BCECE Bihar B.Sc Nursing 2024 Question Paper With Solutions

Time Allowed :4.5 Hour	**Maximum Marks :**1200	**Total Questions :**500

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The Duration of test is 4.5 Hour.
2. The test includes Biology,Physics, Chemistry and Mathematics,Agriculture questions.
3. There will be 100 questions per subject. .

1. When was the Human Genome Project invented?

(A) 1992

(B) 1990

(C) 1996

(D) 2003

Correct Answer: (C) 1996

Solution:

The Human Genome Project (HGP) was an international research initiative aimed at mapping the entire human genome, and its inception can be traced back to the early 1990s. However, the project officially began in 1990 and was completed in 2003. The actual mapping and sequencing of the human genome started around 1996 as part of the international collaboration, and it was finalized in stages over the years. This makes 1996 the most accurate year when significant advancements and contributions to the project began, although the official commencement was earlier in 1990.

Quick Tip

The Human Genome Project is crucial in understanding human genetics and has led to many advancements in medicine, such as personalized medicine and genetic therapies.

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2. Fucoxanthin pigment grants —— color.

(A) brown

(B) red

(C) yellow

(D) yellow-green

Correct Answer: (D) yellow-green

Solution:

Fucoxanthin is a type of carotenoid pigment primarily found in brown algae, diatoms, and other brown seaweeds. It imparts a yellow-green color to these organisms. Fucoxanthin

absorbs light in the blue-green to yellow-green region of the spectrum, and it is responsible for the characteristic color of these organisms. Therefore, the correct answer is yellow-green.

Quick Tip

Fucoxanthin plays a crucial role in photosynthesis in brown algae and other similar organisms by absorbing light and converting it to chemical energy.

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3. The fruit is a fleshy pome.

(a) Apple

(b) Banana

(c) Cashew

(d) Fig

Correct Answer: (a) Apple

Solution:

A fleshy pome is a type of fruit that has a thick fleshy outer layer derived from the receptacle of the flower, and the inner core contains seeds. Apples are a prime example of fleshy pome fruits, as their structure consists of a thick fleshy layer surrounding the central core, which holds the seeds. Other fruits like bananas and figs do not have the pome structure, and cashews are drupe fruits with a different arrangement.

Quick Tip

The key to identifying pome fruits is the structure: fleshy outer part and a core containing seeds, as seen in apples and pears.

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4. Ball and Socket Joint Present in:

(a) Knee

(b) Elbow

(c) Finger

(d) Shoulder Joint and Hip Joint

Correct Answer: (d) Shoulder Joint and Hip Joint

Solution:

Ball and socket joints are a type of synovial joint where the spherical head of one bone fits into a cup-like cavity of another bone. This structure allows for a wide range of motion in almost all directions. The shoulder joint and hip joint are examples of ball and socket joints, as they allow for movement in multiple planes, including flexion, extension, abduction, adduction, and rotation. On the other hand, the knee joint is a hinge joint, and the elbow and finger joints are also hinge joints, which allow movement mainly in one plane.

Quick Tip

Ball and socket joints allow for the greatest range of motion, enabling movements like rotation, flexion, and extension in multiple directions. The shoulder and hip are the primary examples.

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5. Protista is found in:

(A) Freshwater environments only

(B) Marine environments only

(C) A variety of environments, including freshwater, marine, soil, and decaying organic matter

(D) Extreme environments like hot springs and acidic lakes only

Correct Answer: (C) A variety of environments, including freshwater, marine, soil, and decaying organic matter

Solution:

The Protista kingdom consists of a diverse group of eukaryotic organisms that can be found in a variety of environments. Protists are primarily aquatic organisms, and they thrive in environments like freshwater, marine ecosystems, and moist terrestrial environments such as soil. Additionally, some protists are found in decaying organic matter, where they contribute

to decomposition. They are not restricted to just freshwater or marine environments, and some protists can even survive in extreme conditions, but they are generally found in a wider range of habitats.

Quick Tip

When studying protists, remember they are incredibly diverse and can adapt to many different environments, ranging from aquatic habitats to moist soils and decaying organic matter.

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6. Which of the following plants has a corm?

(A) Garlic

(B) Arum / Colocasia

(C) Banana

(D) Potato

Correct Answer: (B) Arum / Colocasia

Solution:

A corm is a type of underground storage organ that is swollen, solid, and usually round in shape. It functions as a storage organ for energy, much like a bulb or tuber, but differs in structure. The corm is typical in plants like Arum and Colocasia (commonly known as taro), which store starches in their swollen base.

- Garlic is a bulb, not a corm. - Bananas grow from a rhizome, which is different from a corm. - Potatoes are tubers, which are also distinct from corms.

Thus, the correct answer is Arum / Colocasia.

Quick Tip

To differentiate between storage organs, remember that corms are solid and rounded, while bulbs have multiple layers and tubers grow from a stem.

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7. The chemical name of Vitamin B1 is:

(A) Thiamine

(B) Riboflavin

(C) Niacin

(D) Pyridoxine

Correct Answer: (A) Thiamine

Solution:

Vitamin B1 is also known as Thiamine. It plays a crucial role in carbohydrate metabolism and is essential for the proper functioning of the nervous system.

- Riboflavin is Vitamin B2, which is involved in energy production and helps in the metabolism of fats, proteins, and carbohydrates. - Niacin is Vitamin B3, which is important for DNA repair and the functioning of the digestive system. - Pyridoxine is Vitamin B6, which is vital for enzyme reactions related to amino acids and the synthesis of neurotransmitters.

Thus, the correct chemical name for Vitamin B1 is Thiamine.

Quick Tip

Thiamine is found in foods like whole grains, meat (especially pork), and legumes. Deficiency of Vitamin B1 leads to diseases such as beriberi.

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8. Sushrut first performed plastic surgery on:

(a) Nose

(b) Mouth

(c) Ear

(d) Lips

Correct Answer: (a) Nose

Solution:

Sushrut, an ancient Indian physician, is considered one of the pioneers of plastic surgery. In his seminal work, the ”Sushruta Samhita,” he described detailed procedures for surgical

techniques, including reconstructive surgery for various parts of the body. One of the earliest surgeries he performed was the reconstruction of the nose, which was commonly done for individuals who had suffered from nasal disfigurement, often due to criminal punishment or injury.

The procedure for nasal reconstruction is considered one of the earliest forms of plastic surgery, known as ”rhinoplasty.” This technique involved using a flap of skin from the forehead to reconstruct the lost nasal tissue.

Quick Tip

Plastic surgery has its origins in ancient India, and Sushrut’s work laid the foundation for many modern reconstructive techniques, especially in nose reconstruction.

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9. The amount of murein in gram-positive bacteria is:

(a) 50-60

(b) 20-40

(c) 10-20

(d) 70-80

Correct Answer: (a) 50-60

Solution:

Murein, also known as peptidoglycan, is a polymer that forms the structural component of bacterial cell walls. In gram-positive bacteria, the cell wall is thick and consists of a high amount of murein, which accounts for approximately 50-60 percent of the cell wall’s dry weight. This high concentration of murein contributes to the rigidity and structural integrity of the cell wall, which is a characteristic feature of gram-positive bacteria.

- Gram-negative bacteria have a much thinner layer of murein (around 10-20- Gram-positive bacteria, with their thicker peptidoglycan layer, are more susceptible to certain types of antibiotics, like penicillin, which target the synthesis of this layer.

Quick Tip

Gram-positive bacteria have a thick peptidoglycan layer, which is important for structural integrity and makes them more susceptible to antibiotics that target the cell wall.

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10. AIDS spreads through:

(a) Food

(b) Body fluids

(c) Air

(d) Water

Correct Answer: (b) Body fluids

Solution:

AIDS (Acquired Immunodeficiency Syndrome) is caused by the HIV (Human Immunodeficiency Virus). The virus is transmitted through direct contact with certain body fluids from a person who has HIV. These body fluids include blood, semen, vaginal fluids, and breast milk.

HIV is not spread through food, air, or water, and it is not an airborne disease. The virus requires a direct exchange of these fluids, usually through unprotected sexual contact, sharing needles, or from mother to child during childbirth or breastfeeding.

Quick Tip

To prevent HIV transmission, avoid sharing needles and practice safe sex by using condoms. It's also essential to get tested and ensure your partner's health status.

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11. How many layers does the epidermis have in human skin?

(a) 4

(b) 5

(c) 2

(d) 3

Correct Answer: (b) 5

Solution:

The epidermis is the outermost layer of the skin and plays a crucial role in protecting the body from environmental factors. In human skin, the epidermis consists of 5 layers:
1. Stratum corneum: The outermost layer, composed of dead keratinized cells that provide a waterproof barrier. 2. Stratum lucidum: Present only in thick skin (palms and soles), this layer provides an additional layer of protection. 3. Stratum granulosum: Cells in this layer begin to die and form granules that help to waterproof the skin. 4. Stratum spinosum: Known as the ”prickle cell layer,” it is involved in the skin’s immune response. 5. Stratum basale (Stratum germinativum): The deepest layer, where new skin cells are produced.
These five layers work together to protect the body from mechanical damage, pathogens, and dehydration.

Quick Tip

The stratum basale is the only layer where skin cells actively divide to form new cells, which then move upwards as they mature and become part of the outer layers.

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12. The forelimbs of birds are modified

(a) For walking

(b) For swimming

(c) For flying

(d) For grasping

Correct Answer: (c) For flying

Solution:

In birds, the forelimbs have undergone a significant modification to adapt to flight. The forelimbs are modified into wings, which are essential for flight. These wings are specialized for generating lift and thrust to allow birds to fly. The bones of the forelimbs are lighter and have a different structure compared to those of terrestrial animals, aiding in flight efficiency.

- The forelimbs of birds are not modified for walking, swimming, or grasping (though some birds like parrots and eagles have adaptations for grasping with their feet). The primary function of bird forelimbs is flight.

Quick Tip

The structure of bird wings is highly specialized, including features like feathers and a lightweight skeletal system, which are all adaptations for flight.

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13. Lysosome acts in given condition:

(a) Base

(b) Acid

(c) Both

(d) Neutral

Correct Answer: (b) Acid

Solution:

Lysosomes are membrane-bound organelles in cells that contain enzymes responsible for breaking down waste materials and cellular debris. The enzymes within lysosomes, known as hydrolytic enzymes, work best in acidic conditions, typically at a pH of around 4.5 to 5.5. Therefore, lysosomes are most active in acidic environments, which is why they function best under acidic conditions rather than neutral, basic, or both environments.
Lysosomes help in processes like digestion and waste management within cells by breaking down macromolecules such as proteins, nucleic acids, lipids, and carbohydrates.

Quick Tip

The acidic environment inside lysosomes is critical for their enzymatic function, which helps in the breakdown of cellular waste and foreign particles.

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14. Gymnosperms are classified into four classes:

(a) Cycadopsida (Cycads)

(b) Ginkgopsida (Ginkgoes)

(c) Pinopsida (Conifers)

(d) Gnetopsida (Gnetum and related genera)

Correct Answer: (a), (b), (c), (d) All of the above

Solution:

Gymnosperms are a group of seed-producing plants that do not produce flowers. These plants are classified into four main classes:

1. Cycadopsida (Cycads): This class includes the cycad plants, which are characterized by large, feather-like leaves and cones. They are found primarily in tropical and subtropical regions.

2. Ginkgopsida (Ginkgoes): The Ginkgo tree is the only extant species of this group, known as Ginkgo biloba. It has fan-shaped leaves and is considered a living fossil, as it has existed for millions of years.

3. Pinopsida (Conifers): Conifers, such as pine trees, firs, and spruces, belong to this class. They are characterized by needle-like leaves and cones that produce seeds. Conifers are the most diverse and abundant group of gymnosperms.

4. Gnetopsida (Gnetum and related genera): This class includes Gnetum and related genera, which have unique features, such as vessel elements in their xylem, similar to those found in angiosperms (flowering plants). Gnetum plants are mostly tropical vines, shrubs, or small trees.

These four classes of gymnosperms represent the diversity of non-flowering seed plants.

Quick Tip

Gymnosperms are important for studying the evolution of seed plants and their adaptations to various environments. Conifers are the most economically important group due to their timber production.

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15. The pollination of naked seed gymnosperm plants occurs through:

(A) Insects

(B) Wind

(C) Water

(D) Animals

Correct Answer: (B) Wind

Solution:

Gymnosperms, including conifers and other naked seed plants, do not rely on insects or animals for pollination like many angiosperms (flowering plants) do. Instead, most gymnosperms primarily use wind for pollination. This process is called anemophily, where pollen is carried by wind to female cones or structures in the plant, allowing fertilization to occur.

- Insects and animals generally assist in the pollination of flowering plants (angiosperms), not gymnosperms. - Water is not a common method for pollination in gymnosperms, though it can be in certain aquatic plants.

Therefore, wind plays the most significant role in pollination for gymnosperms.

Quick Tip

Wind pollination in gymnosperms is an efficient way of transferring pollen over large distances, especially in the vast forests where these plants often grow.

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16. The correct statement regarding the function of amylase is:

(A) Breaks down proteins into amino acids

(B) Breaks down fats into fatty acids and glycerol

(C) Breaks down starch into simple sugars

(D) Breaks down DNA into nucleotides

Correct Answer: (C) Breaks down starch into simple sugars

Solution:

Amylase is an enzyme that plays a crucial role in the digestion of carbohydrates. It specifically breaks down starch, a complex carbohydrate, into simpler sugars like maltose

and dextrin. This process begins in the mouth with salivary amylase and continues in the small intestine with pancreatic amylase.

- Proteins are broken down into amino acids by enzymes like protease, not amylase. - Fats are broken down into fatty acids and glycerol by lipase, not amylase. - DNA is broken down into nucleotides by nuclease, not amylase.

Thus, the correct function of amylase is to break down starch into simpler sugars.

Quick Tip

Amylase is the first enzyme in the digestive system that begins the breakdown of carbohydrates, so it is crucial for efficient energy extraction from foods containing starch.

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17. Which is a C4 plant?

(a) Cotton

(b) Maize

(c) Wheat

(d) Rice

Correct Answer: (b) Maize

Solution:

C4 plants are a group of plants that use a special pathway called the C4 pathway for photosynthesis. This pathway helps them efficiently fix carbon dioxide, especially in hot and dry conditions. The C4 pathway is advantageous because it reduces photorespiration, a process that wastes energy, in hot climates.

Maize is a typical C4 plant, which is well-adapted to high temperatures and can carry out photosynthesis more efficiently under such conditions.

- Cotton and wheat are C3 plants, which use the basic Calvin cycle for carbon fixation. - Rice is also a C3 plant, commonly found in tropical areas and characterized by its use of the Calvin cycle for photosynthesis.

Thus, maize is the correct example of a C4 plant.

Quick Tip

C4 plants are more efficient in hot and dry environments compared to C3 plants because they minimize water loss and photorespiration, which is why maize, sugarcane, and sorghum are considered C4 plants.

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18. Which of the following is the largest cranial nerve?

(a) Cranial VI

(b) Cranial nerve X

(c) Cranial nerve VII

(d) Cranial nerve V (trigeminal)

Correct Answer: (d) Cranial nerve V (trigeminal)

Solution:

Cranial nerve V, also known as the trigeminal nerve, is the largest of the cranial nerves. It is responsible for sensation in the face and for motor functions such as biting and chewing. The trigeminal nerve is a mixed nerve, meaning it has both sensory and motor components.
- Cranial nerve VI (abducens) controls the lateral rectus muscle in the eye, allowing for eye movement, but it is not the largest. - Cranial nerve X (vagus) has an important role in autonomic functions, including heart rate and digestion, but it is not the largest. - Cranial nerve VII (facial nerve) controls the muscles of facial expression and is smaller in size compared to the trigeminal nerve.
Thus, the largest cranial nerve is cranial nerve V (trigeminal).

Quick Tip

The trigeminal nerve has three branches: the ophthalmic, maxillary, and mandibular, each responsible for different areas of sensation on the face.

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19. What percent of nephron cortical is present?

(a) 15

(b) 85

(c) 20

(d) 40

Correct Answer: (b) 85

Solution:

The nephron is the functional unit of the kidney, and it plays a key role in filtration, reabsorption, and secretion. Nephrons are made up of two main parts: the cortical nephron and the juxtamedullary nephron.

The cortical nephron has its glomerulus in the outer region of the cortex, and its loop of Henle is short and stays mostly within the renal cortex. Around 85 percent of the nephrons in the human kidney are cortical nephrons, making them the most abundant type of nephron.

- Juxtamedullary nephrons, which are fewer in number, have a longer loop of Henle that extends into the renal medulla and are involved in the concentration of urine.

Thus, 85 Percent of the nephrons in the human kidney are cortical nephrons.

Quick Tip

Cortical nephrons are important for the regular filtering functions of the kidney, while juxtamedullary nephrons play a key role in regulating the concentration of urine.

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20. Fusiform root is present in:

(a) Carrot

(b) Radish

(c) Turnip

(d) Sweet potato

Correct Answer: (a) Carrot

Solution:

A fusiform root is a type of tap root that is swollen in the middle and tapers at both ends, resembling a spindle. It is commonly found in certain types of plants that store nutrients.

The carrot is a classic example of a plant with a fusiform root, where the root is thick in the middle and tapers towards the ends.

- Radish, turnip, and sweet potato do not have fusiform roots. Radish and turnip have conical roots, while sweet potato has a tuberous root.

Thus, carrot is the correct example of a plant with a fusiform root.

Quick Tip

Fusiform roots are adapted for storage, helping plants to store nutrients and energy in the form of starches, as seen in carrots.

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21. How many classes are there in gymnosperms?

(a) 2

(b) 1

(c) 3

(d) 4

Correct Answer: (d) 4

Solution:

Gymnosperms are a group of seed-producing plants that do not produce flowers, and they are classified into four main classes:

1. Cycadopsida (Cycads): This group includes tropical and subtropical plants known for their large, feathery leaves and cones. 2. Ginkgopsida (Ginkgoes): This group is represented by a single living species, Ginkgo biloba, known for its fan-shaped leaves and resistance to environmental stress. 3. Pinopsida (Conifers): Conifers are the largest group of gymnosperms, with needle-like leaves and cones, including pine trees, firs, and spruces. 4. Gnetopsida (Gnetum and related genera): This class includes tropical trees, shrubs, and vines like Gnetum, which have some angiosperm-like features such as vessel elements in their xylem.

Thus, there are four classes in gymnosperms.

Quick Tip

Each of the four gymnosperm classes has unique characteristics and adaptations, but they all share the common feature of having exposed seeds, rather than seeds enclosed in a fruit.

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22. Bacteria have:

(a) Slime or Capsule

(b) Slime layer

(c) Capsule

(d) Slime layer and capsule

Correct Answer: (d) Slime layer and capsule

Solution:

Bacteria have a protective outer covering that can be in the form of either a slime layer or a capsule.

- Capsule: A thick, well-defined layer composed of polysaccharides or proteins that surrounds the bacterial cell wall. Capsules help bacteria evade the host's immune system and provide protection against desiccation. - Slime layer: A less defined, more easily removable layer compared to the capsule. It is composed of loosely bound polysaccharides and helps the bacteria to adhere to surfaces and protect against environmental stress.

In many bacteria, both the slime layer and the capsule are present, although their composition and structure may vary. Therefore, the correct answer is that bacteria can have both a slime layer and a capsule.

Quick Tip

Capsules and slime layers are critical for bacterial survival as they help with protection from host immune responses and enable bacteria to adhere to surfaces, contributing to pathogenicity.

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23. Brown air is due to:

(a) CO2

(b) SO2

(c) CH4

(d) NOx

Correct Answer: (d) NOx

Solution:

Brown air, also known as photochemical smog, is primarily caused by the presence of nitrogen oxides (NOx) in the atmosphere, along with volatile organic compounds (VOCs). When sunlight reacts with these pollutants, it leads to the formation of ground-level ozone and other secondary pollutants, which give the air a brownish appearance.

- CO2 (Carbon dioxide) is a greenhouse gas that contributes to global warming but does not directly cause brown air. - SO2 (Sulfur dioxide) contributes to acid rain but is more associated with the formation of gray air rather than brown air. - CH4 (Methane) is a potent greenhouse gas and contributes to air pollution, but it is not directly responsible for brown air.

Thus, the presence of NOx in combination with VOCs is the main cause of brown air (photochemical smog).

Quick Tip

To prevent the formation of brown air, reducing emissions from vehicles and industrial sources that release NOx and VOCs is essential, along with promoting cleaner technologies and fuels.

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24. The process of fusion of male and female gametes is called

(A) Seed formation

(B) Reproduction

(C) Fertilisation

(D) Pollination

Correct Answer: (C) Fertilisation

Solution:

The fusion of male and female gametes (sperm and egg cells) to form a zygote is called fertilisation. This process is a crucial step in sexual reproduction. Once fertilisation occurs, the zygote will undergo mitotic divisions to form a new organism.

- Seed formation occurs after fertilisation, where the fertilised ovule develops into a seed. - Reproduction is the overall process of producing offspring, but it includes several stages such as fertilisation, development, and growth. - Pollination is the transfer of pollen from male to female reproductive organs in plants, leading to fertilisation, but pollination itself is not the fusion of gametes.

Thus, the correct term for the fusion of male and female gametes is fertilisation.

Quick Tip

Fertilisation is the first step towards the formation of a new organism in sexually reproducing organisms, whether in plants or animals.

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25. Protista are found in:

(a) Air

(b) Water

(c) Soil

(d) Ocean

Correct Answer: (b) Water

Solution:

Protista is a diverse group of eukaryotic microorganisms that can be found in a wide range of environments. They are primarily aquatic organisms and are most commonly found in water, including freshwater and marine environments. Some protists can also be found in moist soil or decaying organic matter, but the majority thrive in aquatic habitats.

- Air is not a common environment for protists as they require moisture and nutrients to survive. - Soil does contain some protists, but they are more commonly found in water. - Ocean also harbors many marine protists, but the most general answer is that they are found

in water.

Thus, water is the most accurate environment where protists are commonly found.

Quick Tip

When studying protists, remember they are primarily found in water, where they play important roles in ecosystems as primary producers or decomposers.

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26. Agar is obtained from:

(a) Gelidium

(b) Gracilaria

(c) Both Gelidium Gracilaria

(d) None of these

Correct Answer: (c) Both Gelidium Gracilaria

Solution:

Agar is a gelatinous substance that is widely used in microbiological media, as a thickening agent in food, and in various other industries. Agar is primarily obtained from certain species of red algae, specifically Gelidium and Gracilaria.

- Gelidium and Gracilaria are marine red algae that contain agar in their cell walls. These algae are the primary sources for commercial agar production. - Agar is not obtained from other types of algae or plants.

Therefore, the correct answer is both Gelidium and Gracilaria.

Quick Tip

Agar, derived from red algae, has a wide range of applications, including in laboratory culture media, food processing, and as a vegetarian substitute for gelatin.

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27. Segmentation of Earth Worm is very to:

(a) 10-20

(b) 5-10

(c) 100-150

(d) 150-200

Correct Answer: (c) 100-150

Solution:

The earthworm exhibits metameric segmentation, which means its body is divided into a series of segments, with each segment containing similar organs and structures. This segmentation is crucial for the earthworm's locomotion and other functions. Typically, an earthworm has 100-150 segments along its body.

- 10-20 segments would be too few for an adult earthworm. - 5-10 segments would also not reflect the characteristic segmentation in a mature earthworm. - 150-200 segments would be larger than what is typically found in most earthworm species.

Thus, 100-150 segments is the typical number of segments found in an earthworm.

Quick Tip

The segmented body of an earthworm plays a critical role in its movement, with each segment containing muscles that contract and expand to help propel the worm through soil.

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28. Which of the following is a fresh water sponge?

(a) Sycon

(b) Spongilla

(c) Euspongia

(d) Fresh water sponge i

Correct Answer: (b) Spongilla

Solution: - Sycon: Sycon, also known as the Scypha, is a type of marine sponge, not a fresh water species. While it shares many characteristics with freshwater sponges, it is found in the marine environment, so this option is incorrect.

- Spongilla: This is the correct answer. Spongilla is a genus of freshwater sponges. These sponges are typically found in clean, freshwater environments such as lakes, ponds, and streams. They have a distinctive appearance and are a key part of aquatic ecosystems.
- Euspongia: Euspongia, also known as the ”bath sponge,” is a type of sponge found in marine environments. This is also not a freshwater species and is used commercially for its soft texture.
- Fresh water sponge: This is not a scientific term, and the phrase is merely a translation of ”Spongilla” in Hindi. Therefore, this option is incorrect.
Thus, the correct answer is Spongilla (b), as it is the genus of freshwater sponges.

Quick Tip

Spongilla is a common freshwater sponge found in clean aquatic environments, whereas Sycon and Euspongia are marine sponges. Understanding the habitat is key to identifying the type of sponge.

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29. Which one has an age $>$ 100 years?

(a) Parrot

(b) Horse

(c) Turtle

(d) Banana tree

Correct Answer: (c) Turtle

Solution: - Parrot: While parrots can live a long time, they do not usually live for over 100 years. The lifespan of a parrot generally ranges from 50 to 80 years, depending on the species. Therefore, this option is incorrect. - Horse: Horses also live a long time, but their lifespan is typically between 25 to 30 years, with some horses living up to 40 years. They do not reach 100 years, so this option is incorrect. - Turtle: Turtles, especially certain species like the Galápagos tortoise, can live over 100 years. Some individual turtles have been recorded living well beyond a century, making this the correct answer. - Banana tree: A banana tree has a much shorter lifespan, generally living only for about 1 to 2 years before

producing fruit and dying. It does not live for over 100 years, so this option is incorrect. Thus, the correct answer is Turtle (c), as some species of turtles are known to live over 100 years.

Quick Tip

Certain species of turtles, particularly the Galápagos tortoise, are known to have exceptional lifespans, with some reaching over 100 years of age. This is in stark contrast to most other animals like parrots, horses, or banana trees.

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30. Who gives the idea of cell arising from pre-existing cells?

(a) Schwann

(b) Hooke

(c) Schleiden

(d) Virchow

Correct Answer: (d) Virchow

Solution: Virchow is credited with the theory that all cells arise from pre-existing cells. His famous phrase ”Omnis cellula e cellula” translates to ”All cells come from cells.” This idea is part of the cell theory, which revolutionized the understanding of biology and cell division. Virchow’s contribution was foundational to the modern understanding of cellular reproduction, and he is considered one of the most influential scientists in the development of cell biology.

Quick Tip

Virchow’s work in pathology laid the groundwork for understanding the origins of cells, which is a cornerstone of cellular biology today.

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31. Who provides color to the skin?

(a) Melanin

(b) Keratin

(c) Albumin

(d) Chitin

Correct Answer: (a) Melanin

Solution: Melanin is the pigment responsible for the color of the skin, hair, and eyes. It is produced by specialized cells called melanocytes, located in the epidermis. The amount and type of melanin determine the color of an individual's skin. There are two primary types of melanin: eumelanin (brown/black) and pheomelanin (yellow/red). The greater the production of melanin, the darker the skin tone. In contrast, keratin is a protein that makes up the skin's outer layer but does not affect skin color. Albumin and chitin are not involved in skin pigmentation.

Quick Tip

The amount and type of melanin are influenced by genetic factors and exposure to sunlight.

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32. Hormone, interact with membrane, the secondary messenger. Which of the following is a secondary messenger?

(a) AMP

(b) T3

(c) Renin

(d) ANF

Correct Answer: (a) AMP

Solution: A secondary messenger is a molecule that acts as an intermediary in the signal transduction process. When a hormone (such as a peptide or catecholamine) binds to a receptor on the cell membrane, it activates an intracellular signaling pathway. These pathways often involve secondary messengers, which amplify the signal inside the cell. Among the options: - **AMP (Adenosine monophosphate)** acts as a secondary messenger in many hormone signaling pathways, such as the one activated by glucagon and adrenaline

through G-protein-coupled receptors. It is involved in the cyclic AMP pathway. - **T3 (Triiodothyronine)** is a thyroid hormone that interacts directly with nuclear receptors and does not function as a secondary messenger. - **Renin** is an enzyme involved in the renin-angiotensin system, but it is not a secondary messenger itself; it catalyzes the conversion of angiotensinogen to angiotensin I. - **ANF (Atrial natriuretic factor)** is a hormone that affects blood pressure and fluid balance, but it is not a secondary messenger. Thus, AMP is the correct answer, as it is the key secondary messenger in several signaling cascades, including the activation of protein kinases in response to hormone binding to membrane receptors.

Quick Tip

Remember, secondary messengers like AMP amplify the signal of hormones and activate cellular responses, often by interacting with protein kinases or other signaling molecules.

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33. Nucleic acid bond present:

(a) Disulphide

(b) Phosphodiester

(c) Ester

(d) Peptide

Correct Answer: (b) Phosphodiester

Solution: Nucleic acids, including DNA and RNA, are composed of long chains of nucleotides. The nucleotides in a nucleic acid are linked together by specific bonds that form between the phosphate group of one nucleotide and the sugar molecule of the adjacent nucleotide. This type of bond is known as a **phosphodiester bond**.

Let's analyze each option: - **Disulphide bond** is a covalent bond that forms between two cysteine amino acids in proteins. It is not involved in the structure of nucleic acids.

- **Phosphodiester bond** is the correct answer. This bond links the phosphate group of one nucleotide to the sugar molecule (usually deoxyribose or ribose) of the next nucleotide in

DNA or RNA, forming the backbone of the nucleic acid structure.

- **Ester bond** is a bond between an alcohol and an acid. While ester bonds are common in other biological molecules, they are not involved in the structure of nucleic acids.

- **Peptide bond** is a covalent bond that links amino acids together to form proteins. It is unrelated to nucleic acids.

Thus, the correct answer is the **phosphodiester bond**, which is essential for the formation of nucleic acid chains.

Quick Tip

In nucleic acids, the phosphodiester bonds form the sugar-phosphate backbone, ensuring the structural integrity of DNA and RNA molecules.

---

34. What is the largest organ?

(a) Stomach

(b) Lungs

(c) Pancreas

(d) Heart

Correct Answer: (a) Stomach

Solution: The largest organ in the human body is the skin. While this question presents options that include internal organs, the skin is the largest organ by surface area and weight. However, none of the listed options is correct. Let's analyze the given options:

- **Stomach** is an important digestive organ, but it is not the largest organ in the body. The stomach is roughly the size of a football. - **Lungs** are large organs responsible for respiration, but the size of the lungs is still smaller compared to the skin. - **Pancreas** is a small, elongated organ located behind the stomach that plays a key role in digestion and blood sugar regulation, but it is not the largest. - **Heart** is a muscular organ responsible for pumping blood, but it is also not the largest organ in the body.

Thus, the correct answer is **Skin**, although it is not present in the options. The skin is by far the largest organ in terms of surface area and weight.

Quick Tip

Always remember, the largest organ in the human body by weight and surface area is the skin, even though it's not often considered in multiple-choice questions like this.

---

34. RUBISCO CO acts as

(a) Carbonylase

(b) Oxygenase

(c) Both Carbonylase & Oxygenase

Correct Answer: (c) Both Carbonylase Oxygenase

Solution: RUBISCO (Ribulose-1,5-bisphosphate carboxylase/oxygenase) is an enzyme found in the chloroplasts of plants, which plays a critical role in the process of photosynthesis. It catalyzes two key reactions:
1. Carboxylation: RUBISCO acts as a **carbonylase** when it adds carbon dioxide (CO2) to ribulose-1,5-bisphosphate (RuBP) in the Calvin cycle, which is the primary carbon fixation pathway in plants. 2. Oxygenation: RUBISCO also acts as an **oxygenase** when it reacts with oxygen (O2) instead of carbon dioxide, leading to a process known as photorespiration. This process can be less efficient in terms of carbon fixation.
Thus, RUBISCO can function as both a carbonylase and an oxygenase, depending on the presence of CO2 or O2 in the environment.

Quick Tip

RUBISCO's dual functionality is critical in balancing photosynthesis and photorespiration. Understanding its roles in both carboxylation and oxygenation is essential for studying plant metabolism.

---

35. Product of Cyclic Pathway

(a) NADPH

(b) ATP

(c) H^+

(d) H_2O

Correct Answer: (b) ATP

Solution: The cyclic pathway is part of the light reactions of photosynthesis, specifically the cyclic photophosphorylation process. In this process, light energy is used to drive the movement of electrons through the electron transport chain in the thylakoid membranes of the chloroplasts. The electrons are recycled through the system in a cycle, which ultimately leads to the production of ATP but not NADPH.

The key product of the cyclic pathway is ATP. This is because the electrons flow in a cycle and are used to pump protons (H^+) across the membrane, which generates a proton gradient used by ATP synthase to produce ATP. NADPH is not generated in this pathway; it is produced in the non-cyclic pathway (Z-scheme) of photosynthesis.

Thus, ATP is the correct answer, as it is the main product of the cyclic photophosphorylation pathway.

Quick Tip

In photosynthesis, cyclic photophosphorylation is primarily used to produce ATP, which is essential for the Calvin cycle. Non-cyclic photophosphorylation produces both ATP and NADPH.

---

36. Colourless blood of animal due to

(a) Cu

(b) Fe

(c) Hemoglobin

(d) None of Above

Correct Answer: (d) None of Above

Solution: Colourless blood in animals occurs when the blood lacks red blood cells or hemoglobin, which are responsible for the characteristic red color of blood.

- Cu (Copper): In some invertebrates like mollusks, copper-based blood (hemocyanin) is present. Hemocyanin is blue in color when oxygenated, not colorless. So, copper-based blood is not colourless.
- Fe (Iron): Iron is a component of hemoglobin in vertebrates, but iron itself is not a reason for blood being colourless. In fact, hemoglobin is red when oxygenated due to the presence of iron.
- Hemoglobin: Hemoglobin gives blood its red color when oxygenated. If an animal's blood lacks hemoglobin, it could result in pale or colourless blood, but this is not typical for most animals.
- None of Above: This option is correct because colourless blood typically occurs in animals that lack hemoglobin or have a different kind of circulatory fluid like lymph. In certain animals such as some marine invertebrates (e.g., certain mollusks), the absence of red blood cells results in a pale or colorless fluid.
Thus, the correct answer is (d) None of Above.

Quick Tip

The color of blood in animals is usually attributed to the presence of hemoglobin (iron-based) or hemocyanin (copper-based). Hemoglobin gives the characteristic red color to blood in vertebrates.

---

37. If parent blood group A and AB, then which is not possible blood group in progeny?

(a) A

(b) AB

(c) B

(d) O

Correct Answer: (d) O

Solution: The ABO blood group system is based on the presence of antigens on the surface of red blood cells. - Parent blood groups A and AB: - Parent 1 (blood group A) can contribute either A or O allele. - Parent 2 (blood group AB) can contribute either A or B allele.

Thus, the possible combinations for the progeny are: - AA (Blood group A) - AB (Blood group AB) - AB (Blood group AB) - BB (Blood group B)
It is not possible for the progeny to have O blood group because, for O blood group, both parents must carry the O allele, which is not possible if one parent is group A and the other is group AB. Hence, O is not a possible blood type for the progeny.
Thus, the correct answer is (d) O.

Quick Tip

For O blood type to occur in progeny, both parents must carry the O allele. If either parent has blood group A or AB, O cannot be inherited.

---

38. Which of these is a lymphoid organ?

(a) Tonsill

(b) Spleen

(c) Thymus

(d) All of these

Correct Answer: (d) All of these

Solution: Lymphoid organs are those organs that play a crucial role in the body's immune response. They are involved in the production and maturation of lymphocytes, which are white blood cells involved in the immune response. The main lymphoid organs are: - Tonsils: These are lymphoid tissues located at the back of the throat that help trap pathogens entering through the mouth and nose. - Spleen: This organ filters blood, removing old and damaged red blood cells and playing a key role in the immune response by helping the body fight infections. - Thymus: The thymus is responsible for the maturation of T lymphocytes (T cells), which are critical for adaptive immunity.
Since all three organs are involved in immune functions and lymphocyte production or maturation, the correct answer is (d) All of these.

Quick Tip

Lymphoid organs are critical to the immune system, and all three mentioned organs contribute significantly to immune function.

---

39. Which of the following is given to immunosuppressive patients?

(a) Cyclosporin-A

(b) Statins

(c) Drugs

(d) Streptokinase

Correct Answer: (a) Cyclosporin-A

Solution: Cyclosporin-A is a widely used immunosuppressive drug. It is primarily given to prevent organ rejection after transplants (kidney, heart, liver, etc.). It works by inhibiting T-cell activation, which is crucial in the body's immune response, especially during transplant procedures.
- Cyclosporin-A: An immunosuppressive agent that suppresses the immune system to prevent rejection in organ transplants. - Statins: These are cholesterol-lowering drugs and are not used for immunosuppression. - Drugs: This option is too vague to be a correct answer, as it does not specify any particular immunosuppressive agent. - Streptokinase: A thrombolytic agent used to break down blood clots and is unrelated to immunosuppression.
Thus, the correct answer is (a) Cyclosporin-A.

Quick Tip

Cyclosporin-A is essential in the field of transplant medicine to prevent rejection of grafts. It is often given in combination with other immunosuppressive drugs.

---

40. How many cerebral ventricles do humans have?

(a) 2

(b) 3

(c) 4

(d) 5

Correct Answer: (c) 4

Solution: Humans have a total of 4 cerebral ventricles. These include:
1. Two lateral ventricles (one in each hemisphere of the brain) 2. One third ventricle (located in the midline of the brain, between the two thalami) 3. One fourth ventricle (located between the brainstem and the cerebellum)
These ventricles are filled with cerebrospinal fluid (CSF), which helps in cushioning the brain, removing waste products, and maintaining a stable chemical environment.
Thus, the correct answer is (c) 4.

Quick Tip

The four ventricles (two lateral, third, and fourth) are interconnected and play a vital role in maintaining the homeostasis of the brain's environment.

---

41. Which element is present in cytochrome?

(a) Magnesium

(b) Iron

(c) Calcium

(d) Potassium

Correct Answer: (b) Iron

Solution: Cytochromes are a group of heme-containing enzymes that play a key role in electron transport in cells, particularly in mitochondria. The heme group within cytochromes contains an iron (Fe) atom, which is essential for their function in redox reactions. The iron atom in cytochromes undergoes reversible oxidation and reduction, which is crucial for the electron transfer in cellular respiration.
Thus, the correct answer is (b) Iron.

Quick Tip

Iron in the heme group of cytochromes enables their role in cellular respiration and energy production by facilitating electron transport in the mitochondria.

---

42. Photolysis of water occurs in the presence of which element?

(a) Magnesium

(b) Manganese

(c) Calcium

(d) Potassium

Correct Answer: (b) Manganese

Solution: The photolysis of water, also known as the light-dependent reactions of photosynthesis, involves the splitting of water molecules to release oxygen. This process occurs in the presence of the enzyme water splitting complex within photosystem II. The element manganese (Mn) plays a crucial role in the catalytic activity of this complex, facilitating the oxidation of water molecules into oxygen, protons, and electrons.
The manganese ion alternates between different oxidation states, which is essential for this process. The general reaction for water photolysis is:

$$2H_2O \rightarrow O_2 + 4H^+ + 4e^-$$

Thus, manganese (Mn) is the key element involved in the photolysis of water during photosynthesis.
Therefore, the correct answer is (b) Manganese.

Quick Tip

Manganese is crucial for the functioning of the oxygen-evolving complex in photosystem II, enabling the photolysis of water to occur and generating oxygen as a byproduct.

---

43. How many pairs of salivary glands does a rat have?

(a) 2

(b) 3

(c) 4

(d) 5

Correct Answer: (b) 3

Solution: Rats, like most mammals, possess three pairs of salivary glands. These glands are responsible for secreting saliva, which aids in the digestion of food, keeps the oral cavity moist, and initiates the breakdown of food via enzymatic action.
The three pairs of salivary glands in rats are:
1. Parotid glands: Located near the ears, these glands produce a watery secretion that helps in the moistening of food. 2. Submandibular glands: Situated under the lower jaw, these glands secrete saliva that contains enzymes to aid in digestion. 3. Sublingual glands: Found under the tongue, these glands produce a mucous-type secretion.
Thus, rats have three pairs of salivary glands, making the correct answer (b) 3.

Quick Tip

Rats and most mammals possess three pairs of salivary glands: parotid, submandibular, and sublingual, each contributing to different aspects of digestion and mouth moisture.

---

44. How many chambers are there in a frog's heart?

(a) 2

(b) 3

(c) 4

(d) 1

Correct Answer: (b) 3

Solution: The frog's heart has three chambers: two atria and one ventricle. In comparison to mammals that have a four-chambered heart, the frog's three-chambered heart helps in the circulation of blood in a less efficient but still effective manner for their physiological needs.

The three chambers are:

1. Left Atrium: Receives oxygenated blood from the lungs. 2. Right Atrium: Receives deoxygenated blood from the body. 3. Ventricle: Pumps mixed blood (oxygenated and deoxygenated) to both the lungs and the rest of the body.

The circulatory system in frogs is not as efficient as that of mammals, as the oxygenated and deoxygenated blood mix in the ventricle. However, the three-chambered heart is sufficient for their requirements, particularly in their amphibious environment.

Thus, the correct answer is (b) 3 chambers.

Quick Tip

The frog's heart has three chambers: two atria and one ventricle. This is different from mammals, which have a four-chambered heart, but still provides effective circulation in amphibians.

---

45. What percentage of animals are invertebrates?

(A) 50%

(B) 70%

(C) 85%

(D) 95%

Correct Answer: (D) 95%

Solution:

In the animal kingdom, the majority of animals are classified as invertebrates. These are animals that lack a backbone. It is estimated that approximately 95% of all animal species are invertebrates. This includes organisms like insects, mollusks, and arthropods, which thrive in almost all environments, from land to sea. In contrast, vertebrates, which include animals like humans, birds, fish, and reptiles, make up only about 5% of the total animal kingdom.

Quick Tip

Invertebrates represent the vast majority of animal species, and their immense diversity is a key factor in their ability to adapt to various ecosystems.

---

46. The primary structure of which enzyme was discovered first?

(A) Trypsin

(B) Rnase A

(C) Lysozyme

(D) Carboxypeptidase

Correct Answer: (C) Lysozyme

Solution:

The primary structure of the enzyme Lysozyme was discovered first. Lysozyme, an enzyme found in tears, saliva, and other body fluids, was the first enzyme whose structure was solved in detail. The work was carried out by the scientists Sir Alexander Fleming and later by others, providing significant insight into enzyme function and structure. This discovery paved the way for further studies into the structures of other enzymes, such as Rnase A, Trypsin, and Carboxypeptidase.

Quick Tip

Lysozyme's discovery helped in understanding the relationship between the primary structure of proteins and their biological functions, marking a major milestone in biochemistry.

---

47. Which organism has the maximum number of chromosomes?

(A) Horse

(B) Drosophila

(C) Human (46)

(D) Ascaris

Correct Answer: (A) Horse

Solution:

The horse (Equus ferus caballus) has the maximum number of chromosomes among the given options, with 64 chromosomes (32 pairs). In comparison, Drosophila (fruit fly) has only 8 chromosomes, and humans have 46 chromosomes (23 pairs). Ascaris, a type of roundworm, has 2 chromosomes in each cell. Therefore, the organism with the maximum number of chromosomes in this list is the horse.

Quick Tip

The number of chromosomes varies greatly among different species. While humans have 46 chromosomes, many animals and plants may have more or fewer chromosomes depending on their genetic makeup.

---

48. If there are 20 nucleotides in a polynucleotide chain, then what is the number of phosphodiester bonds?

(A) 21

(B) 20

(C) 19

(D) 18

Correct Answer: (C) 19

Solution:

In a polynucleotide chain, the number of phosphodiester bonds is always one less than the number of nucleotides. This is because each nucleotide is connected to the next one by a phosphodiester bond, and the last nucleotide does not require a bond to any subsequent nucleotide. Thus, for a chain of 20 nucleotides, the number of phosphodiester bonds will be $20 - 1 = 19$.

Quick Tip

Remember, in polynucleotides, the phosphodiester bond connects the 3’ carbon of one nucleotide to the 5’ carbon of the next nucleotide, forming a long chain of nucleotides.

---

49. Group in Auxins

(A) - OH

(B) - COOH

(C) - CO

(D) - O

Correct Answer: (B) - COOH

Solution:

Auxins are a class of plant hormones primarily responsible for growth regulation. The most common group in auxins is the carboxyl group (-COOH). However, the correct answer in this case points out that the ”COOH” group represents the essential part in auxins, which likely refers to their carboxyl group attachment. Hence, the group associated with auxins is the carboxyl group (-COOH), which appears in the option as COOH.

Quick Tip

Auxins like indole-3-acetic acid (IAA) contain a carboxyl group (-COOH), which is crucial for their function in plant growth and development.

---

50. Bile Juice helps in Digestion of

(A) Lipid

(B) Starch

(C) Protein

(D) Lipid and Starch

Correct Answer: (A) Lipid

Solution:

Bile juice is secreted by the liver and stored in the gallbladder. Its primary function is to aid in the digestion and absorption of fats (lipids). The bile contains bile salts that emulsify fats, breaking them into smaller droplets, which increases the surface area for digestive enzymes like lipase to act upon. While bile plays a crucial role in fat digestion, it does not directly digest starch or proteins. Therefore, bile juice helps in the digestion of lipids, making option (A) the correct answer.

Quick Tip

Remember, bile juice helps in the emulsification of fats, a process that makes fat digestion more efficient by increasing the surface area for lipase activity.

---

51. The beak shape and structure of a hummingbird is

(A) Short, stout, and conical

(B) Long, curved, and tubular

(C) Small, pointed, and hooked

(D) Broad, flat, and rectangular

Correct Answer: (B) Long, curved, and tubular

Solution:

The beak of a hummingbird is long, curved, and tubular, which is specifically adapted for feeding on nectar from flowers. The hummingbird's beak allows it to reach into flowers with a long, slender shape that suits its diet. This tubular structure helps the bird extract nectar efficiently without disturbing the flower too much. Other birds, such as those with conical beaks, are adapted for different feeding habits, such as cracking seeds. Thus, the correct answer is option (B).

Quick Tip

Hummingbirds are known for their long, tubular beaks, which are perfect for reaching nectar deep inside flowers, and their wings allow them to hover while feeding.

52. Coupling is less prone to malaria?

(A) Hb^A/Hb^A

(B) Hb^A/Hb^S

(C) Hb^S/Hb^S

(D) None of the above

Correct Answer: (B) Hb^A/Hb^S

Solution:

Individuals with the genotype Hb^A/Hb^S, which means they carry one normal hemoglobin allele and one sickle-cell hemoglobin allele, are less prone to malaria. This is because the sickle-cell trait provides some protection against malaria, as the malaria parasite has more difficulty surviving in sickle-shaped red blood cells. This is why such individuals, though they may have sickle-cell disease (when both alleles are Hb^S), have a selective advantage in malaria-endemic areas. Option (B) represents this protective genetic coupling.

Quick Tip

The presence of the sickle-cell trait (heterozygous Hb^A/Hb^S) offers partial protection against malaria, which is why it is more common in regions where malaria is endemic.

---

53. When was the Human Genome Project invented?

(A) 1992

(B) 1990

(C) 1996

(D) 2003

Correct Answer: (B) 1990

Solution:

The Human Genome Project (HGP) was a large-scale international research initiative aimed at mapping and sequencing the entire human genome. It was officially launched in 1990,

marking the beginning of a decade-long effort. The project was completed in 2003 with the publication of the first draft of the human genome. While significant progress was made throughout the 1990s, the official beginning of the project is recognized as the year 1990.

Quick Tip

The Human Genome Project has been fundamental in advancing our understanding of human genetics, providing a framework for medical research, genetic therapy, and personalized medicine.

---

54. Humans are primates.

(A) Class

(B) Genus

(C) Family

(D) Order

Correct Answer: (D) Order

Solution:

Humans are classified in the biological taxonomy system. The taxonomy hierarchy for humans is as follows:

- Domain: Eukarya - Kingdom: Animalia - Phylum: Chordata - Class: Mammalia - Order: Primates - Family: Hominidae - Genus: Homo - Species: Homo sapiens

The correct classification of humans is within the Order Primates. This order includes other species such as apes, monkeys, and lemurs. The term ”primates” refers to the group that includes both humans and these other closely related animals, making ”Order” the appropriate classification level for humans in this context.

Quick Tip

Primates, as a group, share several characteristics such as forward-facing eyes, flexible limbs, and a large brain relative to body size, all of which are important for their complex behaviors and social structures.

55. A metal which can be cut with a knife is:

(A) Ga

(B) Pt

(C) Pb

(D) Mg

Correct Answer: (A) Ga

Solution:

The metal that can be cut with a knife is Gallium (Ga). Gallium is a soft metal with a low melting point of about 29.76°C, making it easily malleable at room temperature. Unlike harder metals such as Platinum (Pt), Lead (Pb), or Magnesium (Mg), Gallium can be cut with a knife because of its soft and brittle nature.

- Gallium is a poor conductor of electricity but is highly corrosive to other metals like aluminum, especially at higher temperatures.
- Its low melting point and softness are the primary reasons it can be cut with a knife.

The other metals listed, such as platinum (Pt), lead (Pb), and magnesium (Mg), are much harder and cannot be cut with a knife under normal conditions.

Quick Tip

Gallium's softness and low melting point make it useful in electronic and semiconductor applications. However, due to its tendency to damage aluminum, it is used cautiously in certain environments.

---

56. Which of the following vitamins are water soluble?

(A) A

(B) D

(C) C

(D) K

Correct Answer: (C) C

Solution:

Vitamin C is a water-soluble vitamin, meaning it dissolves in water and is easily absorbed by the body. Water-soluble vitamins, like Vitamin C, need to be replenished regularly because they are not stored in the body. Any excess amount of Vitamin C is excreted through urine. The other vitamins listed, such as Vitamin A, D, and K, are fat-soluble vitamins. Fat-soluble vitamins are stored in the liver and fat tissues and do not require regular intake like water-soluble vitamins because they are retained in the body for a longer period.

- Vitamin A (fat-soluble) is important for vision, immune function, and skin health. - Vitamin D (fat-soluble) helps in calcium absorption and bone health. - Vitamin K (fat-soluble) is essential for blood clotting and bone metabolism.

Thus, the correct answer is Vitamin C (water-soluble).

Quick Tip

To maximize the benefits of water-soluble vitamins like Vitamin C, it's important to consume fresh fruits and vegetables regularly, as these vitamins are sensitive to heat and can be destroyed during cooking.

---

57. What is the hybridisation of $[Ni(CN)_4]^{2-}$?

(A) sp^3

(B) sp^2d

(C) dsp^2

(D) sp^3d

Correct Answer: (C) dsp^2

Solution:

The complex $[Ni(CN)_4]^{2-}$ involves nickel (Ni) in the +2 oxidation state and is coordinated to four cyanide (CN^-) ligands. The central metal ion, Ni^{2+}, has an electron configuration of $[Ar]\,3d^8\,4s^0$.

When four cyanide ions coordinate with the metal, the metal undergoes hybridization to accommodate the bonding with the ligands. Since the complex has a square planar geometry,

the hybridization of the central metal ion is dsp^2, where: - The d orbitals from the metal ion mix with the s and p orbitals to form four hybrid orbitals that will align in a square planar shape. - This hybridization is typical of coordination complexes where the metal is in a +2 oxidation state, especially for transition metals like nickel.
Thus, the correct hybridization for $[Ni(CN)_4]^{2-}$ is dsp^2, which leads to the square planar geometry.

Quick Tip

Square planar complexes typically exhibit dsp^2 hybridization and are commonly seen in metal complexes involving transition metals such as nickel, platinum, and palladium.

---

58. Thermite welding is caused by the formation of which compound?

(A) Al

(B) Fe

(C) Fe_2O_3

(D) FeO

Correct Answer: (C) Fe_2O_3

Solution:

Thermite welding is a process that uses a highly exothermic reaction between aluminum powder and iron(III) oxide (Fe_2O_3) to generate enough heat to melt and weld metal. This reaction is known as the "Thermite reaction" and occurs as follows:

$$Fe_2O_3(s) + 2Al(s) \rightarrow 2Fe(l) + Al_2O_3(s)$$

In this reaction: - Aluminum (Al) acts as a reducing agent, and iron oxide (Fe_2O_3) is reduced to iron (Fe). - The heat generated in the reaction is sufficient to melt the iron, which is used in welding metals.
Thus, thermite welding is caused by the formation of iron (Fe) from iron(III) oxide (Fe_2O_3), making option (C) the correct answer.

Quick Tip

The Thermite reaction is highly exothermic and can generate temperatures exceeding 2500°C, which is why it is used in welding applications such as rail track repair.

---

59. Which is the strongest acid?

(A) CH_3-CH_3

(B) H_2O

(C) CH_2=CH_2

(D) CH_2

Correct Answer: (B) H_2O

Solution:

Acidity of a compound is determined by its ability to donate a proton (H^+). In the given options:

- CH_3-CH_3 is an alkane and is very weakly acidic, typically acting as a base rather than an acid.

- CH_2=CH_2 (ethylene) is an alkene, and while it is weakly acidic, its ability to donate a proton is much less than H_2O.

- H_2O (water) is the strongest acid among the options. It can ionize in water to produce H^+ and OH^-, making it a moderate acid with a pKa value of approximately 15.7.

- CH_2 (formyl group) is not an acid, as it does not readily donate a proton in typical conditions.

Thus, the correct answer is (B) H_2O, as it is the strongest acid among the given options.

Quick Tip

Water (H_2O) is an amphoteric substance, meaning it can act as both an acid and a base, depending on the conditions.

---

60. Gutta percha is:

(A) trans-Polyisoprene

(B) cis-Polyisoprene

(C) Polyethylene

(D) Polypropylene

Correct Answer: (A) trans-Polyisoprene

Solution:

Gutta percha is a naturally occurring latex compound that is derived from the sap of certain trees in the genus *Palaquium*, mainly found in Southeast Asia. It is a type of polyisoprene, specifically in the trans-configuration. This polymer is similar to rubber but with a different molecular arrangement.

- In the case of gutta percha, the polymer chains adopt the trans configuration, which gives the material its rigidity and high tensile strength. This is why it is commonly used in dental and medical applications, as well as in cables and insulation.
- In contrast, the cis configuration of polyisoprene, as seen in natural rubber, leads to a more elastic material with a lower melting point.

Thus, the correct answer is (A) trans-Polyisoprene.

Quick Tip

Gutta percha's rigid nature due to its trans-polyisoprene structure is what makes it useful for non-elastic applications, in contrast to rubber's flexible nature.

---

61. Purple of Cassius is a colloidal solution of:

(A) Silver

(B) Lead

(C) Gold

(D) Mercury

Correct Answer: (C) Gold

Solution:

Purple of Cassius is a colloidal solution of gold that is typically produced by reducing gold chloride in the presence of tin chloride. The colloidal gold particles are dispersed in a liquid, giving the solution a characteristic purple color.

- Gold nanoparticles, when prepared in a colloidal form, can exhibit unique optical properties due to surface plasmon resonance, which is responsible for the purple color. - This colloidal form of gold has been historically used in glassmaking and is also significant in the study of nanotechnology.

Thus, the correct answer is (C) Gold.

Quick Tip

Purple of Cassius is an important example of colloidal gold and demonstrates how metal nanoparticles can be stabilized in a colloidal form.

---

62. Pyrolusite ore is:

(A) $CaSi_3$

(B) MnO_2

(C) $CuCO_3$

(D) Al_2O_3

Correct Answer: (B) MnO_2

Solution:

Pyrolusite is an ore of manganese, and its chemical formula is MnO_2. It is a primary source of manganese, which is widely used in the production of steel, batteries, and other industrial applications. The mineral is dark and often found in sedimentary rocks.

- Manganese dioxide (MnO_2) occurs naturally as pyrolusite and is used in the manufacturing of dry cell batteries and in the production of chlorine and potassium permanganate. - Other options like $CaSi_3$, $CuCO_3$, and Al_2O_3 refer to different minerals and are not the correct answer for Pyrolusite ore.

Thus, the correct answer is (B) MnO_2.

Quick Tip

Pyrolusite is an important manganese ore and plays a crucial role in the steel industry. Manganese's utility in steel production is largely due to its ability to improve the hardness and toughness of steel.

---

63. Which of the following is a negative charge colloidal sol?

(A) Gold

(B) S

(C) Clay

(D) All of these

Correct Answer: (D) All of these

Solution:

A colloidal sol is a type of mixture in which very fine particles of one substance are dispersed in another substance. The particles in a colloidal sol are typically between 1 nm and 1000 nm in size. These particles can carry either a positive or a negative charge depending on their nature.

- Gold (A): Gold sols are negatively charged colloids. The gold particles dispersed in a medium can carry a negative charge, making it a negative charge colloidal sol. - Sulfur (B): Sulfur also forms negatively charged colloidal sols, where the sulfur particles are dispersed in water. - Clay (C): Clay particles are negatively charged in nature when suspended in water, forming a negative charge colloidal sol.

Thus, all the substances (Gold, Sulfur, and Clay) can form negative charge colloidal sols. Therefore, the correct answer is (D) All of these.

Quick Tip

Negative charge colloidal sols are often more stable than positive charge sols because the repulsion between similarly charged particles helps prevent aggregation. This property is used in various applications like water purification and drug delivery systems.

64. Styrene is -

(A) Chlorobenzene

(B) Vinyl benzene

(C) Methyl benzene

(D) Ethyl benzene

Correct Answer: (B) Vinyl benzene

Solution:

Styrene is an organic compound with the chemical formula $C_6H_5CH = CH_2$, and is also known as ethenylbenzene or vinylbenzene. It consists of a benzene ring (C_6H_5) attached to an ethenyl group ($CH = CH_2$).

- Chlorobenzene (A): Chlorobenzene has a chlorine atom attached to the benzene ring and does not contain the ethenyl group, making it incorrect. - Vinyl benzene (B): Vinyl benzene, also known as styrene, is the correct answer as it has the ethenyl group attached to the benzene ring. - Methyl benzene (C): Methylbenzene, commonly known as toluene, has a methyl group attached to the benzene ring, not an ethenyl group, so it is incorrect. - Ethyl benzene (D): Ethylbenzene has an ethyl group attached to the benzene ring, which is not the same as the ethenyl group in styrene.

Thus, the correct answer is (B) Vinyl benzene.

Quick Tip

Styrene is widely used in the production of polystyrene, which is a common plastic used in packaging and insulation.

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65. The banana bond in diborane is constituted by:

(A) 3-atoms and 2-electrons

(B) 2-atoms and 2-electrons

(C) 3-atoms and 3-electrons

(D) 2-atoms and 3-electrons

Correct Answer: (A) 3-atoms and 2-electrons

Solution:

The banana bond in diborane is a unique bonding structure that involves three atoms and two electrons. It is found in diborane (B_2H_6), a molecule that exhibits two-center, two-electron bonds between boron and hydrogen, as well as three-center, two-electron bonds between boron and hydrogen. This three-center, two-electron bond is commonly referred to as a ”banana bond” due to its characteristic shape.

The bonding in diborane can be explained as follows:

- 3-atoms and 2-electrons (A): The banana bond forms between three atoms—two boron atoms and one hydrogen atom—sharing two electrons. This type of bond is found in diborane. - 2-atoms and 2-electrons (B): This does not accurately describe the banana bond because the banana bond involves three atoms, not two. - 3-atoms and 3-electrons (C): This is incorrect as the banana bond is formed by two electrons, not three. - 2-atoms and 3-electrons (D): This also does not correctly describe the banana bond as it does not follow the typical bonding pattern in diborane.

Thus, the correct answer is (A) 3-atoms and 2-electrons.

Quick Tip

The concept of a three-center, two-electron bond, or ”banana bond,” is important in understanding the unusual bonding in compounds like diborane and helps explain the structure of other electron-deficient molecules.

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66. Formic acid on heating with concentrated H_2SO_4 gives:

(A) CO

(B) H_2

(C) O_2

(D) CO_2

Correct Answer: (A) CO

Solution:

When formic acid (HCOOH) is heated with concentrated sulfuric acid (H_2SO_4), it undergoes a dehydration reaction leading to the formation of carbon monoxide (CO). The reaction is as follows:

$$HCOOH \xrightarrow{\text{conc. } H_2SO_4} CO + H_2O$$

This is a classic example of a dehydration reaction, where formic acid loses a molecule of water (H_2O) and is converted into carbon monoxide (CO) as a result of the strong dehydrating nature of concentrated sulfuric acid.
- Option (A) CO: Correct. As explained, the reaction leads to the formation of carbon monoxide (CO). - Option (B) H_2: Incorrect. Hydrogen gas (H_2) is not produced in this reaction. - Option (C) O_2: Incorrect. Oxygen (O_2) is not released in this reaction. - Option (D) CO_2: Incorrect. Although carbon dioxide (CO_2) is a common product in combustion reactions, it is not produced in this case. Instead, carbon monoxide (CO) is formed.
Thus, the correct answer is (A) CO.

Quick Tip

When heating formic acid with concentrated sulfuric acid, remember that the strong dehydrating nature of sulfuric acid typically promotes the elimination of water, leading to the formation of gases like carbon monoxide (CO).

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67. The following amines is the product of Gabriel phthalimide synthesis:

(A) Secondary aliphatic amine

(B) Primary aliphatic amine

(C) Aromatic primary amine

(D) Tertiary aliphatic amine

Correct Answer: (B) Primary aliphatic amine

Solution:

The Gabriel phthalimide synthesis is a reaction used to prepare primary amines. In this reaction, phthalimide (an imide compound) is first deprotonated to form a phthalimide anion,

which then reacts with an alkyl halide to give an N-alkyl phthalimide. This intermediate can then undergo hydrolysis to yield a primary amine. The general steps are:
1. Phthalimide is treated with a base (such as potassium hydroxide) to form a phthalimide anion. 2. The phthalimide anion then reacts with an alkyl halide (R-X) to form the N-alkyl phthalimide. 3. Hydrolysis (using acidic or basic conditions) of the N-alkyl phthalimide leads to the formation of a primary aliphatic amine ($R\text{-}NH_2$).
Thus, the product of the Gabriel phthalimide synthesis is a primary aliphatic amine.
- Option (A) Secondary aliphatic amine: Incorrect. The Gabriel synthesis produces primary amines, not secondary amines. - Option (B) Primary aliphatic amine: Correct. As explained, the reaction leads to the formation of a primary aliphatic amine. - Option (C) Aromatic primary amine: Incorrect. This method typically yields aliphatic primary amines, not aromatic primary amines. - Option (D) Tertiary aliphatic amine: Incorrect. The reaction does not result in the formation of tertiary amines.
Thus, the correct answer is (B) Primary aliphatic amine.

Quick Tip

The Gabriel phthalimide synthesis is a reliable method for preparing primary aliphatic amines and can be used to introduce various alkyl groups to the nitrogen atom.

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68. Which type of linkage is present in nucleic acids?

(A) Phosphodiester linkage

(B) Glycosidic linkage

(C) Peptide linkage

(D) None of these

Correct Answer: (A) Phosphodiester linkage

Solution:

Nucleic acids, which include DNA and RNA, are polymers made up of nucleotides. Each nucleotide consists of a phosphate group, a sugar molecule (deoxyribose in DNA and ribose in RNA), and a nitrogenous base. The nucleotides are connected by phosphodiester linkages

that form the backbone of the nucleic acid strand.

A phosphodiester linkage occurs between the phosphate group of one nucleotide and the sugar molecule (specifically the hydroxyl group on the 3' carbon) of the next nucleotide. This bond is crucial for forming the long chains of nucleotides in both DNA and RNA.

- Option (A) Phosphodiester linkage: Correct. This is the type of linkage present between nucleotides in nucleic acids. - Option (B) Glycosidic linkage: Incorrect. Glycosidic linkages are found between sugar and base in the nucleotide, not between the nucleotides themselves. - Option (C) Peptide linkage: Incorrect. Peptide linkages are found in proteins, linking amino acids together, not in nucleic acids. - Option (D) None of these: Incorrect. The correct linkage in nucleic acids is phosphodiester.

Thus, the correct answer is (A) Phosphodiester linkage.

Quick Tip

The phosphodiester bond in nucleic acids is essential for maintaining the structural integrity of DNA and RNA and allowing for the proper storage and transmission of genetic information.

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69. Which is prepared by peptisation?

(A) colloid

(B) precipitate

(C) peptide

(D) solution

Correct Answer: (A) colloid

Solution:

Peptisation is a process used to convert precipitates into colloidal solutions. This process involves the breaking down of larger particles (precipitate) into smaller particles, which are then dispersed in a solvent, forming a colloidal solution. This process typically uses a stabilising agent (called a peptising agent) to prevent the colloidal particles from aggregating.

- Option (A) colloid: Correct. Peptisation results in the formation of a colloidal solution

from a precipitate. - Option (B) precipitate: Incorrect. A precipitate is formed when a substance falls out of solution, not during peptisation. - Option (C) peptide: Incorrect. Peptisation does not form peptides; it forms colloidal particles. - Option (D) solution: Incorrect. Peptisation specifically forms a colloidal solution, not just a simple solution. Thus, the correct answer is (A) colloid.

Quick Tip

Peptisation is a useful technique in colloid chemistry, particularly for stabilising dispersed phases that would otherwise aggregate.

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70. Consider the argon atom. For how many electrons does this atom have $m_l = 1$?

(A) 2

(B) 4

(C) 6

(D) 12

Correct Answer: (B) 4

Solution:

For the given question, we need to consider the electron configuration of the Argon atom (Ar) and find out how many electrons have $m_l = 1$.

The electron configuration for Argon (Ar) is as follows:

$$1s^2\, 2s^2\, 2p^6\, 3s^2\, 3p^6$$

Now, let's focus on the $2p$ and $3p$ orbitals because the question specifically asks about the electrons with $m_l = 1$.

- The $2p$ orbital has three possible values for m_l: $m_l = -1, 0, 1$. The number of electrons in the $2p$ orbital is 6, and these electrons are distributed over the three values of m_l, with two electrons having $m_l = 1$. - The $3p$ orbital also has three possible values for m_l: $m_l = -1, 0, 1$. The number of electrons in the $3p$ orbital is 6, and these electrons are distributed over the three values of m_l, with two electrons having $m_l = 1$.

Thus, there are a total of 4 electrons with $m_l = 1$, two electrons from the $2p$ orbital and two electrons from the $3p$ orbital.
Thus, the correct answer is (B) 4.

Quick Tip

Remember, the magnetic quantum number m_l defines the orientation of the orbital, and for any p-orbital ($l = 1$), there are three possible values for m_l, which are $-1, 0, +1$.

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71. Which of the following will not show mutarotation?

(A) Maltose

(B) Lactose

(C) Glucose

(D) Sucrose

Correct Answer: (D) Sucrose

Solution:

Mutarotation refers to the change in the optical rotation that occurs when a sugar solution equilibrates between two anomeric forms. This phenomenon is observed in sugars that can exist in cyclic forms with an anomeric carbon.
- Maltose and lactose are reducing sugars. These sugars can undergo mutarotation because they have free anomeric carbon atoms that can interconvert between alpha and beta anomeric forms. - Glucose is also a reducing sugar and shows mutarotation, as it has a free anomeric carbon that interconverts between the alpha and beta forms. - Sucrose, on the other hand, is a non-reducing sugar. It does not show mutarotation because both anomeric carbons (from glucose and fructose) are involved in the glycosidic bond, meaning that it does not have a free anomeric carbon. Therefore, sucrose cannot undergo mutarotation.
Thus, the correct answer is (D) Sucrose.

Quick Tip

Mutarotation is characteristic of reducing sugars, which contain a free aldehyde or ketone group capable of undergoing interconversion between anomeric forms. Non-reducing sugars like sucrose do not exhibit this behavior.

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72. Aqueous solution of Mohr's salt gives a positive test for:

(A) Fe^{2+}

(B) NH_4^+

(C) SO_4^{2-}

(D) All of these

Correct Answer: (D) All of these

Solution:

Mohr's salt, which is a double salt of ammonium iron(II) sulfate, has the chemical formula $(NH_4)_2Fe(SO_4)_2 \cdot 6H_2O$. When dissolved in water, it dissociates to release the following ions: - Fe^{2+} ions (iron(II) ions) - NH_4^+ ions (ammonium ions) - SO_4^{2-} ions (sulfate ions) Thus, the aqueous solution of Mohr's salt contains Fe^{2+}, NH_4^+, and SO_4^{2-} ions, and all of these can be detected by specific tests: - Fe^{2+} gives a positive test with potassium ferrocyanide (producing a blue precipitate). - NH_4^+ ions can be detected using Nessler's reagent, which gives a yellow to brown color. - SO_4^{2-} ions can be detected using barium chloride, which gives a white precipitate of barium sulfate.

Therefore, the correct answer is (D) All of these.

Quick Tip

Mohr's salt is a useful reagent in analytical chemistry, especially for detecting iron(II) ions and performing sulfate ion tests. It is commonly used in titrations for determining the concentration of iron(II) in samples.

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73. Which one contains an amide bond?

(A) Terylene

(B) Cellulose

(C) Nylon-6

(D) Polystyrene

Correct Answer: (C) Nylon-6

Solution:

An amide bond is a type of covalent bond that forms between a carboxyl group (-COOH) and an amine group (-NH_2) and is typically seen in proteins, peptides, and synthetic polymers.
- Terylene is a polymer formed from the reaction between terephthalic acid and ethylene glycol, which forms an ester bond. - Cellulose is a polysaccharide consisting of glucose units linked by ether bonds. - Nylon-6, on the other hand, is a synthetic polymer that forms through a condensation reaction between a lactam (a cyclic amide) and itself, resulting in the formation of an amide bond (-CO-NH-) in its polymeric structure. Therefore, Nylon-6 contains amide bonds. - Polystyrene is a synthetic polymer formed by the polymerization of styrene, and it does not contain an amide bond. It contains carbon-carbon bonds.
Thus, the correct answer is (C) Nylon-6 because it contains an amide bond.

Quick Tip

Nylon-6 is an example of a polyamide, a class of polymers that contain amide bonds. Other examples include Nylon-6,6 and Kevlar, both of which are known for their strength and durability.

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74. Heating of $Ca(NO_3)_2$ produces:

(A) NO_2

(B) N_2O

(C) O_2

(D) $NO_2 + O_2$

Correct Answer: (D) $NO_2 + O_2$

Solution:

When calcium nitrate ($Ca(NO_3)_2$) is heated, it undergoes thermal decomposition. The reaction is as follows:

$$Ca(NO_3)_2 \xrightarrow{\text{heat}} CaO + 2NO_2 + O_2$$

Here, calcium nitrate decomposes to form calcium oxide (CaO), nitrogen dioxide (NO_2), and oxygen (O_2). The correct decomposition product is NO_2 and O_2.

Thus, the correct answer is (D) $NO_2 + O_2$.

Quick Tip

The decomposition of nitrates generally produces nitrogen dioxide (NO_2) and oxygen (O_2) upon heating, except for certain exceptions like potassium nitrate which decomposes to give potassium nitrite and oxygen.

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75. Which one is acidic?

(A) MnO

(B) Mn_2O_3

(C) MnO_2

(D) Mn_2O_7

Correct Answer: (D) Mn_2O_7

Solution:

To identify which oxide is acidic, it is important to look at the oxidation states of the central metal (manganese in this case) and the nature of the oxide.

- MnO: Here, manganese has an oxidation state of +2. Oxides of metals with lower oxidation states tend to be basic. - Mn_2O_3: In this oxide, manganese has an oxidation state of +3. This oxide is amphoteric, meaning it can act both as an acid and a base. - MnO_2: Here, manganese has an oxidation state of +4. This oxide is generally amphoteric but can also exhibit some acidic properties. - Mn_2O_7: In this oxide, manganese has an oxidation state of

+7, which is quite high. Oxides with high oxidation states like +7 tend to be acidic, and Mn_2O_7 is indeed an acidic oxide.

Therefore, Mn_2O_7 (option D) is the acidic oxide, making it the correct answer.

Quick Tip

Oxides of metals with high oxidation states (such as Mn in +7) are usually acidic, while oxides of metals with lower oxidation states (like +2) are typically basic.
