-paid, one-time voucher system developed by the National Payments Corporation of India (NPCI).
2. It functions as a digital currency that can be stored in a wallet and used for any general-purpose transaction by the public.

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

Correct Answer: (a)
Explanation:

- **Statement 1 is correct:** It is a person-specific and purpose-specific digital voucher.
- **Statement 2 is incorrect:** e-RUPI is not a currency but a payment instrument (voucher). It is leaked/issued for specific uses (like vaccine subsidies or fertilizers) and cannot be used for general shopping like cash.

8. Consider the following statements:

1. The National Strategy on Blockchain (2021) aims to promote e-governance services and state-specific blockchain applications.
2. NBFLite is a blockchain sandbox platform developed by the RBI to facilitate international crypto-trading for startups.
3. Under the Digital India initiative, the Union Government has recognized blockchain as a key emerging technology.

Which of the statements given above are correct?

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

Correct Answer: (b)
Explanation:

- **Statement 1 is correct:** The strategy focuses on using blockchain for transparency in government services.
- **Statement 2 is incorrect:** NBFLite was developed by the Ministry of Electronics & IT (MeitY), not RBI, and it is for capacity building and research, not crypto-trading.
- **Statement 3 is correct:** MeitY promotes blockchain for a secure and unified digital ecosystem.

9. Consider the following statements regarding Encryption:

1. Asymmetric Encryption uses a single, shared key for both the process of scrambling and descrambling data.
2. End-to-End Encryption (E2EE) ensures that only the communicating users can read messages, preventing ISPs and service providers from accessing the data.

3. WhatsApp and Signal are examples of messaging platforms that utilize E2EE for user privacy.

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

Correct Answer: (b)

Explanation:

- **Statement 1 is incorrect: Symmetric** encryption uses one key. Asymmetric encryption uses two keys (Public and Private).
- **Statement 2 is correct:** E2EE protects data in transit so that only the devices at the ends have the keys to decrypt it.
- **Statement 3 is correct:** These apps use E2EE by default to secure chats.

10. Consider the following statements regarding QKD:

1. Unlike traditional cryptography which relies on mathematical complexity, QKD bases its security on the fundamental laws of quantum mechanics.
2. In a QKD system, any attempt by an eavesdropper to intercept the key will disturb the quantum bits (qubits), thereby alerting the legitimate users.

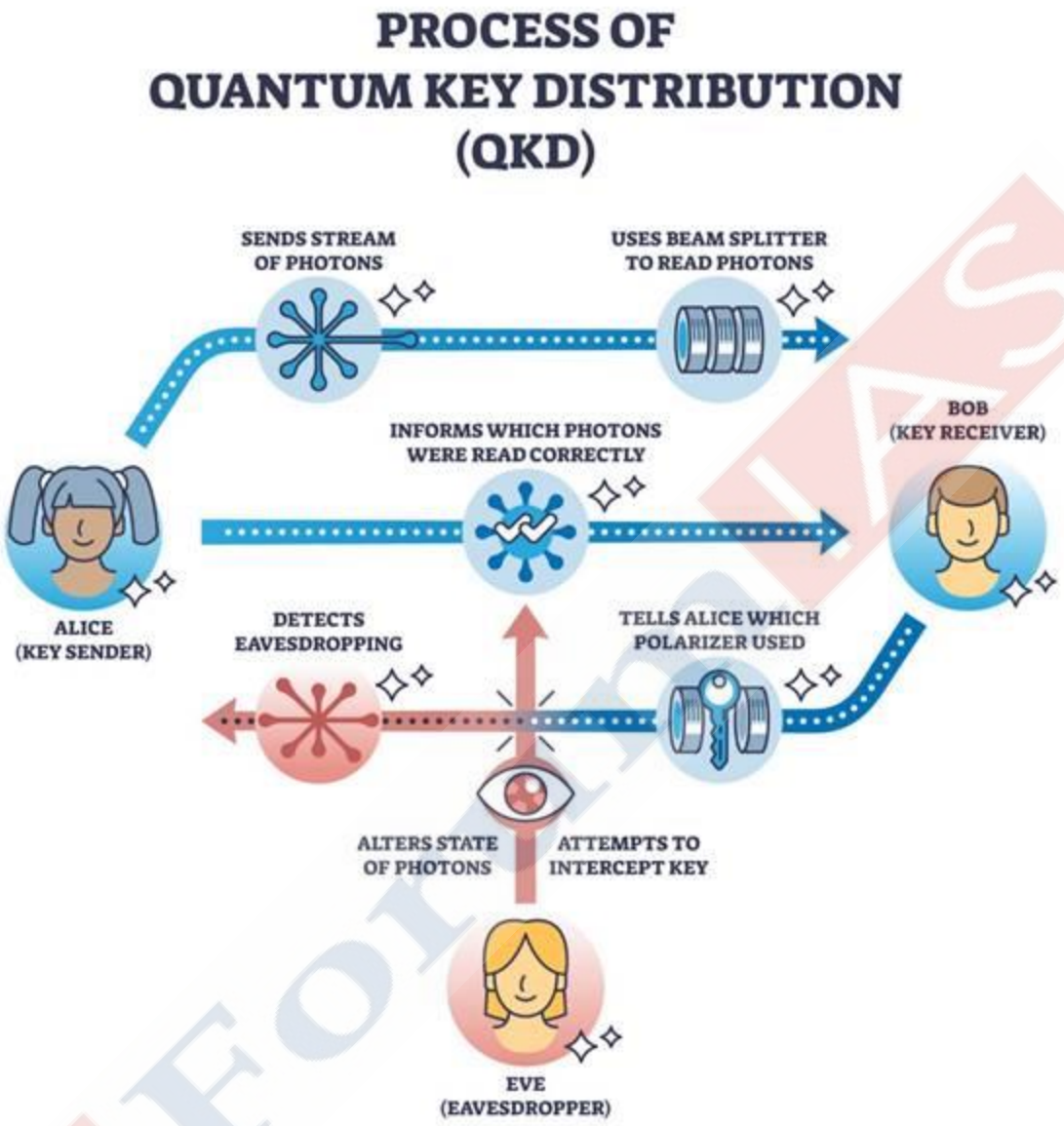
Which of the statements given above is/are correct?

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

Correct Answer: (c)

Explanation:

- **Statement 1 is correct:** Traditional encryption can be cracked by powerful computers; QKD is "unconditionally secure" because it relies on physics.
- **Statement 2 is correct:** In quantum physics, the act of observing/measuring a system changes it. If an eavesdropper tries to read the qubit, the disturbance is immediately detectable by the sender and receiver.


PROCESS OF
QUANTUM KEY DISTRIBUTION
(QKD)
SENDS STREAM OF PHOTONS
USES BEAM SPLITTER TO READ PHOTONS
BOB (KEY RECEIVER)
INFORMS WHICH PHOTONS WERE READ CORRECTLY
ALICE (KEY SENDER)
DETECTS EAVESDROPPING
TELLS ALICE WHICH POLARIZER USED
ALTERS STATE OF PHOTONS
ATTEMPTS TO INTERCEPT KEY
EVE (EAVESDROPPER)