ForumIAS

Prelims Marathon

3rd week April, 2026

HISTORY
ECONOMICS
POLITY
SCIENCE AND TECHNOLOGY
GEOGRAPHY AND ENVIRONMENT

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Human Diseases

1. Consider the following statements regarding Messenger RNA (mRNA) vaccines:

1. They are capable of eliciting both innate and adaptive immune responses.
2. They utilize a cell-free process for production, enabling rapid development and large-scale manufacturing.
3. mRNA vaccines possess higher inherent stability and thermotolerance compared to conventional inactivated virus 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:

· **Statement 1 and 2 are correct:** mRNA vaccines work by providing the genetic code for cells to produce an antigen, triggering a robust immune response (1). Because they are produced via chemical synthesis rather than in cell cultures, they allow for very fast production cycles (2).

- **Statement 3 is incorrect:** A major drawback of mRNA vaccines is their instability. They are highly sensitive to temperature and typically require ultra-cold chain storage (e.g., -70°C for Pfizer) to prevent the mRNA from degrading.

2. Which one of the following conditions is not categorized as an infectious/epidemic disease?

(a) Ebola Virus Disease
(b) Bells Palsy
(c) Cholera
(d) Lyme Disease

Correct Answer: (b)

Explanation:

· **Ebola, Cholera, and Lyme Disease** are all caused by pathogens (viruses, bacteria, and bacteria-carrying ticks respectively) and can spread through populations.

- **Bells Palsy** is a neurological condition causing temporary weakness or paralysis of the facial muscles. It is not a communicable or epidemic disease; it is generally believed to be caused by inflammation of the facial nerve, often linked to viral reactivation (like Herpes) but not spread as an epidemic.

3. The terms SDN-1, SDN-2, and SDN-3 are frequently discussed in scientific literature in the context of:

(a) Biological methods for carbon sequestration.
(b) Targeted genome editing in organisms using Site-Directed Nucleases.
(c) Developing next-generation antimicrobial resistance coatings.
(d) Enhancing the efficiency of Third-Generation Biofuels.

Correct Answer: (b)

Explanation:

SDN stands for Site-Directed Nucleases. These are categories of gene editing (like CRISPR).

- **SDN-1** involves small insertions/deletions without external DNA.
- **SDN-2** uses a small repair template to edit DNA.
- **SDN-3** involves inserting large segments of foreign DNA.

The Government of India recently exempted SDN-1 and SDN-2 from the stringent GM regulations applied to transgenic crops.

4. The National Centre for Disease Informatics and Research (NCDIR), which maintains the National Cancer Registry Programme, operates under the administrative aegis of:
(a) Ministry of Health and Family Welfare
(b) Indian Council of Medical Research (ICMR)
(c) NITI Aayog
(d) Council of Scientific & Industrial Research (CSIR)

Correct Answer: (b)
Explanation:
The NCDIR is a constituent institute of the Indian Council of Medical Research (ICMR). It is primarily involved in data informatics regarding cancer, diabetes, and cardiovascular diseases in India.

5. Which of the following statements best describes the phenomenon of Brood Parasitism?
(a) A virus utilizing the hosts cellular machinery to synthesize its own viral proteins.
(b) An organism that feeds exclusively on the dead and decaying remains of its host.
(c) A bird species that relies on others to raise its young by laying eggs in their nests.
(d) A plant parasite that attaches to a host only for structural support without taking nutrients.

Correct Answer: (c)
Explanation:
Brood parasitism is a type of social parasitism. A classic example is the Cuckoo (Koel) and the Crow. The cuckoo lays its eggs in the crows nest, and the crow (the host) incubates them and feeds the hatchlings, often at the expense of its own biological offspring.

6. The term Evil Quartet is used by ecologists to describe the four major drivers of which of the following?
(a) Global Climate Change
(b) Biodiversity Loss and Extinction
(c) Desertification of Arid Lands
(d) Marine Plastic Pollution

Correct Answer: (b)
Explanation:
The Evil Quartet identifies the four primary causes of biodiversity loss:

1. Habitat Loss and Fragmentation (the most important).
2. Over-exploitation.
3. Alien Species Invasions.
4. Co-extinctions.

7. Consider the following statements regarding viruses:
1. Certain viruses possess the ability to cross the blood-brain barrier and directly invade Central Nervous System (CNS) tissues.
2. Bacteriophages (viruses that infect bacteria) typically possess double-stranded DNA as their genetic material.

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:** Viruses like Rabies, Polio, and Japanese Encephalitis are neurotropic, meaning they can directly infect the CNS.

- **Statement 2 is correct:** Most known bacteriophages have dsDNA genomes, although some smaller groups carry ssDNA or RNA.

8. Consider the following diseases/pathogens:
I. Gonorrhea
II. Tuberculosis
III. Hepatitis B
IV. Human Immunodeficiency Virus (HIV)
V. Syphilis
How many of the above are classified as Sexually Transmitted Infections (STIs)?
(a) Only two
(b) Only three
(c) Only four
(d) All the five

Correct Answer: (c)
Explanation:

· Gonorrhea, Hepatitis B, HIV, and Syphilis (not in the list but implied in STIs) are all STIs.

- Tuberculosis (II) is an airborne respiratory disease spread through droplets and is not classified as an STI.
- *Note:* Pyelonephritis (from your original list) is a kidney infection, usually a complication of a UTI, not primarily an STI.

9. Consider the following table regarding vitamins:

Vitamin	**Primary Source**	**Deficiency Disease**
I. Vitamin A	Dairy & Carrots	Night Blindness
II. Vitamin B2	Leafy Vegetables	Skin lesions (Ariboflavinosis)
III. Vitamin K	Green Vegetables	Impaired Blood Clotting
IV. Vitamin D	Sunlight & Fish	Rickets

In how many of the above rows is the information correctly matched?

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

Correct Answer: (c)
Explanation:

- Rows I, II, and IV are correctly matched.
  - Row III is incorrectly matched in your provided text: Vitamin K deficiency leads to excessive bleeding (haemorrhage) due to non-clotting of blood, not Anaemia (which is usually associated with Iron, Vitamin B12, or Folic Acid).

10. Consider the following modes of transmission with regard to the Human Immunodeficiency Virus (HIV):

1. Transfusion of contaminated blood or blood products.
2. Transmission from mother to child via breast milk.
3. Sharing utensils or food with an HIV-positive person.

In how many of the above ways can HIV be transmitted from one person to another?
(a) Only one
(b) Only two
(c) All the three
(d) None

Correct Answer: (b)
Explanation:

- **Statement 1 and 2 are correct:** HIV is transmitted through specific bodily fluids: blood, semen, vaginal fluids, and breast milk.
  - **Statement 3 is incorrect:** HIV is not transmitted through casual contact such as sharing food, water, utensils, coughing, sneezing, or hugging. The virus does not survive long outside the human body.

Diseases and Impacts

1. Consider the following statements regarding Hepatitis B:

1. The Hepatitis B virus (HBV) is significantly more resilient and infectious than the Human Immunodeficiency Virus (HIV).
2. Chronic infection with Hepatitis B is a primary leading cause of hepatocellular carcinoma (liver cancer).

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:** Hepatitis B is highly contagious—estimated to be 50 to 100 times more infectious than HIV. It can survive outside the body for at least 7 days.

- **Statement 2 is correct:** Long-term (chronic) Hepatitis B causes liver inflammation that can lead to cirrhosis and eventually liver cancer.

2. Regarding the H1N1 virus (Swine Flu), consider the following statements:

1. Antiviral drugs, rather than antibiotics, form the primary line of medical treatment for the infection.
2. Culling of the entire pig population in an epidemic area is the mandatory protocol for preventing the spread of the virus to humans.

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:** H1N1 is a virus; antibiotics only treat bacterial infections. Antivirals like Oseltamivir (Tamiflu) are used for treatment.

- **Statement 2 is incorrect:** Swine flu is primarily spread through human-to-human contact. While it originated in pigs, mass culling is generally used for Bird Flu (Avian Influenza) rather than standard seasonal Swine Flu outbreaks.

3. With reference to Dengue fever, consider the following statements:

1. It is a viral disease primarily transmitted by the *Aedes aegypti* mosquito.
2. Retro-orbital pain (pain behind the eyes) and hemorrhagic manifestations like bleeding from gums are characteristic clinical symptoms.

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:** Dengue is caused by the Dengue Virus (DENV), not a protozoan.

- **Statement 2 is correct:** Breakbone fever is known for severe muscle/joint pain, pain behind the eyes (retro-orbital), and in severe cases (Dengue Hemorrhagic Fever), bleeding from the nose or gums.

4. Which of the following diseases affecting milching animals are classified as infectious?

1. Foot and Mouth Disease
2. Anthrax
3. Black Quarter
4. Cowpox

Select the correct answer using the code given below:

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

Correct Answer: (d)

Explanation:

All four are infectious. Foot and Mouth Disease and Cowpox are viral; Anthrax and Black Quarter (Blackleg) are highly infectious bacterial diseases.

5. Which of the following pairs is correctly matched?

(a) Tuberculosis and Plague: Viral Diseases
(b) AIDS and Syphilis: Hereditary Disorders
(c) Hemophilia and Color Blindness: Sex-linked Recessive Disorders
(d) Diphtheria and Pneumonia: Protozoan Diseases

Correct Answer: (c)

Explanation:

- Hemophilia and Color Blindness are classic X-linked genetic disorders.
  - TB and Plague are bacterial. Syphilis is bacterial, but AIDS is viral. Diphtheria and Pneumonia are bacterial.

6. Consider the following statements:

1. Viruses are capable of surviving and remaining infective in deep ocean waters.
2. Certain viruses, known as bacteriophages, specifically target and infect bacterial cells.
3. Viruses can manipulate the cellular transcriptional machinery of a host to replicate their own genome.

How many of the statements given above are correct?

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

Correct Answer: (c)

Explanation:

- **Statement 1 is correct:** Marine viruses are the most abundant biological entities in the ocean.
  - **Statement 2 is correct:** Bacteriophages are viruses that eat bacteria.
  - **Statement 3 is correct:** Viruses lack their own machinery; they hijack the host's transcription and translation systems to produce viral proteins.

7. Which of the following statements regarding the adaptability of microorganisms is/are correct?

1. Some thermophilic microorganisms can survive and reproduce in environments exceeding 100°C.
2. Certain acidophilic microorganisms can thrive in environments with a pH level as low as 1 or 2.

Select the correct answer using the code given below:

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

Correct Answer: (c)

Explanation:

- **Statement 1 is correct:** Hyperthermophiles (mostly Archaea) thrive in hydrothermal vents where temperatures exceed boiling point.

- **Statement 2 is correct:** Acidophiles grow in highly acidic conditions like volcanic pools or mine drainage.

8. Consider the following statements regarding the human immune system:

1. B-cells are primarily responsible for humoral immunity by producing antibodies that circulate in blood plasma.
2. T-cells directly attack infected cells and coordinate the overall immune response also produce antibodies.

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 correct: B-cells:** Mature in Bone marrow; produce antibodies (Humoral).

· **Statement 2 incorrect: T-cells:** Mature in Thymus; responsible for Cell-mediated immunity. T-cells directly attack infected cells and coordinate the overall immune response but do not produce antibodies.

9. With reference to Probiotics, consider the following statements:

1. They are live microorganisms consisting of specific strains of both bacteria and yeasts.
2. They are laboratory-synthesized organisms that do not naturally inhabit the human body.
3. They aid in the breakdown of lactose and support digestive health.

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 & 3 are correct:** Probiotics often include *Lactobacillus* (bacteria) and *Saccharomyces boulardii* (yeast). They help digest milk sugars.

- **Statement 2 is incorrect:** Probiotics are good microbes similar to those already living naturally in the human gut.

10. In a primary ecological succession on a bare rocky surface, which of the following organisms are most likely to be found surviving without any soil?

1. Lichens
2. Mosses
3. Ferns
4. Mushrooms

Select the correct answer using the code given below:

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

Correct Answer: (b)
Explanation:

· **Lichens** are the ultimate pioneer species that can grow on bare rock by secreting acids to break down the minerals.

- **Mosses** typically follow lichens.
- **Ferns** usually require at least a thin layer of soil. Mushrooms are fungi that require organic matter (decomposing material) to survive, which is not found on bare rock.

Biological And Health Sciences

1. Consider the following statements:

1. Adenoviruses possess double-stranded DNA genomes, whereas Retroviruses possess double-stranded RNA genomes.
2. The common cold can be caused by an Adenovirus, while AIDS is caused by a Retrovirus.
3. Retroviruses use the enzyme reverse transcriptase to integrate their genetic material into the host's DNA.

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:** Adenoviruses possess double-stranded DNA genomes, whereas Retroviruses possess single-stranded RNA genomes. Unlike the original prompt's incorrect premise, Adenoviruses are dsDNA viruses. Retroviruses (like HIV) are ssRNA viruses.

- **Statement 2 is correct:** Adenoviruses are a common cause of respiratory infections (cold); HIV is a classic retrovirus.
- **Statement 3 is correct:** This is the defining characteristic of retroviruses, allowing them to turn RNA into DNA within a host cell.

2. Regarding the structural differences between plant and animal cells, consider the following statements:

1. Plant cells possess a rigid cell wall composed of plasma, which is absent in animal cells.
2. Both plant and animal cells possess a plasma membrane that regulates the entry and exit of substances.
3. Mature plant cells typically contain a single, large central vacuole, whereas animal cells contain multiple smaller vacuoles.

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: Plant cells possess a rigid cell wall composed of cellulose, which is absent in animal cells.

Statement 2&3 are correct:

- **Plasma Membrane (Both):** Acts as a selectively permeable barrier, controlling which substances (nutrients, waste) enter or exit both plant and animal cells.
- **Vacuole Difference (Plant vs. Animal):** Plant cells use one large central vacuole for storage and turgor pressure (rigidity), while animal cells typically contain smaller, temporary vacuoles for storage and transport.

3. Consider the following statements regarding Multidrug-Resistant (MDR) and Extensively Drug-Resistant (XDR) Tuberculosis:

1. MDR-TB is characterized by resistance to the two most powerful first-line drugs: Isoniazid and Rifampicin.
2. XDR-TB involves resistance to first-line drugs plus any fluoroquinolone and at least one of the three second-line injectable drugs.
3. The emergence of MDR and XDR strains is primarily driven by the misuse and mismanagement of antibiotic treatments.

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: (Multidrug-Resistant TB):** This type of TB is resistant to at least Isoniazid and Rifampicin, the two most powerful first-line drugs used to treat standard tuberculosis. Because these standard medicines fail, treatment requires longer, more complex, and more toxic second-line regimens.
- **Statement 2 is correct: (Extensively Drug-Resistant TB):** A more dangerous form of MDR-TB. It involves resistance to the first-line drugs (Isoniazid/Rifampicin), plus any member of the fluoroquinolone family, and at least one of the three second-line injectable drugs (amikacin, kanamycin, or capreomycin).
- **Statement 3 is correct: Cause of Resistance:** The primary driver of these resistant strains is human error, specifically the misuse, mismanagement, or premature interruption of treatment regimens. Poor quality drugs or incorrect dosages allow the bacteria to survive and develop genetic mutations that resist medication.

4. Consider the following statements regarding Aflatoxins:

1. They are highly toxic compounds primarily produced by certain species of b, such acteria as *Aspergillus flavus*.
2. Normal cooking processes, such as boiling or roasting, are generally insufficient to destroy these toxins in contaminated grains.

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:** Aflatoxins are potent poisons (mycotoxins) produced by certain molds, most notably *Aspergillus flavus*, which grow on crops like corn, peanuts, and nuts, particularly in warm, humid conditions. They are known to be strong carcinogens (causing liver cancer) and can cause acute health issues or death in both humans and animals.

· **Statement 2 is correct:** Aflatoxins are chemically stable and thermostable, meaning they can withstand high temperatures. Normal cooking methods—such as boiling, roasting, or steaming—do not destroy these toxins, so even cooked foods made from contaminated grains remain dangerous.

5. Consider the following pairs of plants and their common propagation methods:

1. Sweet Orange : Grafting
2. Jasmine : Layering
3. Banana : Stem Cuttings

Which of the pairs given above is/are correctly matched?

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

Correct Answer: (a)

Explanation:

Sweet orange is commonly grafted onto hardy rootstocks. Jasmine is frequently propagated by bending a branch to the ground (layering). Banana, however, is propagated via rhizomes or suckers, not stem cuttings.

6. Which of the following statements are correct?

1. Caffeine acts as a diuretic by increasing the excretion of water from the body.
2. Citric acid is commonly added to soft drinks to provide a tart flavor and act as a preservative.
3. Vitamin C (Ascorbic acid) is essential for the synthesis of collagen, which is vital for skin and bone health.

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

Correct Answer: (d)

Explanation:

All are correct. Citric acid cannot substitute for Ascorbic acid in nutrition.

7. Consider the following statements regarding Adult Stem Cells (ASCs) and Embryonic Stem Cells (ESCs):

1. ESCs are pluripotent, meaning they can differentiate into nearly any cell type in the body.
2. ASCs are generally multipotent, with their differentiation potential typically limited to cell types of their tissue of origin.
3. ESCs are derived from the inner cell mass of a blastocyst, while ASCs exist in various tissues throughout an individual's life.

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 correctly differentiate the two. ESCs have the highest potential (pluripotency), while ASCs act as a repair system for specific tissues (multipotency).

8. With reference to Synthetic Embryo Models (Human embryo models without sperm or eggs), consider the following statements:
1. These models are created using pluripotent stem cells that are reprogrammed to mimic the stages of early embryonic development.
2. Such models are currently intended for research into early pregnancy loss and genetic disorders rather than for reproductive cloning.

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:
Scientists use stem cells to recreate structures that resemble post-implantation embryos to study the black box of early human development without using actual biological embryos.

9. Which of the following statements correctly differentiates between saturated and unsaturated fatty acids?
1. Saturated fatty acids contain only single bonds between carbon atoms, allowing them to pack tightly and remain solid at room temperature.
2. Unsaturated fatty acids contain one or more double bonds, which creates kinks in the chain, typically keeping them liquid at room temperature.
3. Trans-fats are a type of unsaturated fat that has been industrially hydrogenated to behave like saturated fats.

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

Correct Answer: (d)
Explanation:
All are correct. Butter and ghee are saturated (solid); oils are unsaturated (liquid). Trans-fats are chemically modified unsaturated fats used to increase shelf life.

10. With reference to the components of human blood, consider the following statements:
1. Plasma, the liquid component, accounts for approximately 55% of the total blood volume.
2. Red Blood Cells (Erythrocytes) lack a nucleus at maturity to maximize space for hemoglobin.
3. Platelets (Thrombocytes) are the primary cell fragments responsible for blood coagulation (clotting).

How many of the statements given above are correct?

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

Correct Answer: (c)
Explanation:

- **Statement 1 is correct:** Plasma is >50%.
- **Statement 2 is correct:** Human RBCs are enucleated.
- **Statement 3 is correct:** White blood cells (from the original prompt) are for immunity; Platelets are for clotting.

Biological And Health Sciences Miscellaneous

1. Consider the following statements regarding the physiological effects of vitamin deficiencies:

1. The non-functioning of lachrymal (tear) glands is a significant symptom associated with Vitamin A deficiency.
2. Vitamin B1 deficiency can manifest as heart enlargement and gastrointestinal disturbances.
3. Vitamin C deficiency often results in pain in the joints and muscles due to impaired collagen synthesis.
4. Deficiency of Vitamin D is associated with an increased parathyroid hormone (PTH).

Which of the statements given above are correct?
(a) 1 and 2 only
(b) 2, 3 and 4 only
(c) 1, 2 and 3 only
(d) 1, 2, 3 and 4

Correct Answer: (c)
Explanation:

- **Statement 1 correct:** Vitamin A is vital for the health of epithelial tissues; deficiency leads to Xerophthalmia, where lachrymal glands stop producing tears.
- **Statement 2 correct:** Deficiency of B1 (Thiamine) causes Beriberi, which can be wet (affecting the heart) or dry (affecting the nervous system).
- **Statement 3 correct:** Vitamin C (Scurvy) causes muscle and joint pain.
- **Statement 4 incorrect:** Vitamin D deficiency is primarily associated with elevated levels of parathyroid hormone (PTH). Low vitamin D reduces calcium absorption, triggering the parathyroid glands to produce excess PTH, a condition known as secondary hyperparathyroidism. Vitamin D is crucial for calcium absorption; its lack causes the body to lose calcium through the kidneys.

2. Which of the following organelles in a eukaryotic cell contains its own DNA and is capable of semi-autonomous replication, apart from the nucleus?
(a) Centriole
(b) Golgi apparatus
(c) Lysosome
(d) Mitochondrion

Correct Answer: (d)
Explanation:

Mitochondria and Chloroplasts (in plants) contain their own circular DNA and ribosomes, supporting the endosymbiotic theory. This is known as extranuclear or cytoplasmic DNA.

3. With reference to the circulatory system in a healthy human, which one of the following statements is correct?

(a) Veins are significantly fewer in number and hold a smaller volume of blood compared to arteries.
(b) Formed elements (blood cells) constitute approximately 70% of the total blood volume.
(c) White Blood Cells (WBCs) are produced exclusively within the lymph nodes.
(d) In a normal blood count, the number of platelets is significantly higher than the number of White Blood Cells.

Correct Answer: (d)

Explanation:

(a) is incorrect: Veins are more numerous and act as blood reservoirs, holding about 65% of the body's blood.
(b) is incorrect: Blood cells constitute about 45%; Plasma is 55%.
(c) is incorrect: WBCs are produced in the bone marrow and matured in various lymphoid organs.
(d) is correct: A normal adult has 1.5–4.5 lakh platelets per microliter, whereas WBC count is only 4,000–11,000.

4. With reference to the functioning of the human kidney, consider the following statements:

1. Once the nitrogenous waste is removed, the filtered (cleaner) blood is returned to the systemic circulation via the renal artery.
2. In the nephron, essential substances like glucose are reabsorbed from the filtrate in the tubules and returned to the blood.

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:** The renal artery brings unclean blood *to* the kidney. Filtered, cleaner blood leaves the kidney through the Renal Vein.

- **Statement 2 is correct:** Selective reabsorption occurs in the Proximal Convoluted Tubule (PCT), where 100% of glucose is typically reabsorbed back into the peritubular capillaries.

5. Match List I (Substance) with List II (Physiological Role):

List I (Substance)	**List II (Role)**
I. Ptyalin	A) Converts Angiotensinogen to Angiotensin
II. Pepsin	B) Digests Starch

III. Renin	C) Digests Proteins
IV. Oxytocin	D) Induces Smooth Muscle Contraction

Codes:
(a) I-B, II-C, III-A, IV-D
(b) I-C, II-A, III-B, IV-D
(c) I-B, II-A, III-C, IV-D
(d) I-D, II-C, III-A, IV-B

Correct Answer: (a)
Explanation:
Ptyalin (Salivary Amylase) breaks down starch. Pepsin breaks down proteins in the stomach. Renin (enzyme from kidneys) is part of the blood pressure regulation system. Oxytocin induces labor and milk ejection by contracting smooth muscles.

6. Match List I (Drug/Chemical) with List II (Common Use):

List I (Chemical)	**List II (Use)**
I. Atropine	A) Local Anaesthesia
II. Ether	B) Relief in Angina (Heart trouble)
III. Nitroglycerine	C) Dilation of the Pupil
IV. Pyrethrin	D) Mosquito/Pest Control

Codes:
(a) I-C, II-A, III-B, IV-D
(b) I-A, II-C, III-B, IV-D
(c) I-B, II-D, III-A, IV-C
(d) I-C, II-A, III-D, IV-B

Correct Answer: (a)
Explanation:
Atropine dilates the pupil (mydriasis). Ether was a classic general anaesthetic. Nitroglycerine is a vasodilator used for heart pain. Pyrethrin is a natural insecticide derived from Chrysanthemums.

7. Match List I with List II regarding plant parts:

List I	List II (Botanical Part)
I. Fruit	A) Ovule
II. Seed	B) Leaf
III. Wood	C) Stem (Secondary Xylem)
IV. Starch	D) Mature Ovary

Codes:
(a) I-D, II-A, III-C, IV-B
(b) I-B, II-A, III-C, IV-D
(c) I-D, II-C, III-A, IV-B
(d) I-A, II-D, III-C, IV-B

Correct Answer: (a)
Explanation:
A fruit is a ripened ovary; a seed is a fertilized ovule. Wood is technically the secondary xylem of a stem. Starch is the primary storage polysaccharide synthesized in leaves (and stored in various parts).

8. Living organisms require various elements for survival. Which of the following groups consists exclusively of Macronutrients in the human body?
(a) Potassium, Manganese, Molybdenum, Calcium
(b) Potassium, Sodium, Magnesium, Calcium
(c) Sodium, Magnesium, Copper, Manganese
(d) Iron, Zinc, Copper, Molybdenum

Correct Answer: (b)
Explanation:
Macronutrients include Carbon, Hydrogen, Oxygen, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, and Sodium. Elements like Manganese, Molybdenum, Copper, and Zinc are Micronutrients (trace elements).

MCQ 9: Elemental Composition of Proteins
Proteins are complex organic compounds. Which of the following elements are present in the basic molecular structure of *all* proteins?
1. Carbon
2. Hydrogen
3. Oxygen
4. Nitrogen

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

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

Correct Answer: (d)
Explanation: All proteins are polymers of amino acids. An amino acid essentially contains an amine group (NH2), a carboxyl group (-COOH), and a side chain, all of which are built using Carbon, Hydrogen, Oxygen, and Nitrogen.

10. Which of the following correctly describes the primary role of Adenosine Triphosphate (ATP) in a living cell?
(a) It serves as the primary genetic material for inheritance.
(b) It acts as the energy currency, transferring energy for cellular processes.
(c) It is the main structural component of the cell wall.
(d) It is an enzyme responsible for protein synthesis.

Correct Answer: (b)
Explanation:
ATP is the molecule that captures chemical energy obtained from the breakdown of food molecules and releases it to fuel other cellular processes.

Life Science Miscellaneous

1. With reference to the components of human blood, consider the following statements:
1. Plasma, the straw-colored liquid component, constitutes approximately 55% of the total blood volume.
2. Red blood cells (Erythrocytes) contain the iron-rich protein hemoglobin, which is essential for the transport of oxygen.
3. White blood cells (Leukocytes) are primarily responsible for the coagulation of blood at the site of an injury.

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

Correct Answer: (b)
Explanation:
· **Statement 1 and 2 are correct:** Plasma is the major component (>50%) and RBCs carry oxygen via hemoglobin.
- **Statement 3 is incorrect:** White blood cells are part of the immune system. The cells primarily responsible for blood clotting (coagulation) are Platelets (Thrombocytes).

2. With reference to the human immune system, what does the term Innate Immunity refer to?
(a) An antigen-specific defense mechanism developed after exposure to a pathogen or vaccine.
(b) The first line of defense that provides immediate, non-specific protection against a broad range of pathogens.
(c) A type of immunological memory that allows for a rapid response upon a second encounter with a specific virus.
(d) Immunity mediated exclusively by specialized B-lymphocytes and T-lymphocytes.

Correct Answer: (b)

Explanation:

Innate immunity is present from birth. It includes physical barriers (skin, mucus) and non-specific cells (macrophages) that respond immediately to any foreign invader, unlike Adaptive Immunity, which is specific and acquired over time.

3. Consider the following statements regarding biomolecules and human physiology:

1. Carbohydrates serve as both immediate fuel and long-term energy reserves in the form of glycogen.
2. All enzymes known to biology are globular proteins in their chemical nature.
3. Certain symbiotic microorganisms in the human gut are responsible for synthesizing vitamins such as Vitamin K and B12.

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:** Glucose provides immediate energy; glycogen (in liver/muscles) acts as a reserve.
  - **Statement 2 is incorrect:** While most enzymes are proteins, certain RNA molecules called Ribozymes also act as enzymes.
  - **Statement 3 is correct:** Gut flora contribute significantly to our nutritional needs by synthesizing essential vitamins.

4. Consider the following statements regarding prokaryotic organisms:

1. They lack membrane-bound organelles such as mitochondria and the Golgi apparatus.
2. Their genetic material is localized in a region called the nucleoid, which is not enclosed by a nuclear envelope.
3. Some prokaryotes, such as certain bacteria, function as obligate intracellular parasites.

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:

Prokaryotes (Bacteria, Archaea) are characterized by the lack of a true nucleus. Some, like *Chlamydia* or *Rickettsia*, can only replicate inside a host cell, making them obligate intracellular parasites.

5. Bioluminescence is the production and emission of light by a living organism. This phenomenon primarily involves the biochemical oxidation of which of the following substances?

(a) Luciferin
(b) Bilirubin
(c) Melanin
(d) Lignin

Correct Answer: (a)

Explanation:

Commonly found in marine organisms like Ctenophores (comb jellies) and fireflies, where chemical energy is converted to light through the enzyme luciferase acting on luciferin. It is a key feature of the phylum Ctenophora (e.g., *Pleurobrachia* and *Ctenoplana*). Bioluminescence occurs when the pigment Luciferin reacts with oxygen, often facilitated by the enzyme luciferase. Bilirubin is a bile pigment, Melanin gives skin color, and Lignin is a structural polymer in plants.

6. With reference to the process of Transcription in eukaryotic cells, consider the following statements:

1. It involves the synthesis of an RNA molecule using a DNA strand as a template.
2. In eukaryotic cells, this process takes place primarily within the nucleus.
3. The enzyme RNA polymerase is the primary catalyst required for the synthesis of the RNA strand.

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:

Transcription is the first step of gene expression where DNA is copied into RNA. Since DNA is housed in the nucleus in eukaryotes, transcription happens there. RNA polymerase is the enzyme that reads the DNA and builds the RNA.

7. The pH scale is used to measure the hydrogen ion concentration in a solution. Arrange the following substances in decreasing order of their pH (from most basic to most acidic):

1. Lemon Juice
2. Milk of Magnesia
3. Caustic Soda (Sodium Hydroxide)

Select the correct answer using the code given below:

(a) 3-1-2
(b) 3-2-1
(c) 2-1-3
(d) 1-2-3

Correct Answer: (b)

Explanation:

- **Caustic Soda** is a strong base (pH approx 14).
- **Milk of Magnesia** is a mild base (pH approx 10.5$).
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Therefore, the decreasing order is 3 (Caustic Soda) > 2 (Milk of Magnesia) > 1 (Lemon Juice).

8. Consider the following statements regarding biological reproduction:

1. Asexual reproduction typically produces clones as it does not involve the fusion of gametes.
2. Sexual reproduction is a major driver of genetic diversity due to the shuffling of genes during meiosis.
3. Multicellularity is an absolute prerequisite for sexual reproduction.

How many of the statements given above are correct?

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

Correct Answer: (b)
Explanation:

· **Statement 1 and 2 are correct:** Asexual reproduction is efficient but lacks variation; sexual reproduction creates diversity.

- **Statement 3 is incorrect:** Many unicellular organisms (like certain protists and fungi) can reproduce sexually or undergo genetic exchange.

9. Which of the following specific cell types is responsible for the secretion of Insulin in the human body?
(a) Alpha cells of the Islets of Langerhans
(b) Beta cells of the Islets of Langerhans
(c) Hepatocytes of the liver
(d) Cells of the Adrenal Cortex

Correct Answer: (b)
Explanation:
The pancreas contains clusters called Islets of Langerhans. Beta cells produce Insulin (lowers blood sugar), while Alpha cells produce Glucagon (raises blood sugar).

10. In the context of aerobic respiration, in which part of the eukaryotic cell does the majority of ATP (Adenosine Triphosphate) synthesis occur?
(a) Nucleus
(b) Ribosomes
(c) Mitochondria
(d) Lysosomes

Correct Answer: (c)
Explanation:
Mitochondria are known as the powerhouse of the cell because they are the site of the Krebs cycle and the electron transport chain, which generate the bulk of the cell's ATP through aerobic respiration.

Biological And Health Sciences Miscellaneous

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(b) Ribosomes
(c) Mitochondria
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Correct Answer: (c)

Explanation:
Mitochondria are known as the powerhouse of the cell because they are the site of the Krebs cycle and the electron transport chain, which generate the bulk of the cell's ATP through aerobic respiration.

Cells and Tissues

1. Consider the following statements regarding the cell wall:
1. It is a rigid, non-living structure located outside the plasma membrane in plant cells and fungi.
2. It provides mechanical strength and structural support to the cell, protecting it against osmotic pressure.
3. It serves as the primary metabolic gatekeeper, controlling the selective permeability of all ions and organic molecules into the cytoplasm.

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:** The cell wall is a structural layer that provides protection and rigidity.
    - **Statement 3 is incorrect:** The cell wall is generally permeable to most small molecules. It is the Plasma Membrane (cell membrane) that is selectively permeable and controls the entry and exit of specific substances.

2. Consider the following pairs regarding the types of immunity and their components:
1. Physiological Barrier: Skin and Mucous membranes
2. Cellular Defence: Macrophages and Natural Killer cells
3. Chemical Mediators: Antibodies (Humoral immunity)

Which of the pairs given above are correctly matched?
(a) 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1 and 2 only

Correct Answer: (b)
Explanation:
- **Pair 1 is incorrectly matched:** Skin is a Physical/Anatomical barrier. Physiological barriers include body temperature, pH of the stomach, and tears.
    - **Pair 2 is correctly matched:** Macrophages are specialized cells that engulf and destroy pathogens.
    - **Pair 3 is correctly matched:** Antibodies are proteins (chemical mediators) that neutralize pathogens in body fluids.

3. With reference to Thrombectomy consider the following statements:
1. It is a minimally invasive surgical procedure specifically designed to remove a blood clot (thrombus) from a blood vessel.
2. It is considered the gold-standard emergency treatment for Hemorrhagic strokes caused by ruptured blood vessels.

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:** Thrombectomy removes clots to restore blood flow.
  - **Statement 2 is incorrect:** It is used for Ischemic strokes (caused by a clot). In a Hemorrhagic stroke, the vessel has burst; removing a non-existent clot is not the treatment, and thinning the blood or invasive mechanical removal could worsen the bleeding.

4. Consider the following statements regarding the complexity of cellular structures:
1. Prokaryotic cells are characterized by the presence of circular DNA that is not enclosed within a nuclear envelope.
2. Eukaryotic cells possess membrane-bound organelles, such as mitochondria, which are involved in specialized metabolic functions.

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:** Prokaryotes (Bacteria) have a nucleoid region instead of a true nucleus.
  - **Statement 2 is correct:** Eukaryotes (Plants/Animals) have highly organized compartmentalized organelles.

5. Consider the following table comparing cell types:

Feature	**Prokaryotic Cell**	**Eukaryotic Cell**
I. Nucleus	Absent	Present
II. Ribosomes	Larger	Smaller
III. Organelles	Lacks Mitochondria	Contains Mitochondria
IV. Cell Wall	Chemically simpler	Chemically complex

How many rows in the table above correctly match the features of the cell types?
(a) Only one
(b) Only two

(c) Only three
(d) All four

Correct Answer: (b)
Explanation:

- **Rows I and III are correct.**
  - **Row II is incorrect:** Prokaryotes have smaller ribosomes; Eukaryotes have larger ribosomes in the cytoplasm.
  - **Row IV is incorrect:** Prokaryotic cell walls (Peptidoglycan) are chemically more complex than the cellulose-based walls of plants.

6. Consider the following statements regarding plant tissues:
1. Parenchyma cells are relatively unspecialized and possess thin cellulose cell walls.
2. Collenchyma tissue provides mechanical support and flexibility, allowing plant parts to bend without snapping.
3. Sclerenchyma is composed of living cells that provide buoyancy to aquatic plants.

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.**
  - **Statement 3 is incorrect:** Sclerenchyma consists of dead cells with lignified walls (e.g., coconut husk). The tissue providing buoyancy in aquatic plants is a specialized parenchyma called Aerenchyma.

7. With reference to complex permanent tissues in plants, consider the following statements:
1. Both Xylem and Phloem are considered conducting tissues and together they constitute the vascular bundle.
2. Xylem is primarily responsible for the unidirectional transport of water and minerals from roots to leaves.
3. Phloem consists of dead cells that transport food products from the leaves to the rest of the plant.

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.**
  - **Statement 3 is incorrect:** Most cells in the Phloem (Sieve tubes, Companion cells) are living cells. Only Phloem fibers are dead. In Xylem, most cells (tracheids, vessels) are dead.

8. Consider the following statements regarding animal tissues:
1. Epithelial tissues serve as protective coverings and are the first to develop during embryonic growth.

2. Connective tissues, which bind and support other tissues, are derived from the mesodermal layer of the embryo.
3. Squamous epithelium is characterized by tall, pillar-like cells found in the lining of the stomach.

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.**
  - **Statement 3 is incorrect:** Squamous epithelium consists of flattened, scale-like cells. Tall, pillar-like cells are called Columnar epithelium, which are indeed found in the stomach lining.

9. Match the following organs of the Digestive System with their primary physiological roles:

Organ	**Primary Function**
I. Stomach	A) Absorption of the majority of nutrients
II. Small Intestine	B) Secretion of HCl and Pepsin
III. Large Intestine	C) Reabsorption of water and formation of feces
IV. Liver	D) Production of Bile for fat emulsification

Select the correct match:

(a) I-B, II-A, III-C, IV-D
(b) I-A, II-B, III-D, IV-C
(c) I-C, II-D, III-A, IV-B
(d) I-B, II-C, III-A, IV-D

Correct Answer: (a)

Explanation: The Stomach initiates protein digestion (B). The Small Intestine is the main site of nutrient absorption (A). The Large Intestine recovers water (C). The Liver produces bile (D).

10. Consider the following statements:

1. The Liver is the largest gland in the human body and performs critical detoxification of harmful substances.
2. The Pancreas functions as a dual gland, performing both exocrine (digestive enzymes) and endocrine (blood sugar regulation) roles.

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:** The liver produces bile and filters toxins.
- **Statement 2 is correct:** It is a heterocrine gland. It secretes pancreatic juice (exocrine) and hormones like Insulin/Glucagon (endocrine).