REET Science Top 50 Questions PDF

Q1. Interfascicular cambium and cork cambium are formed due to
(a) Cell division
(b) Cell differentiation
(c) Cell dedifferentiation
(d) Redifferentiation

Q2. What is the type of polyembryony in which only a few embryos are formed within the seed, while others remain undeveloped?
(a) Facultative Polyembryony
(b) Sporophytic Polyembryony
(c) Endospermic Polyembryony
(d) Embryo Sac Polyembryony

Q3. Match List – I with List – II.

	List - I		List – II
(A)	Bronchioles	(i)	Dense regular connective tissue
(B)	Goblet cell	(ii)	Loose Connective Tissue
(C)	Tendons	(iii)	Glandular Tissue
(D)	Adipose Tissue	(iv)	Ciliated Epithelium

Choose the correct answer from the options given below:
(a) (A) - (iii), (B) - (iv), (C) - (ii), (D) - (i)
(b) (B) - (iv), (B) - (iii), (C) - (i), (D) - (ii)
(c) (C) - (i), (B) - (ii), (C) - (iii), (D) - (iv)
(d) (D) - (ii), (B) - (i), (C) - (iv), (D) - (iii)

Q4. Which among the following is not a prokaryote?
(a) Saccharomyces
(b) Mycobacterium
(c) Oscillatoria
(d) Nostoc

Q5. More than 200 species of cichlid fish got extinct in the Lake Victoria because of
(a) Over-Exploitation
(b) Alien species invasion
(c) Habitat loss and fragmentation
(d) Co-extinction

Q6. Which of the following best describes the function of the receptacle in a flower?
(a) To produce and protect the ovules
(b) To hold the sepals, petals, and reproductive organs in place
(c) To produce and distribute pollen
(d) To produce and store nectar

Q7. The blood to the heart muscles gets affected in which disease?
(a) Angina
(b) Heart Failure
(c) Coronary Artery Disease
(d) Hypertension

Q8. Select wrong statement:
(a) First transgenic animal was sheep
(b) First transgenic plant was tobacco
(c) First transgenic crop in India is Bt-Cotton
(d) Banting and Best were the first to isolate insulin from dog's pancreas

Q9. Water soluble vitamin is
(a) Vitamin E
(b) Vitamin K
(c) Vitamin B
(d) Vitamin A

Q10. Select the correctly written scientific name of Mango which was first described by Carolus Linnaeus.
(a) Mangifera indica Car. Linn
(b) Mangifera indica Linn
(c) Mangifera indica
(d) Mangifera Indica

Q11. A drug called 'Heroin' is synthesized by
(a) methylation of morphine
(b) acetylation of morphine
(c) glycosylation of morphine
(d) nitration of morphine

Q12. The correct order of second ionization potential of carbon, nitrogen, oxygen and fluorine is
(a) C > N > O > F
(b) O > N > F > C
(c) O > F > N > C
(d) F > O > N > C

Q13. What is the IUPAC name of the element with atomic number 112?
(a) Unnilennium
(b) Ununnilium
(c) Unununium
(d) Ununbium

Q14. On subjecting mesityloxide to the iodoform reaction, one of the products is the sodium salt of an organic acid. Which acid is obtained?
(a) $(CH_3)_2$ C = CH–CH_2COOH
(b) $(CH_3)_2$CH–COOH
(c) $(CH_3)_2$C=CH–COOH
(d) $(CH_3)_2$C=CH–CO–COOH

Q15. Acetic acid dissolved in benzene shows a molecular mass of
(a) 30
(b) 60
(c) 120
(d) 180

Q16. A radioactivity decay is always considered as
(a) Zero order reaction
(b) First order reaction
(c) Both the above
(d) Second order reaction

Q17. The ionization of nitrogen is –
(a) The same as that of oxygen
(b) Half that of oxygen
(c) Less than that of oxygen
(d) Greater than that of oxygen

Q18. Which of the following substance is used in making soap?
(a) Vegetable Oil
(b) Mobil Oil
(c) Kerosene Oil
(d) Cutting Oil

Q19. Nitrogen, Phosphorus, Potassium belongs to the category of _____.
(a) Macro nutrients
(b) Micro nutrients
(c) Both a and b
(d) None of the above

Q20. The primary pollutant that leads to photochemical smog is:
(a) Acrolein
(b) Nitrogen oxides
(c) Ozone
(d) Sulphur dioxide

Q21. The limiting value of average velocity when time interval becomes infinitesimally small or approaches to zero will give
(a) Instantaneous speed
(b) Instantaneous velocity
(c) Instantaneous acceleration
(d) None of the above

Q22. Which of the following processes are the thermodynamically reversible?
(a) Throtting
(b) Free expansion
(c) Constant volume and constant pressure
(d) Isothermal and adiabatic

Q23. Binding energy of a nucleus is:
(a) Energy given to the nucleus during its formation
(b) Loss of energy from the nucleus during its formation
(c) Energy equivalent to the total mass of the nucleus
(d) Total K.E. and P.E. of the nucleons in the nucleus

Q24. Which nature of light is exposed by its diffraction and interference?
(a) Nature of light is electromagnetic
(b) Wave nature of light
(c) Quantum nature of light
(d) Longitudinal nature of light

Q25. In a p-n junction diode, change in temperature due to heating
(a) Affects only reverse resistance
(b) Affects only forward resistance
(c) Does not affect resistance of p-n junction
(d) Affects the overall V – I characteristics of p-n junction

Q26. The image of a star is obtained at F of a concave mirror when the incident ray is
(a) along the focal plane
(b) inclined to principal axis
(c) perpendicular to principal axis
(d) parallel to principal axis

Q27. Which of the following statements regarding amalgam is true?
Statement 1: It is an alloy of mercury.
Statement 2: It is an alloy of tin and lead.
(a) Only 1
(b) Only 2
(c) Both 1 and 2
(d) Neither 1 nor 2

Q28. Which permanent tissue makes a plant hard and stiff?
(a) Collenchyma
(b) Sclerenchyma
(c) Parenchyma
(d) Aerenchyma

Q29. Which of the following processes is used to convert a substance directly from the solid to the gaseous state?
(a) Distillation
(b) Sublimation
(c) Evaporation
(d) Chromatography

Q30. Compounds of which of the following metals is used in black and white photography?
(a) Al
(b) Ag
(c) Cu
(d) Au

Q31. Which gas is typically produced when metal reacts with acids?
(a) Carbon dioxide
(b) Oxygen
(c) Hydrogen
(d) Nitrogen

Q32. An object is placed on the principal axis of a convex lens of focal length 10 cm. If the distance of the object from the lens is 30 cm, what is the distance of the image formed?
(a) 20 cm
(b) 15 cm
(c) 10 cm
(d) 30 cm

Q33. Which of the following terms constitutes the female part of the flower.
(a) sepals, petal and stamen
(b) stigma, style and ovary
(c) ovary, stamen and stigma
(d) ovary, style and stamen

Q34. Which of the following is a dead tissue in a plant body?
(a) Collenchyma
(b) Chlorenchyma
(c) Parenchyma
(d) Sclerenchyma

Q35. Solid Carbon dioxide is known as _____.
(a) Gas ice
(b) Wet ice
(c) Solid ice
(d) Dry ice

Q36. The amount of work done in moving a charge of 4C across two points having a potential difference of 6V is _____.
(a) 48 J
(b) 12 J
(c) 36 J
(d) 24 J

Q37. A fuse wire is an alloy made up of which of the following materials?
(a) Tin – Silver
(b) Silver - Lead
(c) Tin - Lead
(d) Tin – Nickel

Q38. An object with a mass of 22 kg moving with a velocity of 5 m/s possesses kinetic energy of:
(a) 275 J
(b) 110 J
(c) 1100 J
(d) 2750 J

Q39. How does Amoeba reproduce?
(a) Binary fission
(b) Sexual Reproduction
(c) Fragmentation
(d) Budding

Q40. Which one among the following is responsible for formation of "Ozone Holes" in the atmosphere?
(a) Benzopyrene
(b) Hydrocarbons
(c) Chlorofluorocarbons
(d) UV radiation

Q41. If a box of mass 25 kg is pushed 15 m by a force of 'F' N and work done in the process is 480 J. Find F:
(a) 50
(b) 32
(c) 16
(d) 25

Q42. What is the repeated reflection of sound from the walls of a big hall that results in persistence of sound called?
(a) Music
(b) Pitch
(c) Note
(d) Reverberation

Q43. Identifying a way to reduce the pollution caused due to burning of fossil fuels
(a) By lowering the temperature of burning
(b) By increasing the efficiency of the combustion process
(c) By increasing the number of carbon molecules
(d) By decreasing the latent heat

Q44. Which of the following is NOT an application of third law of motion?
(a) A fielder pulls his hands gradually with the moving ball while holding a catch
(b) Colliding with player while kicking a football and feeling hurt
(c) As the sailor jumps in forward direction, the boat moves backwards
(d) A forward force on the bullet and recoil of the gun

Q45. Which of the following proteins is found in plasma?
(a) Leptin
(b) Keratin
(c) Albumin
(d) Insulin

Q46. Newton's first law of motion is known as
(a) Gravity
(b) Law of Inertia
(c) Law of conservation of momentum
(d) Vertical motion

Q47. Which type of reaction occurs when carbon burns in oxygen to give carbon dioxide?
(a) Addition reaction
(b) Combustion reaction
(c) Decomposition reaction
(d) Substitution reaction

Q48. Which of the following organelles shows similarity to a prokaryotic cell?
(a) Mitochondria only
(b) Chloroplast only
(c) Both chloroplast and mitochondria
(d) None of the above

Q49. A spherical mirror whose reflecting surface is curved inwards is called a _____ mirror.
(a) convex
(b) conflict
(c) concave
(d) plane

Q50. Which of the following is an electromagnetic wave?
(a) Infrared rays
(b) Ultrasonic wave
(c) Sound wave
(d) Cathode rays

Solutions

S1. Ans.(c)
Sol. The correct answer is Cell dedifferentiation.
Option c:
- Cell dedifferentiation is defined as a temporary process in which cells become less specialized and return to an earlier cell state.
- Under some circumstances, a differentiated cell can regain its ability to divide.
- Cell dedifferentiation results in the formation of interfascicular cambium and cork cambium.
- Therefore, this is the correct answer.

Information Booster
- Interfascicular cambium is a continuous ring formed by the meristematic activity of the cells of medullary rays present next to intrafascicular cambium.
- Cork cambium is a meristematic tissue, which divides and replaces the broken cells of epidermal and cortex layer due to the high activity of vascular cambium.

Additional Information
Option a:
- Cell division is defined as the process where
- After mitosis, plant cells divide in half by forming a new cell wall (cell plate) between daughter nuclei.
- Both interfascicular cambium and cork cambium are not formed by cell division.
- Therefore, this is the incorrect option.

Option b:
- Cell differentiation is the process through which cells from the same source generate cell groups with different morphological and functional features over time.

- Interfascicular cambium and cork cambium are not formed by cell differentiation.
- Therefore, this is the incorrect option.

Option d:
- A mature plant cell loses its ability to divide after being dedifferentiated.
- Both the interfascicular cambium and cork cambium are not formed due to the process of redifferentiation.
- Therefore, this is the incorrect option.

The correct answer is option c.

S2. Ans.(a)

Sol. The correct answer is Facultative Polyembryony.
- Facultative polyembryony is a form of polyembryony in which only a small number of embryos develop inside the seed while the rest do not.
- In plants with many ovules in a single ovary, this sort of polyembryony is frequently observed.
- Only a small percentage of the ovules in facultative polyembryony mature into embryos, with the majority remaining as non-embryonic tissue.
- As a result, seeds are produced that have numerous embryos, each of which has the capacity to develop into a different plant.
- Because facultative polyembryony only happens under specific circumstances, it is not a constant or predictable phenomenon.
- Citrus fruits, mangoes, and some eucalyptus species are some typical examples of plants that display facultative polyembryony.
- Multiple embryos can form either spontaneously or as a result of external influences, which is referred to as facultative polyembryony.
- The term "facultative" refers to the fact that the development of numerous embryos is not a certain outcome and may only take place in specific circumstances.
- Facultative polyembryony is frequently observed in species that are significant for horticulture or agriculture and can produce offspring with beneficial features, such as improved yield or disease resistance.

S3. Ans.(b)

Sol. The correct answer is (b) (B) - (iv), (B) - (iii), (C) - (i), (D) - (ii)
- **Ciliated epithelium** is mainly present on the inner surface of hollow organs like **bronchioles and fallopian tubes**. The function is to move **particles or mucus in a specific direction over the epithelium**.
- Some of the **columnar or cuboidal cells** get specialized **for secretion and are called the glandular epithelium**. They are mainly of two types: **unicellular**, consisting of isolated **glandular cells (goblet cells of the alimentary canal)**, and **multicellular**, consisting of **clusters of cells (salivary gland)**.
- **Tendons** are **dense regular connective tissues**. They **attach skeletal muscles to bones**.
- **Adipose tissue** is a type of **loose connective tissue** located mainly beneath the skin. The cells of this tissue are specialized to **store fats**.
- Therefore, **the correct answer is option b**.

Information Booster

- Animal tissues are different and are broadly classified into four types: **(i) Epithelial, (ii) Connective, (iii) Muscular, and (iv) Neural**
- Epithelial tissue provides a covering or a lining for some parts of the body.
- Connective tissues are most abundant and widely distributed in the body of complex animals.
- Muscle is made of many long, cylindrical fibers arranged in parallel arrays. They are three types: skeletal, smooth, and cardiac.
- Neural tissue exerts the greatest control over the body's responsiveness to changing conditions.

S4. Ans.(a)

Sol. The correct answer is Saccharomyces.

Option a: Saccharomyces - CORRECT

- *Saccharomyces* is a genus belonging to **Kingdom Fungi**.
- *Saccharomyces* are **unicellular eukaryotic organisms**.
- Golgi complex, mitochondria, vacuoles, and endoplasmic reticulum are some of the cell organelles found in *Saccharomyces*.

Option b: Mycobacterium – INCORRECT

- *Mycobacterium* is a gram-positive rod-shaped bacteria.
- They belong to **Kingdom Monera**.
- They are **unicellular prokaryotic organisms**. They **lack any cell organelles** and a well-defined **nucleus**.

Option c: Oscillatoria – INCORRECT

- *Oscillatoria* is a filamentous **cyanobacterium** found in freshwater environments.
- They are **unicellular prokaryotic organisms** belonging to **Kingdom Monera**.

Option d: Nostoc – INCORRECT

- *Nostoc* is a genus of cyanobacteria.
- They are unicellular prokaryotic organisms belonging to Kingdom Monera.

Information Booster

- Living organisms can be divided into tow groups based on their cell structure i.e. prokaryotes and eukaryotes.
- The cells of these organisms are respectively called prokaryotic cells and eukaryotic cells.

S5. Ans.(b)

Sol. The correct answer is Alien species invasion.

Alien species invasions:

- When alien species are introduced unintentionally or deliberately for whatever purpose, some of them turn invasive and cause the decline or extinction of indigenous species.
- **The Nile perch introduced into Lake Victoria in East Africa led eventually to the extinction of an ecologically unique assemblage of more than 200 species of cichlid fish in the lake.**

- The introduction of African catfish **Clarias gariepinus** for aquaculture purposes is posing a threat to the indigenous catfishes in our rivers.

Information Booster

- **Causes of biodiversity losses:** The accelerated rates of species extinctions that the world is facing now are largely due to human activities.
- There are four major causes called **"The Evil Quartet" - Over-Exploitation, Alien species invasion, Habitat loss and fragmentation & Co-extinction.**

Additional Information

Over-exploitation:

- Many species extinctions in the last 500 years (**Steller's sea cow, passenger pigeon**) were due to overexploitation by humans.
- Presently, many marine fish populations around the world are over-harvested, endangering the continued existence of some commercially important species.

Habitat loss and fragmentation:

- This is the most important cause driving animals and plants to extinction.
- The most dramatic examples of habitat loss come from **tropical rainforests**.
- Once covering more than **14 per cent** of the earth's land surface, these rain forests now cover no more than **6 per cent**. They are being destroyed fast.
- Besides total loss, the degradation of many habitats by pollution also threatens the survival of many species.
- When large habitats are broken up into small fragments due to various human activities, mammals and birds requiring large territories and certain animals with migratory habits are badly affected, leading to population declines.

Co-extinctions:

- When a species become extinct, that plant and animal species associated with it in an obligatory way also become extinct.
- When a host fish species become extinct, its unique assemblage of parasites also meets the same fate.
- Another example is the case of a coevolved plant-pollinator mutualism where extinction of one invariably leads to the extinction of the other.

S6. Ans.(b)

Sol. The correct answer is To hold the sepals, petals, and reproductive organs in place.

- The structure in a flower known as the **receptacle** holds and supports the many floral organs, such as the **sepals, petals, stamens, and pistil**.
- The **receptacle** acts as a base for the attachment of the other floral organs and is found at the flower stalk's tip.
- The sepals, which are **usually green and resemble leaves, serve to shield the budding flower**.
- Pollinators are drawn to the petals because they are more delicate and frequently have vibrant colours.

- The female **pistil** is responsible for developing and guarding the ovules, while the male reproductive organs, the **stamens**, are in charge of making and dispersing pollen.
- **For efficient and effective pollination, the receptacle offers a platform** on which these numerous floral organs can be positioned in a predetermined configuration.
- The overall look and form of the flower can also be significantly influenced by the size, shape, and texture of the receptacle.
- **In conclusion**, the **sepals, petals, stamens, and pistil**, as well as other floral organs, are held and supported by the **receptacle** in a flower.
- It offers a framework for these organs to be positioned successfully for successful pollination.

S7. Ans.(c)

Sol. The correct answer is Coronary Artery Disease.

Coronary Artery Disease (CAD):

- **Coronary Artery Disease**, often referred to as **atherosclerosis**, affects the vessels that supply blood to the heart muscle.
- It is caused by deposits of **calcium, fat, cholesterol, and fibrous tissues**, which makes the lumen of arteries narrower.

Information Booster

- The **coronary arteries supply blood to the muscles of the heart**. These carry oxygenated blood to the heart cells so that they can function properly.
- The coronary arteries are of two types - **The left coronary artery & the right coronary artery.**

Additional Information

Angina:

- It is also called **'angina pectoris'**. A symptom of acute chest pain appears when not enough oxygen is reaching the heart muscle.
- Angina can occur in men and women of any age, but it is more common among the middle-aged and elderly. It occurs due to conditions that affect blood flow.

Heart Failure:

- Heart failure means the state of the heart when it is not pumping blood effectively enough to meet the needs of the body.
- It is sometimes called **congestive heart failure** because congestion of the lungs is one of the main symptoms of this disease. Heart failure is not the same as **cardiac arrest** (when the heart stops beating) or a **heart attack** (when the heart muscle is suddenly damaged by an inadequate blood supply).

High Blood Pressure (Hypertension):

- Hypertension is the term for blood pressure that is higher than **normal (120/80)**. In this measurement, **120 mm Hg** (millimeters of mercury pressure) is the **systolic**, or **pumping**, pressure, and **80 mm Hg** is the **diastolic**, or **resting pressure**.
- If repeated checks of blood pressure of an individual are **140/90 (140 over 90) or higher**, it shows **hypertension**.
- High blood pressure leads to heart diseases and also affects vital organs like the **brain** and **kidney**.

S8. Ans.(a)

Sol. The correct answer is First transgenic animal was sheep.

- In **1974**, Rudolf Jaenisch created a **transgenic mouse** by introducing foreign DNA into its embryo, making it the world's first transgenic animal.
- The **first genetically modified plant** was produced in **1982**, an antibiotic-resistant **tobacco** plant.
- In **2002**, in **India**, the **first genetically modified crop of cotton** was officially introduced.
- In **1921**, **Frederick Banting** and **Charles H. Best** discovered the hormone **insulin** in **pancreatic extracts of dogs**.
- The **first cloned mammal**, the sheep **"Dolly"**, was born on **5 July 1996**.

So, the incorrect statement is **First transgenic animal was sheep**.

S9. Ans.(b)

Sol. The correct answer is Vitamin B.

Vitamin:

- Vitamins are organic substances that **we require in adequate quantities for good health**.
- Our body **cannot synthesize them**.
- Therefore, we need to consume **natural sources such as fruits and vegetables**.
- Vitamins are divided into two groups: **fat-soluble vitamins** (**Vitamins A, D, E, and K**) and **water-soluble vitamins** (**Vitamins of B group and Vitamin C**).

S10. Ans.(b)

Sol. The correct answer is Mangifera indica Linn

- There are certain rules for naming an organism using **binomial nomenclature**.
- The **first word** always starts **with a capital letter** and represents **the genus**.
- The **second word starts with a small letter** and represents **the species**.
- **The scientific name is written in italics or underlined when handwritten.**
- According to the rules of binomial nomenclature, the correctly written **scientific name of mango is *Mangifera indica* Linn.**

S11. Ans.(b)

Sol. The correct answer is acetylation of morphine.

- **Heroin**, an opioid commonly called **smack**, is chemically diacetylmorphine, which is a white, odorless, bitter crystalline compound.
- It is obtained **by acetylation of morphine**.
- Morphine is extracted from the **latex** of the poppy plant *Papaver somniferum*.
- **Heroin is taken generally by snorting and injection**.
- It acts as a **depressant** and slows down body functions.

Information Booster

- **Opiates** are drugs obtained from opium or artificially produced substitutes that have opium-like effects.
- They produce **morphine-like effects**.
- Medically, they are primarily used for **pain relief, including anesthesia**.

- **Opioids** are drugs that bind to specific opioid receptors present in our **central nervous system and gastrointestinal tract**.
- **Example:** codeine, morphine, heroin.

S12. Ans.(c)

Sol. The correct answer is O > F > N > C.

Generally, ionization potential increases on moving along the period.

To determine the order of second ionization potentials, stability of the resulting ions after the removal of the first electron is a necessary factor:

- **Carbon (C):** The first ionization results in the removal of an electron from the 2p orbital. Its configuration after the first ionization is $\mathbf{1s^2\ 2s^2\ 2p^1}$. The second ionization will remove an electron from 2p, requiring significant energy.
- **Nitrogen (N):** The first ionization removes an electron from 2p, resulting in $\mathbf{1s^2\ 2s^2\ 2p^2}$. The second ionization will remove another electron from the 2p orbital of the relatively stable half-filled 2p shell, requiring more energy than carbon.
- **Oxygen (O):** The first ionization removes one electron from the 2p orbital, resulting in the configuration $\mathbf{1s^2\ 2s^2\ 2p^3}$, which is relatively stable (half-filled p subshell). The second ionization requires even more energy.
- **Fluorine (F):** The first ionization removes an electron from the 2p orbital, resulting in $\mathbf{1s^2\ 2s^2\ 2p^4}$. Removal of the second electron will require high energy but less than O, where the electron is being removed from a more stable electronic configuration.

Information Booster

Ionization potential (or ionization energy) is the energy required to remove an electron from an atom or ion. The second ionization potential refers to the energy required to remove a second electron after the first has been removed. The stability of the resulting ion and the electron configuration significantly influence this energy.

Conclusion:

The correct order of second ionization potential of carbon, nitrogen, oxygen, and fluorine is : O > F > N > C

S13. Ans.(d)

Sol. The correct answer is Ununbium.

- The element with atomic number **112** has the digits **"1-1-2"**.
- Applying the **IUPAC naming system**:
  - **1 - un**
  - **1 - un**
  - **2 - bi**
- Combining these prefixes and adding the **"-ium"** suffix gives **"Ununbium"**.

Information Booster

Nomenclature of Elements with Atomic Numbers Greater than 100

- The **IUPAC** (International Union of Pure and Applied Chemistry) has a systematic naming convention for elements with atomic numbers greater than **100**.

- The name is derived from the **Latin and Greek roots** for the digits of the atomic number, followed by the suffix **"-ium"**.
- Each digit of the atomic number is assigned a specific prefix:
  - **0 - nil**
  - **1 - un**
  - **2 - bi**
  - **3 - tri**
  - **4 - quad**
  - **5 - pent**
  - **6 - hex**
  - **7 - sept**
  - **8 - oct**
  - **9 – enn**
- The digits are concatenated to form the element name.

The correct option is Ununbium.

- **Note:** The element with atomic number **112** is now known by its official name, **Copernicium (Cn)**, but prior to being named, its systematic IUPAC name was **Ununbium (Uub)**.

S14. Ans.(c)

Sol. The correct answer is $(CH_3)_2C=CH–COOH$.

- The structure of **mesityl oxide** is:
- **$(CH_3)_2C=CH-CO-CH_3$**
- When subjected to the **iodoform reaction**:
  - The **methyl ketone group (-$COCH_3$)** undergoes **halogenation and subsequent hydrolysis**.
  - This results in the cleavage of the molecule into **iodoform (CHI_3) and an organic acid**.
- After cleavage, the remaining structure forms the organic acid:
- **$(CH_3)_2C=CH-COOH$**

This compound is known as **3-methyl-2-butenoic acid**.

Information Booster

Iodoform Reaction and Product Formation

- The **iodoform reaction** occurs in compounds with a **methyl ketone group (-$COCH_3$)** or secondary alcohols with at least one methyl group on the alpha carbon.
- In the reaction, the methyl group adjacent to the carbonyl group is oxidized, leading to the cleavage of the molecule and forming:
  - **Iodoform (CHI_3)** as one product
  - **A carboxylic acid** as the other product

S15. Ans.(c)

Sol. The correct answer is 120.

Association of Acetic Acid in Non-Polar Solvents

Acetic Acid in Benzene

- Acetic acid (**CH_3COOH**) is known to dimerize in non-polar solvents like benzene. This dimerization occurs through **hydrogen bonding** between two acetic acid molecules.

- The process of **dimerization** effectively **doubles the molecular mass** of the acetic acid as it forms a **dimer $(CH_3COOH)_2$**.

CALCULATION:

Molecular Mass of Acetic Acid

- The molecular mass of a single acetic acid molecule (**CH_3COOH**) is **60 g/mol**.
- In benzene, where dimerization occurs, the molecular mass of the **dimer $(CH_3COOH)_2$** would be **2 × 60 g/mol = 120 g/mol**.

CONCLUSION:

When acetic acid is dissolved in benzene, it shows a **molecular mass of 120 g/mol** due to dimerization.

S16. Ans.(b)

Sol. The correct answer is First order reaction.

- **Radioactive decay is the process by which an unstable atomic nucleus loses energy by radiation.** It emits specific ionizing particles or radiation to become stable.
- **Each radioactive element or isotope has a unique half-life,** which is the time required for half of a quantity of radioactive material to decay.
- In first-order reactions, **like radioactive decay, the rate of reaction is directly proportional to the concentration of one reactant. In the case of radioactive decay, the rate of decay is directly proportional to the number of parent radioactive atoms (N) present at that instant.**
- This means that the amount of radioactive material decreases exponentially over time. This is because the number of atoms that decay is proportional to the total number of atoms, which is decreasing.
- **The differential equation for a first-order reaction is $-dN/dt = \lambda N$,**
- where **λ (lambda)** is the decay constant.
- **The decay constant is a measure of the probability of decay per unit time. It is the inverse of the mean lifespan of the decaying quantity. Hence, the relationship between half-life, mean lifetime, and the decay constant is generally understood in terms of first-order kinetics.**
- By plotting the natural logarithm of the amount of undecayed radioactive isotope against time, one gets a **straight line, characteristic of a first-order reaction**. This straight line confirms whether the radioactive decay follows a first-order rate law or not.

Additional Information

- **Zero-order reaction:** In zero-order reactions, the rate of reaction does not depend on the concentration of reactants, which means it remains constant. However, the rate of radioactive decay decreases with time as the number of parent atoms decreases, making it a first-order process, not a zero-order.
- **Both the above:** As explained earlier, radioactive decay is considered as a first-order reaction, not a zero-order reaction, so it cannot be both.
- **Second-order reaction:** In second-order reactions, the rate of reaction is directly proportional to the square of the concentration of a reactant or to the product of the concentration of two reactants. However, in radioactive decay, the rate of reaction depends only on the concentration of one reactant (the parent radioactive atoms), which characterizes first-order reactions. Hence, it's not a second-order reaction.

S17. Ans.(d)

Sol. The correct answer is Greater than that of oxygen.

- The **first ionization energy (IE_1)** is the energy required to remove the most loosely bound electron from a gaseous atom in its ground state.

Nitrogen (N):

- **First Ionization Energy (IE_1):** Nitrogen has a higher first ionization energy compared to oxygen.
- **Explanation:** Nitrogen's **p-orbital is half-filled**, which makes it relatively more stable. Removing an electron from this half-filled orbital requires more energy, resulting in a **higher ionization energy for nitrogen**.

Oxygen (O):

- **First Ionization Energy (IE_1):** Oxygen has a slightly **lower first ionization energy** than nitrogen.
- **Explanation:** In the case of **oxygen**, removing one electron **eliminates the electron–electron repulsion** caused by pairing the electrons in the **2p orbital**, resulting in a **half-filled orbital**. This stability contributes to a **slightly lower ionization energy for oxygen**.

Additional Information

Ionization potential (I.P)

- It is the energy required to take out the **outermost electron** from an isolated gaseous atom.
- The **ionization energy** of a chemical element is expressed in **kilojoules** or **electron volts**.
- The energy required to remove the **first electron** is called the **1st ionization potential**.
- The **more stable** the atom, the **higher** its I.P.
- The **second I.P value** is the energy required to remove the **second electron** after the removal of the **first electron**.
- Generally, the **2nd I.P values** are **larger** than the **1st I.P values**, because it requires the removal of electrons from a **cation**.
- **Third I.P values** are even **larger than 2nd I.P values**.

The ionization potential depends on:

- **The size of the atoms:** Smaller the size of the atoms, the higher is the I.P value.
- **The penetration power:** It is easier to remove an electron from the more diffused shell electron than a less diffused one. The ease of removal follows the order:
- **f > d > p > s**.
- **The charge of the species:** The greater the **positive charge**, the **higher** is the I.P value. **I.P value is directly proportional to the positive charge and inversely proportional to the negative charge**.
- **Electronic configuration:** It is harder to remove an electron from a **stable electronic configuration** (fully filled and half-filled orbitals).

S18. Ans.(a)

Sol. The correct answer is Vegetable Oil.

When treating any oil or fat with sodium hydroxide solution, the oil or fat corresponding acids are converts into sodium salts and glycerol. This reaction is called saponification.

S19. Ans.(a)

Sol. The correct answer is Macro nutrients.

Nitrogen (N), phosphorus (P), and potassium (K) are classed as primary **macronutrients**. These nutrients are called macronutrients because plants take them up in larger amounts than other nutrients. They are essential building blocks in plant structures and are vital for processes such as photosynthesis, protein production, and energy transfer.

- **Nitrogen** is a vital part of amino acids, proteins, and enzymes in plants. It is also a component of chlorophyll, which plants use in photosynthesis to make their food.
- **Phosphorus** aids in energy storage and transfer. It is also involved in DNA and RNA synthesis, which is necessary for cell division and plant growth.
- **Potassium** helps opening and closing of stomata, which permits the exchange of gases and water vapor, and also has a role in photosynthesis and in the health of the plant's immune system.

These are the most important elements required for crops and examples include **nitrogen (N), potassium (K), calcium (Ca), phosphorus (P), magnesium (Mg), sulphur (S), oxygen (O), carbon (C), and hydrogen (H).**

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Micronutrients, also known as **trace elements**, are required by plants in smaller quantities compared to macronutrients, but they're equally essential for plant health and production.

The essential micronutrients for plants and their roles:

- **Iron (Fe):** Iron is crucial for **photosynthesis, chlorophyll synthesis, and enzyme functioning**. Iron deficiency often results in **chlorosis** in young leaves.
- **Manganese (Mn):** Manganese is involved in **enzyme activation, chlorophyll production, and the photosynthetic oxygen evolution process**.
- **Zinc (Zn):** Zinc regulates **auxin**, a **growth hormone** involved in **stem elongation and leaf expansion**. Zinc deficiency causes **stunted growth**.
- **Copper (Cu):** Copper is essential for **overall metabolism**, particularly for **photosynthetic and respiratory enzymes**. It's also involved in **lignin synthesis**, which is important for **cell wall stability and plant defense**.
- **Boron (B):** Boron aids in **cell wall formation and stability**, maintains the **integrity of cell membranes**, aids in **carbohydrate metabolism**, and is involved in **pollen germination and pollen tube growth**.
- **Molybdenum (Mo):** This element is a component of **enzymes involved in nitrogen fixation and nitrate reduction**.
- **Chlorine (Cl):** Chlorine is required in the process of **photosynthesis** and is key for **osmosis and ionic balance**.
- **Nickel (Ni):** Nickel is a component of the **urease enzyme** and is essential for **nitrogen metabolism**.

S20. Ans.(b)

Sol. The correct answer is Nitrogen oxides.

- In photochemical smog, nitrogen oxides, and hydrocarbons are primary pollutants whereas ozone and acrolein are secondary pollutants.

- A chemical reaction between solar ultraviolet radiation and an atmosphere polluted with hydrocarbons and oxides of nitrogen causes photochemical smog. This is especially common from automobile exhaust. Smog can happen both during the day and at night, but photochemical smog only happens in the presence of sunlight.
- Photochemical smog is composed of primary and secondary pollutants. Primary pollutants, which include nitrogen oxides and volatile organic compounds, are introduced into the atmosphere via vehicular emissions and industrial processes.
- Photochemical smog is a type of smog produced when ultraviolet light from the sun reacts with nitrogen oxides in the atmosphere. It is visible as a brown haze, and is most prominent during the morning and afternoon, especially in densely populated, warm cities.
- Nitrogen oxides are compounds of nitrogen and oxygen produced during combustion. Ozone is produced when nitrogen oxides, pollutants in cars' industrial exhausts, react with products of hydrocarbons.

S21. Ans.(b)

Sol. The correct answer is Instantaneous velocity.

VELOCITY

- The rate of change in the position of a moving object with respect to time is called velocity.
- It is a vector quantity.
- The SI unit of velocity is m/s.
- The velocity of a moving object is defined as:
  - Average velocity.
  - Instantaneous velocity.
- We can define velocity at a particular instant as the limiting value of average velocity when the time interval Δt approaches zero.
- We can define velocity at a particular instant as the limiting value of average velocity when the time interval Δt approaches zero.
- **Mathematically, we can write the same as follows:**

$$v = \lim_{\Delta t \to 0} \Delta x/\Delta t$$

- When we calculate average velocity or speed, the selected time interval can be large or small.
- But when the time interval selected is infinitesimally small, then it is known as instantaneous velocity or speed.
- For a moving object, the instantaneous speed at any point is equal to the magnitude of instantaneous velocity.
- But the average speed in a given time interval is always greater or equal to the magnitude of average velocity in that interval.

S22. Ans.(d)

Sol. The correct answer is Isothermal and adiabatic.

Reversible Processes:

- A thermodynamic process driving from **initial state to final state** is said to be **reversible**, if the system as well as its surrounding returns back to its **initial state**, without any change in the universe.

- The processes which can be idealized as reversible are:
  - **Motion without friction**,
  - **Expansion/compression with infinitesimal pressure difference**,
  - **Energy transfer as heat with infinitesimal temperature difference**,
  - **Isothermal** and **adiabatic**.

Irreversible Processes:

- A thermodynamic process that does not return back to its initial state is termed as an **irreversible process**.
- The examples of irreversible processes are:
  - **Motion with friction**,
  - **Throttling**,
  - **Free expansion**,
  - **Constant Volume and constant pressure**,
  - **Expansion/compression with finite pressure difference**,
  - **Energy transfer as heat with finite**,
  - **Mixing of matter at different states**,
  - **Mixing of non-identical gases**.

S23. Ans.(b)

Sol. The correct answer is Loss of energy from the nucleus during its formation.

Binding Energy of the nucleus:

- The energy that holds a nucleus together, or the energy required to disassemble a nucleus into its constituent protons and neutrons completely is called **binding energy**.
  - Or the energy that would be liberated by combining individual protons and neutrons into a single nucleus is called binding energy.
- The **higher** the binding energy of the nucleus, the **more stable** the atomic nucleus will be.
- The **weak nuclear binding force** is responsible for **radioactive decay**.
- The particles present in the nucleus (**protons** and **neutrons**) are called **nucleons**.
  - The sum of the individual masses of various particles in the nucleus must be equal to the nuclear mass, but this is not happening.
  - The **nuclear mass** is somewhat less than the sum of the individual masses of various nuclear particles.
  - The **difference between the actual nuclear mass and the expected nuclear mass** is called the **mass defect**.
  - The **energy equivalent to mass defect** is responsible for holding the nucleons together and is called the **binding energy of the nucleus**.
- So **binding energy** is the **loss of energy** from the nucleus during its formation.

S24. Ans.(b)

Sol. The correct answer is Wave nature of light.

- **Interference:** When **two light sources** from different coherent sources meet together, then there is a **distribution of energy** disturbed by each other. This superposition of two light waves is called **Interference** of light waves.
- **Diffraction:** The phenomenon of **bending of light** the sharp edges of the size of its wavelength is called **diffraction**.

- Since the **interference and diffraction pattern** can be observed by the **wave** only.
- That's why we can say that the **Young's double-slit experiments** and **diffraction by single slit** manifest the **wave nature of light**. So, **option 2** is correct.

Additional Information:

The following are the **conditions for the interference** to happen:

- The **source** should emit light waves continuously.
- **Light waves emitted** should have a single wavelength.
- **Waves** should either have a **constant phase difference** or be in phase.
- The **light sources** should be close to each other and narrow.

Photoelectric effect:

The phenomenon in which the **light energy** forces a **metal surface** to release electrons is called the **photoelectric effect**.

- When the **light hits**, it shows the **particle theory of light**, and light is defined as a stream of **photons or energy packets**.
- The other phenomenon such as **interference, diffraction**, and **polarization** can only be explained when the light is treated as a **wave**, wherein the photoelectric effect, line spectra, and the production and scattering of **X-rays** demonstrate the **particle nature of light**.

S25. Ans.(d)

Sol. The correct answer is Affects the overall V – I characteristics of p-n junction.

- The material which is not a good conductor or a good insulator is called as **semiconductor**.
  - For example: **Silicon**
- The **charge carriers** which are present in more quantity in a semiconductor compared to other particles are called **majority charge carriers**.
- The semiconductor device which is used to control the flow of electric current is called as **p-n junction diode**.
- When we increase the **temperature** of the diode, then the **number of electron-hole pairs** increases and hence the **overall resistance of diode changes**.
- As the **overall resistance** changes, the **forward biasing** and the **reversed biasing** both changes. Hence, **options 1, 2, and 3 are wrong**.
- Due to this change in **forward biasing** and the **reversed biasing**, **overall V-I characteristics of p-n junction changes**.

S26. Ans.(d)

Sol. The correct answer is parallel to principal axis.

- There are numerous uses for concave mirrors.
- They create upright, magnified images, making them helpful for shaving and doing makeup.
- They are also employed in telescopes because they focus light to produce noticeably larger images, as well as spotlights and headlights since they project parallel light beams.
- As a result, when the incident ray is parallel to the primary axis, the image of a star can be obtained at F of a concave mirror.

Additional Information:

- A concave mirror is a sort of spherical mirror in which the reflecting surface is the inner curved surface of the sphere; hence, the reflecting surface seems to be farther away from the incident light source in this type of mirror.
- They are also known as converging mirrors because of how they are made, which causes the incident light to be reflected inward.
- They are used to focus light.
- At every location along the curved surface of the mirror, both rules of reflection hold true.
- By connecting the mirror's curvature's center to the point of incidence, the normal is drawn along the radius.
- Because the normal to the reflecting surface varies at each point on the mirror, the beams' convergence occurs after reflection.

S27. Ans.(a)

Sol. The correct answer is Only 1.

- An amalgam is an alloy of mercury with another metal.
- Depending upon the proportion of mercury, it may be a liquid, a soft paste or a solid.
- Nearly all metals can form amalgams with mercury.
- The well-known exceptions are iron, platinum, tungsten, and tantalum.
- Arquerite is a natural amalgam of silver and mercury.
- Sodium amalgam is formed as a byproduct of the chloralkali process.
- Tin amalgam was once used as a reflective mirror coating.

S28. Ans.(b)

Sol. The correct answer is Sclerenchyma.

Sclerenchyma is the permanent tissue that makes plants hard and stiff. It's a simple tissue that provides support to plants.

- Sclerenchyma cells are thick, narrow, and dead.
- They have thick, lignified secondary walls.
- Sclerenchyma cells are found throughout the plant, especially in woody parts like tree bark and branches.
- Sclerenchyma cells can occur as fibers or sclereids.
- Sclerenchyma is the most effective mechanical tissue in plants.

S29. Ans.(b)

Sol. The correct answer is Sublimation.

The process that converts a substance directly from a solid to a gaseous state is called sublimation.

Sublimation:

This is the phase transition where a solid directly changes into a gas without going through a liquid phase.

Additional Information

Distillation:

This process separates components of a liquid mixture by boiling and then condensing the vapors.

Evaporation:

This is the process where a liquid changes into a gas at its surface.

Chromatography:
This technique is used to separate components of a mixture based on their different affinities for a stationary phase.

S30. Ans.(b)
Sol. The correct answer is Ag.
Silver (Ag) compounds are used in black and white photography. Silver compounds are light-sensitive and break down when exposed to light. This process creates a latent image that can be developed into a photograph.

Information Booster
- Silver bromide ($AgBr$): A common silver halide compound used in black and white photography. When exposed to light, it forms silver ions, which create a black and white image.
- Silver chloride ($AgCl$): A silver halide compound used in black and white photography. It's not as sensitive to light as silver bromide, and is mainly used in medical imaging.
- Silver iodide (AgI): A silver halide compound used in black and white photography.
- Silver fluoride (AgF): A silver halide compound, but it's not commonly used in photography.

Photochemical reaction
When exposed to light, silver halide compounds undergo a photochemical reaction that creates a latent image. This image is then developed into a visible photograph.

S31. Ans.(c)
Sol. The correct answer is Hydrogen.
- The metal reacts with acids to form salt and hydrogen gas.
- Metals that are above in the reactivity series react with acid. The reactivity series in given in the tabular form below.

	Metal	**Symbol**
These metals are more reactive than hydrogen	Potassium	K
	Sodium	Na
	Calcium	Ca
	Magnesium	Mg
	Aluminium	Al
	Zinc	Zn
	Iron	Fe
	Tin	Sn
	Lead	Pb
	Hydrogen	**H**
These metals are less reactive than hydrogen	Copper	Cu
	Mercury	Hg
	Silver	Ag
	Gold	Au

S32. Ans.(b)

Sol. The correct answer is 15 cm.

Lens: The transparent curved surface which is used to refract the light and make an image of any object placed in front of it is called a lens.

Convex Lenses: A lens having two spherical surfaces, bulging outwards is called a double convex lens (or simply convex lens).

- It is thicker in the middle compared to the edges.
- Convex lenses converge light rays and hence, convex lenses are also called **converging lenses**.

- **The lens formula is:**
  - $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$
- **Magnification**
  - $m = \frac{v}{u}$

Where,

v= Distance of image,

u= Distance of object,

f= Focal length.

Calculation:

- **Given:**
- u=−30 cm, f=10 cm
- Using the lens formula:
  - Using, $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$
  - $\frac{1}{v} - \frac{1}{-30} = \frac{1}{10}$
  - v = 15 cm

S33. Ans.(b)

Sol. The correct answer is stigma, style and ovary.

- The **pistil** is the female reproductive unit of plants.
  - A pistil has the following **three major parts**:
    - **Stigma**: The stigma is at the top and is connected to the ovary by the style.
      - It receives the pollen grains.
    - **Style**: It is an elongated slender part beneath the stigma that connects the stigma with the ovary.
    - **Ovary**: It is the basal swollen part of the pistil.
      - The ovary is the ductless reproductive gland containing one or more ovules. It is the part of the plant where seed formation occurs.
- The **stamen** is the male reproductive unit of plants and consists of the following **two parts**:
  - **Filament**: A long and slender stalk called filament which may be joined or free.
  - **Anther**: A bilobed terminal structure called the anther.

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- **As a plant's reproductive part**, a flower contains a **stamen** (male flower part) or **pistil** (female flower part).
- Flowers that contain **either only pistils or only stamens** are called **unisexual flowers**.
- Flowers that contain **both stamens and pistil** are called **bisexual flowers**.

S34. Ans.(d)

Sol. The correct answer is Sclerenchyma.

- **Mature Sclerenchyma cells** are usually dead cells.
- They have thickened secondary walls containing lignin.
- The cells are rigid and nonstretchable and are usually found in nongrowing regions of plant bodies, such as the bark or mature stems.

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- The tissue is a group of cells that are similar in structure and work together to achieve a particular function.
- Under **Simple Permanent Tissue**, Plant tissue can be classified as **Parenchyma**, **Collenchyma**, and **Sclerenchyma**.

Parenchyma:

- Parenchyma tissue is composed of thin-walled cells and makes up the photosynthetic tissue in leaves, the pulp of fruits, and the endosperm of many seeds.

Collenchyma:

- Collenchyma tissue mainly forms supporting tissue and has irregular cell walls.
- They are found mainly in the cortex of stems and in leaves.

S35. Ans.(d)

Sol. The correct answer is Dry ice.

- **Solid Carbon dioxide** is known as **dry ice**.
- **Solid Carbon dioxide** has a lower temperature than that of water ice, which does not leave any residue.
- It is useful for preserving frozen foods when mechanical cooling is unavailable.
- **Carbon dioxide** turns to dry ice when the temperature drops to **-110° F**.
- It changes from solid dry ice to carbon dioxide gas.
- Thereafter, it never passes through the liquid phase, and hence it is called **dry ice**.

S36. Ans.(d)

Sol. The correct answer is 24 J.

Moving charge, Q = 4C

The potential difference, V = 6V

We know, Work W = QV

$W = 4 \times 6 = 24$ Joules

S37. Ans.(c)

Sol. The correct answer is Tin – Lead.

- An electric fuse is a **safety device** used to **limit the current** in an electric circuit.
- It **melts** and breaks the circuit whenever there is an **excess flow of current** through the circuit.
- It is made up of the alloy of **tin (Sn)** and **lead (Pb)**.
- It has a **low melting point** and **high resistance**.

Functions of fuse:

- It prevents the **device from failure**.
- It prevents **short circuits**.
- It prevents **overload and blackouts**.

S38. Ans.(a)

Sol. The correct answer is 275 J.

Kinetic energy: The energy needed to move the body of mass m from one point to another with stated velocity v is called kinetic energy.

The Kinetic energy is given as:

$K.E = 1/2 \times m \times V^2$

Where:

- K.E = Kinetic Energy
- m = mass of the object
- V = velocity of an object

Calculation:

Given that:

- m = 22 kg
- v = 5 m/s

$K.E = 1/2 \times 22 \times 5^2$

K.E = 275 J

Therefore, the kinetic energy of the object is **275 J**.

S39. Ans.(a)

Sol. The correct answer is Binary fission.

- An **Amoeba** reproduces by **binary fission**.
- An **amoeba** is a type of **unicellular organism** which has the ability to alter its shape, primarily by extending and retracting **pseudopods**.
- **Prokaryotes** (Bacteria), **Protists** (Amoeba, Paramecium, Euglena, etc.), and eukaryotic cell-organelles like mitochondria and chloroplasts perform **asexual reproduction** by **binary fission**.
- In this process, two similar daughter cells are formed by dividing parent cells.
- The axis of fission/division is different in different protists. Ex.: **Amoeba** divides in any plane due to lack of specific shape; hence it is called as '**simple binary fission**'.
- **Paramecium** divides by '**transverse binary fission**' whereas **Euglena** by '**longitudinal binary fission**'.
- **Binary fission** is usually performed by **living organisms** during favorable conditions, i.e., availability of abundant food material.

S40. Ans.(c)

Sol. The correct answer is Chlorofluorocarbons.

Ozone Hole:

- The **ozone layer**, found in the stratosphere (good ozone), acts as a **protective gas shield** that absorbs harmful ultraviolet (UV) radiation, safeguarding us from the adverse effects of excessive UV exposure.
- An **ozone hole** is a region of the stratosphere over **Antarctica** where the ozone layer is exceptionally depleted.
- The size of the ozone hole over Antarctica varies from year to year, typically opening in August and closing by November or December.
- **Chlorofluorocarbons (CFCs)** are gases used for various purposes including **solvents**, **refrigerants**, and **aerosol sprays**.
- They are organic chemicals and contain **carbon**, (sometimes **hydrogen**), **chlorine**, and **fluorine**.
- **Chlorofluorocarbons** have an **immediate effect** on the environment.
- When released into the air, **CFCs** rise to the stratosphere, where they interact with a few other gases, reducing the ozone layer that protects the Earth from the sun's harmful ultraviolet rays.
- **CFCs' atmospheric effects**, on the other hand, are **not restricted** to their role as ozone-depleting compounds.
- **Infrared absorption bands** prevent heat from exiting the Earth's atmosphere at that wavelength.

S41. Ans.(b)

Sol. The correct answer is 32.

- **Work**: Work is said to be done by a force when the body is displaced actually through some distance in the direction of the applied force.
- Since the body is being displaced in the direction of **F**, therefore work done by the force in displacing the body through a distance **s** is given by:

$W=F \cdot s$

Thus, work done by a force is equal to the scalar or dot product of the force and the displacement of the body.

Given that:

Mass (m) = 25 kg

Distance (s) = 15 m

Work (W) = 480 J

Using equation:

Work = Force × Distance

$\therefore 480 = F \times 15$

$F = \frac{480}{15} = 32N$

Force = 32 N

S42. Ans.(d)

Sol. The correct answer is Reverberation.

Reverberation:

- The persistence of sound in a closed enclosure, due to continuous reflections at the walls or the floor or the ceiling of the enclosure, even after the source has stopped producing sound is known as **'reverberation'**.
- **Reverberation** is related to a shorter reflection time, that is, the sound reflects from a big room or an object, there would be repeated reflections from walls all around.
- Examples of repeated reflection objects are **loudspeakers**, **horns**, **trumpets**, etc.

1. **Music**: The mixture of different frequencies resulting in an ordered sound is called music.
2. **Pitch**: The quality of sound based on the rate of vibrations that are produced is called pitch.
3. **Note**: A single tone of a specified pitch that is sustained for a given duration is called a note.
4. *For example, pressing a single key on the piano in a tune is a musical note.*
5. **Reverberation**: The repeated reflection that results in the persistence of sound is called reverberation. **So option d is correct.**

S43. Ans.(b)

Sol. The correct answer is By increasing the efficiency of the combustion process.

- **Increasing the efficiency of the combustion process** can indeed help reduce the pollution caused by burning fossil fuels. Here are a few ways in which efficiency improvements can be achieved:
  - **Advanced Combustion Technologies**: Utilizing advanced combustion technologies such as pre-combustion chambers, staged combustion, and optimized fuel-air mixing can enhance combustion efficiency. These methods ensure that fuel is burned more completely, reducing the production of pollutants.
  - **Fuel Quality**: Using higher-quality fuels with lower impurities and better combustion properties can improve combustion efficiency and reduce emissions. This includes using cleaner-burning fuels such as low-sulfur diesel or natural gas instead of coal or heavy oils.
  - **Cogeneration and Combined Heat and Power (CHP) Systems**: Cogeneration or CHP systems produce both electricity and useful heat from the same energy source. By capturing waste heat from power generation and utilizing it for heating or other industrial processes, these systems improve overall energy efficiency, reducing the need for separate fuel burning and associated emissions.
  - **Energy Efficiency Measures**: Implementing energy efficiency measures in industrial processes, buildings, and transportation can reduce the overall energy demand. By using energy more efficiently, the need for burning fossil fuels can be minimized, thereby lowering pollution levels.
  - **Carbon Capture and Storage (CCS)**: CCS technologies capture **carbon dioxide (CO_2)** emissions from power plants and industrial facilities and store them underground or use them for other purposes. While not directly increasing combustion efficiency, CCS can help reduce greenhouse gas emissions and mitigate the environmental impact of burning fossil fuels.
- It is important to note that while increasing combustion efficiency can reduce pollution per unit of energy generated, it does not eliminate the fundamental environmental challenges associated with burning fossil fuels.
- Transitioning to cleaner and renewable energy sources remains crucial for achieving significant reductions in pollution and combating climate change.

S44. Ans.(a)

Sol. The correct answer is A fielder pulls his hands gradually with the moving ball while holding a catch.

- Newton's Third Law of Motion states that "To every action, there is an equal and opposite reaction."
- When the rocket is ignited, it releases gases from its thruster thereby creating a force that will push the rocket upwards, which provides a necessary force that helps it in moving ahead.

Additional Information:

- **Newton's First Law** states that every object remains in uniform motion in a straight line unless compelled to change its state by the action of an external force.
  - When a bus starts suddenly, the passengers receive a backward jerk, an application of **Newton's first law of motion**.
- **Newton's Second Law of motion** states that the rate of change of momentum of an object is proportional to the applied force in the direction of the force. i.e. F = ma, where F is the force applied, mmm is the mass of the body, and a is the acceleration produced.
- A fielder pulling his hand back while catching a ball is an application of **Newton's second law of motion**.

S45. Ans.(c)

Sol. The correct answer is Albumin.

- **Plasma's function** is to transport **nutrients**, **hormones**, and **proteins** throughout the body.
- It also transports **waste products of cell metabolism** from different tissues to the organs that detoxify and/or excrete them.
- Plasma is **90% water**, with the remaining **10%** consisting of ions, proteins, dissolved gases, nutritional molecules, and wastes.
- Plasma proteins are of **three different types**: albumin, globulins, and fibrinogen.

Albumin:

- Albumin aids in the maintenance of the **blood's colloid osmotic pressure**.
- It is the **smallest** of the plasma proteins, but it accounts for the **majority** of the total.
- The blood's colloid osmotic pressure is critical for maintaining a **balance between the water inside the blood** and the **water in the tissue fluid surrounding the cells**.
- When **plasma proteins are lacking**, the water in the plasma leaks into the area around the blood vessels, causing **interstitial edema**, which is a symptom of liver illness, kidney disease, and malnutrition, among other things.
- Albumin also aids in the **transfer of a variety of molecules**, including **medicines**, **hormones**, and **fatty acids**.

Additional Information:

- **Leptin:**
  - Leptin is a hormone released by **adipose tissue** (body fat) that helps your body maintain a healthy weight over time.
  - This is accomplished by providing the **sensation of satiety**, which regulates appetite (feeling full).
  - **Insulin stimulates leptin secretion** via a **posttranscriptional process** including the PI3K-PKBmTOR pathway, as well as other unidentified mechanisms.
- **Keratin:**

- It is a **protein** that can be found in your **hair, skin, and nails**.
- Keratin is also found in the **organs** and **glands** of the body.
- Keratin protects **epithelial cells**, strengthens the skin, strengthens internal organs, controls the growth of **epithelial cells**, and maintains **elasticity** in the skin. It also holds cells together and helps them combat mechanical stress.

- **Insulin:**
  - Insulin is a hormone created by your **pancreas** that controls the **amount of glucose** in your bloodstream at any given moment.
  - It also helps **store glucose** in your liver, fat, and muscles.
  - It regulates your **body's metabolism** of carbohydrates, fats, and proteins.

S46. Ans.(b)

Sol. The correct answer is Law of Inertia.

Newton's first law of motion is known as the **Law of Inertia**.

Newton's first law states that if a body is at rest or moving at a constant speed in a straight line:

- **It will remain at rest or keep moving in a straight line at constant speed** unless it is acted upon by a force.

There are **two conditions** on which the 1st law of motion is dependent:

- **Objects at rest:**
  - When an object is at rest, velocity v = 0 and acceleration a = 0 are zero.
  - Therefore, the object continues to be at rest.
- **Objects in motion:**
  - When an object is in motion, velocity is not equal to zero ($v \neq 0$) while acceleration (a = 0) is equal to zero.
  - Therefore, the object will continue to be in motion with constant velocity and in the same direction.

Hence, **option b is correct**.

Additional Information

Newton's First Law of Motion Examples in Daily Life:

- Wearing a seat belt in a car while driving is an example of Newton's 1st law of motion.
  - If an accident occurs, or if brakes are applied to the car suddenly, the body will tend to continue its inertia and move forward, probably proving fatal.
  - To prevent such accidents, seat belts are used, which stop your body from moving forward in inertia, avoiding danger.

S47. Ans.(b)

Sol. The correct answer is Combustion reaction.

A combustion reaction occur when carbon (C) burns in oxygen (O_2) to give Carbon dioxide (CO_2).

Type of Reaction	Definition
Addition Reaction	It is a chemical reaction where two or more reactants come together to form a single compound.

Type of Reaction	Definition
Combustion Reaction	Burning of any substance in the presence of Air/Oxygen is called Combustion Reaction.
Decomposition Reaction	It is a type of Reaction in which under a suitable condition, compound divides into many simpler compounds or elements.
Substitution Reaction	It is a chemical reaction in which one element/compound will replace another element or compound.

S48. Ans.(c)

Sol. The correct answer is Both chloroplast and mitochondria.

Similarities between Prokaryotic cells, Mitochondria, and Chloroplast:

- **Mitochondria** and **chloroplast** are of the **same size** as prokaryotic cells.
- Mitochondria and prokaryotic cells both have their own **circular DNA**.
- The ribosome of bacteria, mitochondria, and chloroplasts have a **70S type of ribosome**.
- Divides by **binary fission**.

S49. Ans.(c)

Sol. The correct answer is concave.

- If a hollow sphere is cut into parts and the outer surface of the cut part is painted, then it becomes a mirror with its inner surface as the reflecting surface. This kind of mirror is known as a **concave mirror**.
- **Uses of the concave mirror:**
  - They are often used as **shaving mirrors** to see a larger image of the face.
  - Concave mirrors are commonly used in **torches**, **search lights**, and **vehicle headlights** to get powerful parallel beams of light.
  - The **dentists** use concave mirrors to see large images of the teeth of patients.
  - Large concave mirrors are used to **concentrate sunlight** to produce heat in **solar furnaces**.

Additional Information:

- A **convex mirror** is a spherical reflecting surface (or any reflecting surface fashioned into a portion of a sphere) in which its bulging side faces the source of light.
- **Convex mirrors** are commonly used as rear-view (wing) mirrors in vehicles.
- A **plane mirror** is a mirror with a flat reflective surface. For light rays striking a plane mirror, the angle of reflection equals the angle of incidence.

S50. Ans.(a)

Sol. The correct answer is Infrared rays.

Waves that consist of vibrating electric and magnetic fields are called **electromagnetic waves**.

The examples of electromagnetic waves are:

1. Radio waves.
2. Microwaves.
3. **Infrared waves**.

4. Visible light.
5. Ultraviolet.
6. X-rays.
7. Gamma rays.

Radio waves are electromagnetic waves with maximum wavelength.

Infrared ray was discovered by **William Herschell**.

- The heat of the sunlight is due to **infrared waves**.
- **Infrared waves** are used in **TV remotes**.

Sound waves are **longitudinal waves**.

- It cannot travel through a vacuum.
- The study of sound is called acoustics.
- Sound travels faster in solids.
- Sound waves higher than 20 kHz are called Ultrasonics sounds.