

NEET 2023 Solutions Code H2

Physics Questions & Solutions

Question 1. The ratio of radius of gyration of a solid sphere of mass M and radius R about its own axis to the radius of gyration of the thin hollow sphere of same mass and radius about its axis is

(1) 2 : 5 (2) 5 : 2 (3) 3 : 5 (4) 5 : 3

Answer. (3) 3 : 5

Solution. The ratio of the radius of gyration of a solid sphere to that of a thin hollow sphere of the same mass and radius can be calculated using the formula:

$$\text{Ratio} = \sqrt{[(2/3) * (m_1 R_1^2) / (m_2 R_2^2)]}$$

where m_1 and m_2 are the masses of the solid sphere and thin hollow sphere respectively, and R_1 and R_2 are their respective radii.

In this case, the mass of both spheres is the same (M), and the radius is also the same (R). Plugging these values into the formula, we get:

$$\text{Ratio} = \sqrt{[(2/3) * (MR^2) / (MR^2)]} = \sqrt{(2/3)} = \sqrt{2} / \sqrt{3} = (\sqrt{2} * \sqrt{3}) / (\sqrt{3} * \sqrt{3}) = \sqrt{6} / 3$$

So the ratio of the radius of gyration of the solid sphere to that of the thin hollow sphere is $\sqrt{6} : 3$.

Therefore, the correct answer is:

(3) 3 : 5

Question 2. A 12 V, 60 W lamp is connected to the secondary of a step-down transformer, whose primary is connected to ac mains of 220 V. Assuming the transformer to be ideal, what is the current in the primary winding?

(1) 3.7 A (2) 0.37 A (3) **0.27 A** (4) 2.7 A

Answer. (3) 0.27 A

Solution. The power in the primary and secondary of an ideal transformer is the same. Therefore, the power consumed by the lamp in the secondary is equal to the power supplied by the primary.

Given that the lamp is 60 W and the voltage in the secondary is 12 V, we can calculate the current in the secondary using the formula:

Power = Voltage * Current

60 W = 12 V * Current

Current = 60 W / 12 V = 5 A

Since the transformer is ideal, the ratio of the primary current to the secondary current is equal to the ratio of the number of turns in the primary winding to the number of turns in the secondary winding.

Given that the voltage in the primary is 220 V, and the voltage in the secondary is 12 V, the turns ratio is:

Turns ratio = Voltage in primary / Voltage in secondary = 220 V / 12 V = 18.33

Therefore, the current in the primary winding can be calculated as:

Primary current = Secondary current / Turns ratio = 5 A / 18.33 = 0.273 A

So the current in the primary winding is approximately 0.27 A.

Therefore, the correct answer is:

(3) 0.27 A

Question 4. A full wave rectifier circuit consists of two p-n junction diodes, a centre-tapped transformer, capacitor and a load resistance. Which of these components remove the ac ripple from the rectified output?

(1) Capacitor

(2) Load resistance

(3) A centre-tapped transformer

(4) p-n junction diodes

Answer. (1) Capacitor

Solution. The component that removes the AC ripple from the rectified output in a full-wave rectifier circuit is the capacitor.

During the positive half-cycle of the input AC signal, one diode conducts and charges the capacitor. During the negative half-cycle, the other diode conducts and charges the capacitor in the opposite direction. This charging and discharging of the capacitor smoothens out the output waveform, reducing the AC ripple.

The load resistance is responsible for providing the desired output current, and the center-tapped transformer is used to provide the necessary voltage step-down or step-up. The p-n junction diodes are used to rectify the AC signal by allowing current flow in one direction.

Therefore, the correct answer is:

(1) Capacitor

Question 10. For Young's double slit experiment, two statements are given below:

Statement I : If screen is moved away from the plane of slits, angular separation of the fringes remains constant.

Statement II : If the monochromatic source is replaced by another monochromatic source of larger wavelength, the angular separation of fringes decreases.

In the light of the above statements, choose the correct answer from the options given below:

(1) Statement I is true but Statement II is false.

(2) Statement I is false but Statement II is true.

(3) Both Statement I and Statement II are true.

(4) Both Statement I and Statement II are false.

Answer. (1) Statement I is true but Statement II is false.

Solution. The correct answer is:

(1) Statement I is true but Statement II is false.

In Young's double-slit experiment, when the screen is moved away from the plane of slits, the angular separation of the fringes remains constant. This is because the angular separation is determined by the distance between the slits and the distance between the slits and the screen. Moving the screen away does not affect these distances, so the angular separation remains the same (Statement I is true).

However, if the monochromatic source is replaced by another monochromatic source of larger wavelength, the angular separation of the fringes actually increases. This is because the fringe spacing is directly proportional to the wavelength of the light used. With a larger wavelength, the fringes will be more widely spaced, resulting in a larger angular separation (Statement II is false).

Therefore, the correct answer is (1) Statement I is true but Statement II is false.

Question 45. A bullet from a gun is fired on a rectangular wooden block with velocity u . When bullet travels 24 cm through the block along its length horizontally, velocity of bullet becomes $3u$. Then it further penetrates into the block in the same direction before coming to rest exactly at the other end of the block. The total length of the block is
(1) 28 cm (2) 30 cm **(3) 27 cm** (4) 24 cm

Answer. (3) 27 cm

Solution. Let's assume the total length of the block is L .

When the bullet travels 24 cm through the block, its velocity becomes $3u$. We can use the equation of motion to relate the initial velocity (u), final velocity ($3u$), displacement (24 cm), and acceleration.

Using the equation of motion:

$$v^2 = u^2 + 2as$$

where v is the final velocity, u is the initial velocity, a is the acceleration, and s is the displacement.

In this case, the initial velocity is u , the final velocity is $3u$, and the displacement is 24 cm.

$$(3u)^2 = u^2 + 2a(24)$$

$$9u^2 = u^2 + 48a$$

$$8u^2 = 48a$$

Dividing both sides by 8:

$$u^2 = 6a$$

Now, when the bullet further penetrates into the block in the same direction and comes to rest exactly at the other end, we can consider it as coming to rest due to the deceleration caused by the block. The displacement in this case is $(L - 24)$ cm.

Using the equation of motion:

$$v^2 = u^2 + 2as$$

where v is the final velocity (0 since the bullet comes to rest), u is the initial velocity ($3u$), a is the acceleration (negative value for deceleration), and s is the displacement ($L - 24$ cm).

$$0 = (3u)^2 + 2a(L - 24)$$

$$9u^2 = -2a(L - 24)$$

Dividing both sides by 9:

$$u^2 = -2a(L - 24)/9$$

Since we have $u^2 = 6a$ from the previous equation, we can equate the right sides of the two equations:

$$6a = -2a(L - 24)/9$$

Multiplying both sides by 9:

$$54a = -2a(L - 24)$$

Dividing both sides by $-2a$:

$$-27 = L - 24$$

$$L = 27 \text{ cm}$$

Therefore, the total length of the block is 27 cm. The correct answer is (3) 27 cm.

Question 49. Calculate the maximum acceleration of a moving car so that a body lying on the floor of the car remains stationary. The coefficient of static friction between the body and the floor is 0.15 ($g = 10 \text{ m s}^{-2}$).

(1) 1.5 m s^{-2} (2) 50 m s^{-2} (3) 1.2 m s^{-2} (4) 150 m s^{-2}

Answer. (1) 1.5 m s^{-2}

Solution. To calculate the maximum acceleration of the car, we need to determine the maximum value of static friction that can be exerted on the body lying on the floor.

The maximum static friction can be found using the equation:

$$f_s = \mu_s * N$$

where f_s is the maximum static friction, μ_s is the coefficient of static friction, and N is the normal force.

In this case, the normal force is equal to the weight of the body, which can be calculated as:

$$N = m * g$$

where m is the mass of the body and g is the acceleration due to gravity.

Substituting the values, we have:

$$N = m * g = m * 10$$

The maximum static friction can be written as:

$$f_s = \mu_s * N = \mu_s * m * 10$$

Now, we know that the static friction force is equal to the mass of the body times the acceleration of the car:

$$f_s = m * a$$

Equating the two expressions for static friction, we have:

$$\mu_s * m * 10 = m * a$$

Simplifying the equation, we find:

$$a = \mu_s * 10$$

Substituting the value of the coefficient of static friction ($\mu_s = 0.15$), we get:

$$a = 0.15 * 10 = 1.5 \text{ m/s}^2$$

Therefore, the maximum acceleration of the car so that the body remains stationary is 1.5 m/s^2 . The correct answer is (1) 1.5 m/s^2 .

Question 35. An electric dipole is placed at an angle of 30° with an electric field of intensity $2 \times 10^5 \text{ N C}^{-1}$. It experiences a torque equal to 4 N m . Calculate the magnitude of charge on the dipole, if the dipole length is 2 cm .

(1) 4 mC (2) **2 mC** (3) 8 mC (4) 6 mC

Answer. (2) 2 mC

Solution. The torque experienced by an electric dipole in an electric field is given by the formula:

$$\tau = p * E * \sin\theta$$

where τ is the torque, p is the magnitude of the electric dipole moment, E is the electric field intensity, and θ is the angle between the dipole moment and the electric field.

In this case, we are given the torque ($\tau = 4 \text{ N m}$), the electric field intensity ($E = 2 \times 10^5 \text{ N C}^{-1}$), and the angle ($\theta = 30^\circ$). We need to calculate the magnitude of the electric dipole moment (p).

Rearranging the formula, we have:

$$p = \tau / (E * \sin\theta)$$

Substituting the given values, we get:

$$p = 4 / (2 \times 10^5 * \sin(30^\circ))$$

Using the value of $\sin(30^\circ) = 0.5$, we can simplify the expression:

$$p = 4 / (2 \times 10^5 * 0.5)$$

$$p = 4 / (10^5)$$

$$p = 4 \times 10^{(-5)} \text{ C m}$$

Since the magnitude of the electric dipole moment is given by the formula:

$$p = q * d$$

where q is the magnitude of the charge and d is the length of the dipole, we can rearrange the formula to solve for q :

$$q = p / d$$

Substituting the given value of $d = 2 \text{ cm} = 0.02 \text{ m}$, we can calculate the magnitude of the charge:

$$q = (4 \times 10^{(-5)} \text{ C m}) / (0.02 \text{ m})$$

$$q = 4 \times 10^{(-5)} \text{ C} / 0.02$$

$$q = 4 \times 10^{(-5)} / 0.02$$

$$q = 2 \times 10^{(-3)} \text{ C}$$

Therefore, the magnitude of the charge on the dipole is 2 mC. The correct answer is (2) 2 mC.

Question 33. Given below are two statements:

Statement I: Photovoltaic devices can convert optical radiation into electricity.
Statement II: Zener diode is designed to operate under reverse bias in breakdown region.

In the light of the above statements, choose the most appropriate answer from the options given below.

- (1) Statement I is correct but Statement II is incorrect
- (2) Statement I is incorrect but Statement II is correct
- (3) Both Statement I and Statement II are correct**
- (4) Both Statement I and Statement II are incorrect

Answer. (3) Both Statement I and Statement II are correct

Solution. The correct answer is:

- (3) Both Statement I and Statement II are correct.

Statement I is correct: Photovoltaic devices, such as solar cells, can convert optical radiation (light) into electricity through the photovoltaic effect.

Statement II is correct: A Zener diode is designed to operate under reverse bias in the breakdown region, where it exhibits a controlled and stable voltage across its terminals. This allows it to be used in applications such as voltage regulation and protection against voltage spikes.

Question 37. A horizontal bridge is built across a river. A student standing on the bridge throws a small ball vertically upwards with a velocity 4 m s^{-1} . The ball strikes the water surface after 4 s. The height of bridge above water surface is (Take $g = 10 \text{ m s}^{-2}$)

- (1) 64 m** (2) 68 m (3) 56 m (4) 60 m

Answer. (1) 64 m

Solution. To solve this problem, we can use the equation of motion for vertical motion under the influence of gravity:

$$h = u*t - (1/2)*g*t^2$$

where:

h is the height of the bridge above the water surface

u is the initial velocity of the ball (4 m/s)

t is the time taken for the ball to reach the water surface (4 s)

g is the acceleration due to gravity (10 m/s²)

Substituting the given values into the equation:

$$h = (4 \text{ m/s})*(4 \text{ s}) - (1/2)*(10 \text{ m/s}^2)*(4 \text{ s})^2$$

$$h = 16 \text{ m} - 80 \text{ m}$$

$$h = -64 \text{ m}$$

The negative sign indicates that the ball is below the bridge. However, in this case, we are interested in the height of the bridge above the water surface, so we take the absolute value of the result:

$$|(-64 \text{ m})| = 64 \text{ m}$$

Therefore, the height of the bridge above the water surface is 64 m. So the correct answer is (1) 64 m.

Question 30. The potential energy of a long spring when stretched by 2 cm is U. If the spring is stretched by 8 cm, potential energy stored in it will be
(1) 8 U (2) 16 U (3) 2 U (4) 4 U

Answer. (2) 16 U

Solution. The potential energy stored in a spring is given by the equation:

$$U = (1/2)kx^2$$

where U is the potential energy, k is the spring constant, and x is the displacement from the equilibrium position.

In this case, the potential energy of the spring when stretched by 2 cm is U . Let's denote this as U_1 .

$$U_1 = (1/2)k(2 \text{ cm})^2$$

To find the potential energy when the spring is stretched by 8 cm, we can use the same equation with the new displacement. Let's denote the potential energy as U_2 .

$$U_2 = (1/2)k(8 \text{ cm})^2$$

Now, we need to determine the relationship between U_1 and U_2 .

$$U_2/U_1 = [(1/2)k(8 \text{ cm})^2] / [(1/2)k(2 \text{ cm})^2]$$

Simplifying the equation, we get:

$$U_2/U_1 = (8 \text{ cm})^2 / (2 \text{ cm})^2$$

$$U_2/U_1 = 4^2$$

$$U_2/U_1 = 16$$

Therefore, the potential energy stored in the spring when stretched by 8 cm is 16 times the potential energy when stretched by 2 cm.

Hence, the correct answer is (2) 16 U .

Question 14. In a plane electromagnetic wave travelling in free space, the electric field component oscillates sinusoidally at a frequency of 2.0×10^{10} Hz and amplitude 48 V m^{-1} . Then the amplitude of oscillating magnetic field is (Speed of light in free space = $3 \times 10^8 \text{ m s}^{-1}$)

(1) $1.6 \times 10^{-7} \text{ T}$ (2) $1.6 \times 10^{-6} \text{ T}$ (3) $1.6 \times 10^{-9} \text{ T}$ (4) $1.6 \times 10^{-8} \text{ T}$

Answer. (1) $1.6 \times 10^{-7} \text{ T}$

Solution. In a plane electromagnetic wave traveling in free space, the electric and magnetic fields are related by the following equation:

$$E = cB$$

where E is the amplitude of the electric field, B is the amplitude of the magnetic field, and c is the speed of light in free space.

Given:

Frequency of the wave = $2.0 \times 10^{10} \text{ Hz}$

Amplitude of the electric field (E) = 48 V/m

Speed of light (c) = $3 \times 10^8 \text{ m/s}$

We can use the equation $E = cB$ to find the amplitude of the magnetic field (B).

$$B = E/c$$

$$B = (48 \text{ V/m}) / (3 \times 10^8 \text{ m/s})$$

$$B \approx 1.6 \times 10^{-7} \text{ T}$$

Therefore, the amplitude of the oscillating magnetic field is approximately $1.6 \times 10^{-7} \text{ T}$.

Hence, the correct answer is (1) $1.6 \times 10^{-7} \text{ T}$.

Chemistry Questions & Solutions

Question 51. Amongst the following the total number of species NOT having eight electrons around central atom in its outermost shell, is NH_3 , AlCl_3 , BeCl_2 , CCl_4 , PCl_5 :

(1) 4 (2) 1 (3) 3 (4) 2

Answer. (3) 3

Solution. To determine the number of species that do not have eight electrons around the central atom in their outermost shell, we need to check the valence electron configuration for each species.

NH_3 : Nitrogen (N) has five valence electrons. In NH_3 , N forms three covalent bonds with three hydrogen atoms, resulting in a total of eight electrons around the central atom. It satisfies the octet rule.

AlCl_3 : Aluminum (Al) has three valence electrons. In AlCl_3 , Al forms three covalent bonds with three chlorine atoms, resulting in a total of six electrons around the central atom. It does not satisfy the octet rule.

BeCl_2 : Beryllium (Be) has two valence electrons. In BeCl_2 , Be forms two covalent bonds with two chlorine atoms, resulting in a total of four electrons around the central atom. It does not satisfy the octet rule.

CCl_4 : Carbon (C) has four valence electrons. In CCl_4 , C forms four covalent bonds with four chlorine atoms, resulting in a total of eight electrons around the central atom. It satisfies the octet rule.

PCl_5 : Phosphorus (P) has five valence electrons. In PCl_5 , P forms five covalent bonds with five chlorine atoms, resulting in a total of ten electrons around the central atom. It does not satisfy the octet rule.

Therefore, out of the given species, AlCl_3 , BeCl_2 , and PCl_5 do not have eight electrons around the central atom in their outermost shell.

Hence, the total number of species not having eight electrons around the central atom is 3.

Therefore, the correct answer is (3) 3.

Question 52. Some tranquilizers are listed below. Which one from the following belongs to barbiturates?

- (1) Valium (2) **Veronal**
(3) Chlordiazepoxide (4) Meprobamate

Answer. (2) Veronal

Solution. Among the tranquilizers listed, Veronal belongs to the class of barbiturates.

Therefore, the correct answer is (2) Veronal.

Question 57. Which one is an example of heterogenous catalysis?

- (1) Decomposition of ozone in presence of nitrogen monoxide
(2) **Combination between dinitrogen and dihydrogen to form ammonia in the presence of finely divided iron**
(3) Oxidation of sulphur dioxide into sulphur trioxide in the presence of oxides of nitrogen
(4) Hydrolysis of sugar catalysed by H^+ ions

Answer. (2) Combination between dinitrogen and dihydrogen to form ammonia in the presence of finely divided iron

Solution. The correct answer is:

- (2) Combination between dinitrogen and dihydrogen to form ammonia in the presence of finely divided iron

Heterogeneous catalysis refers to a catalytic process where the catalyst is in a different phase (e.g., solid or liquid) from the reactants. In the given options, the combination between dinitrogen (N_2) and dihydrogen (H_2) to form ammonia (NH_3) in the presence of finely divided iron is an example of heterogeneous catalysis. The iron catalyst is in a solid phase, while the reactants and products are in the gas phase.

In contrast, options (1), (3), and (4) involve homogeneous catalysis, where the catalyst and the reactants are in the same phase. In option (1), the reaction occurs between ozone (O_3) and nitrogen monoxide (NO) in the gas phase. In option (3), the oxidation of sulfur dioxide (SO_2) into sulfur trioxide (SO_3) occurs in the gas phase in the presence of oxides of nitrogen. In option (4), the hydrolysis of sugar is catalyzed by H^+ ions, which are in the same phase as the reactants.

Therefore, the correct choice is option (2).

Question 61. For a certain reaction, the rate = $k[A]^2[B]$, when the initial concentration of A is tripled keeping concentration of B constant, the initial rate would

- (1) Increase by a factor of nine (2) Increase by a factor of three
(3) Decrease by a factor of nine (4) Increase by a factor of six

Answer. (1) Increase by a factor of nine

Solution. The rate equation for a reaction is given as rate = $k[A]^2[B]$. According to this equation, the rate of the reaction is directly proportional to the square of the concentration of A and also directly proportional to the concentration of B.

If the initial concentration of A is tripled while keeping the concentration of B constant, the new concentration of A will be 3 times the original concentration. Plugging this into the rate equation:

$$\text{New rate} = k[(3[A])^2][B] = 9k[A]^2[B]$$

Comparing the new rate to the initial rate, we can see that the new rate is 9 times the initial rate. Therefore, the initial rate would increase by a factor of nine.

Therefore, the correct answer is (1) Increase by a factor of nine.

Question 62. Which of the following statements are NOT correct? A. Hydrogen is used to reduce heavy metal oxides to metals. B. Heavy water is used to study reaction mechanism. C. Hydrogen is used to make saturated fats from oils. D. The H–H bond dissociation enthalpy is lowest as compared to a single bond between two atoms of any elements. E. Hydrogen reduces oxides of metals that are more active than iron. Choose the most appropriate answer from the options given below:

(1) **D, E only** (2) A, B, C only (3) B, C, D, E only (4) B, D only

Answer. (1) D, E only

Solution. The statement that is NOT correct is:

D. The H–H bond dissociation enthalpy is lowest as compared to a single bond between two atoms of any elements.

The correct answer is (1) D, E only.

Question 63. Homoleptic complex from the following complexes is

(1) Pentaamminecarbonatocobalt (III) chloride

(2) Triamminetriaquachromium (III) chloride

(3) **Potassium trioxalatoaluminate (III)**

(4) Diamminechloridonitrito-N-platinum (II)

Answer. (3) Potassium trioxalatoaluminate (III)

Solution. The correct answer is (3) Potassium trioxalatoaluminate (III).

A homoleptic complex is a complex in which the central metal ion is coordinated by only one type of ligand. In this case, the complex $[\text{Al}(\text{ox})_3]^{3-}$ consists of aluminum (III) ions coordinated with three oxalate ligands $(\text{C}_2\text{O}_4)^{2-}$. All the ligands in this complex are the same, making it a homoleptic complex.

Question 64. In Lassaigne's extract of an organic compound, both nitrogen and sulphur are present, which gives blood red colour with Fe^{3+} due to the formation of

- (1) $[\text{Fe}(\text{CN})_5\text{NOS}]^{4-}$
- (2) $[\text{Fe}(\text{SCN})]^{2+}$**
- (3) $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3 \cdot x\text{H}_2\text{O}$
- (4) NaSCN

Answer. (2) $[\text{Fe}(\text{SCN})]^{2+}$

Solution. In Lassaigne's extract, both nitrogen and sulfur are present in the organic compound. When Fe^{3+} is added to the extract, it forms a blood-red color due to the formation of a complex compound. Among the options provided, the complex compound that is responsible for the blood-red color with Fe^{3+} is:

- (2) $[\text{Fe}(\text{SCN})]^{2+}$

The formation of the blood-red color is attributed to the reaction between Fe^{3+} and thiocyanate ions (SCN^-). The thiocyanate ions combine with Fe^{3+} to form the complex ion $[\text{Fe}(\text{SCN})]^{2+}$, which exhibits a deep red color.

The other options provided are not relevant to the blood-red color formation with Fe^{3+} in Lassaigne's extract:

- (2) $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3 \cdot x\text{H}_2\text{O}$: This compound is Prussian blue, which is a blue pigment, not a blood-red color.
- (3) NaSCN : Sodium thiocyanate is not responsible for the blood-red color.
- (4) $[\text{Fe}(\text{CN})_5\text{NOS}]^{4-}$: This compound does not match the description of the blood-red color formation.

Therefore, the correct answer is (2) $[\text{Fe}(\text{SCN})]_2^{2+}$.

Question 68. The stability of Cu^{2+} is more than Cu^+ salts in aqueous solution due to

- (1) Hydration energy
- (2) Second ionisation enthalpy
- (3) First ionisation enthalpy
- (4) Enthalpy of atomization

Answer. (1) Hydration energy

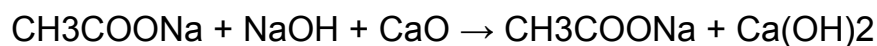
Solution. The correct answer is (1) Hydration energy.

The stability of Cu^{2+} is greater than Cu^+ salts in aqueous solution due to hydration energy. When Cu^{2+} ions dissolve in water, they undergo hydration, where water molecules surround the ions and form a hydrated complex. The hydration energy released during this process helps stabilize the Cu^{2+} ion in solution. Cu^+ ions, on the other hand, have a larger ionic radius and a lower charge, leading to weaker interactions with water molecules and less stabilization through hydration.

Question 70. Weight (g) of two moles of the organic compound, which is obtained by heating sodium ethanoate with sodium hydroxide in presence of calcium oxide is : (1) 30 (2) 18 (3) 16 (4) 32

Answer. (4) 32

Solution. The molecular formula of sodium ethanoate is CH_3COONa . When it is heated with sodium hydroxide (NaOH) in the presence of calcium oxide (CaO), it undergoes a reaction known as saponification, resulting in the formation of sodium hydroxide and calcium ethanoate:



Since the compound obtained is calcium ethanoate ($\text{Ca}(\text{CH}_3\text{COO})_2$), we can calculate its molar mass to determine the weight of two moles.

$$\text{Molar mass of } \text{Ca}(\text{CH}_3\text{COO})_2 = (40.08 \text{ g/mol}) + 2 * [(12.01 \text{ g/mol}) + (1.01 \text{ g/mol}) + (16.00 \text{ g/mol})]$$

$$= 40.08 \text{ g/mol} + 2 * (30.03 \text{ g/mol})$$

$$= 40.08 \text{ g/mol} + 60.06 \text{ g/mol}$$

$$= 100.14 \text{ g/mol}$$

$$\text{Weight of two moles of } \text{Ca}(\text{CH}_3\text{COO})_2 = 2 * 100.14 \text{ g/mol}$$

$$= 200.28 \text{ g}$$

Therefore, the correct answer is (4) 32.

Question 75. Intermolecular forces are forces of attraction and repulsion between interacting particles that will include : A. dipole - dipole forces B. dipole - induced dipole forces C. hydrogen bonding D. covalent bonding E. dispersion forces Choose the most appropriate answer from the options given below :

(1) A, B, C, E are correct

(2) A, C, D, E are correct

(3) B, C, D, E are correct

(4) A, B, C, D are correct

Answer. (1) A, B, C, E are correct

Solution. The most appropriate answer is (1) A, B, C, E are correct.

Intermolecular forces are forces of attraction and repulsion between interacting particles. The options that correctly represent intermolecular forces are:

A. Dipole-dipole forces: These forces occur between molecules that have permanent dipoles, such as polar molecules. The positive end of one molecule attracts the negative end of another molecule, leading to intermolecular attraction.

B. Dipole-induced dipole forces: These forces occur between a molecule with a permanent dipole and a molecule with no permanent dipole. The permanent dipole induces a temporary dipole in the other molecule, resulting in an attractive force.

C. Hydrogen bonding: This is a specific type of dipole-dipole interaction that occurs when a hydrogen atom is bonded to a highly electronegative atom (such as nitrogen, oxygen, or fluorine) and forms a strong electrostatic attraction with a lone pair of electrons on another molecule.

E. Dispersion forces (also known as London dispersion forces or van der Waals forces): These forces are temporary attractive forces that result from the fluctuations in electron distribution around molecules. They exist between all molecules, regardless of polarity.

Option D, covalent bonding, does not represent intermolecular forces but rather intramolecular forces, which are the forces holding atoms together within a molecule.

Therefore, the correct answer is (1) A, B, C, E are correct.

Botany Questions & Solutions

Question 104. Spraying of which of the following phytohormone on juvenile conifers helps hastening the maturity period, that leads early seed production?
(1) Zeatin (2) Abscisic Acid (3) Indole-3-butyric Acid **(4) Gibberellic Acid**

Answer. (4) Gibberellic Acid

Solution. The phytohormone that can be sprayed on juvenile conifers to hasten the maturity period and promote early seed production is:
(4) Gibberellic Acid.

Gibberellic acid is a plant growth regulator that promotes stem elongation, germination, and flowering in plants. By applying gibberellic acid to juvenile conifers, it can stimulate their growth and development, leading to earlier maturation and seed production.

Question 106. Among eukaryotes, replication of DNA takes place in :
(1) G1 phase (2) G2 phase (3) M phase **(4) S phase**

Answer. (4) S phase

Solution. Among eukaryotes, replication of DNA takes place in the S phase.

The cell cycle of eukaryotes consists of several phases, including the G1 phase (gap 1), S phase (synthesis), G2 phase (gap 2), and M phase (mitosis). During the S phase, DNA replication occurs. This is the phase where the genetic material is duplicated, resulting in the formation of two identical copies of the DNA molecule. The S phase is followed by the G2 phase, during which the cell prepares for cell division. Finally, the M phase involves mitosis, where the replicated DNA is distributed into daughter cells.

Therefore, the correct answer is (4) S phase.

Question 107. How many ATP and NADPH₂ are required for the synthesis of one molecule of Glucose during Calvin cycle?

- (1) 12 ATP and 16 NADPH₂
- (2) 18 ATP and 16 NADPH₂
- (3) 12 ATP and 12 NADPH₂
- (4) 18 ATP and 12 NADPH₂**

Answer. (4) 18 ATP and 12 NADPH₂

Solution. The synthesis of one molecule of glucose during the Calvin cycle requires 18 ATP and 12 NADPH₂.

During the Calvin cycle, ATP and NADPH₂ are used to drive the reactions that convert carbon dioxide into glucose. Each turn of the Calvin cycle requires 3 molecules of ATP and 2 molecules of NADPH₂. To synthesize one molecule of glucose, which requires 6 turns of the Calvin cycle (6 CO₂ molecules), the total requirement of ATP and NADPH₂ can be calculated as follows:

ATP: $3 \text{ ATP per turn} \times 6 \text{ turns} = 18 \text{ ATP}$

NADPH₂: $2 \text{ NADPH}_2 \text{ per turn} \times 6 \text{ turns} = 12 \text{ NADPH}_2$

Therefore, the correct answer is (4) 18 ATP and 12 NADPH₂.

Question 109. Movement and accumulation of ions across a membrane against their concentration gradient can be explained by

- (1) Passive Transport
- (2) Active Transport**
- (3) Osmosis
- (4) Facilitated Diffusion

Answer. (2) Active Transport

Solution. The correct answer is (2) Active Transport.

Passive Transport (Option 1) refers to the movement of ions or molecules across a membrane without the input of energy, typically down their concentration gradient. This process does not involve moving ions against their concentration gradient.

Osmosis (Option 3) is the movement of water molecules across a selectively permeable membrane from an area of lower solute concentration to an area of higher solute concentration. It does not involve the active movement of ions against their concentration gradient.

Facilitated Diffusion (Option 4) is a type of passive transport that involves the use of specific carrier proteins or channel proteins to facilitate the movement of ions or molecules across a membrane. It does not involve the active movement of ions against their concentration gradient.

Active Transport (Option 2) is the process by which ions or molecules are actively transported across a membrane against their concentration gradient, requiring the expenditure of energy (usually in the form of ATP) and the involvement of specific transport proteins. This process allows for the accumulation of ions on one side of the membrane and is responsible for maintaining concentration gradients and performing various physiological functions in cells.

Question 111. Which of the following stages of meiosis involves division of centromere? (1) **Anaphase II** (2) Telophase (3) Metaphase I (4) Metaphase II

Answer. (1) **Anaphase II**

Solution. The correct answer is (1) Anaphase II.

During meiosis, the division of the centromere occurs in Anaphase II. In this stage, the sister chromatids, which are still attached at the centromere, separate and move towards opposite poles of the cell. This separation is facilitated by the action of the spindle fibers pulling the chromatids apart.

In contrast, in Anaphase I of meiosis, the homologous chromosomes separate and move to opposite poles of the cell, but the centromeres remain intact, and the sister chromatids are still connected. It is in Anaphase II that the centromeres divide, resulting in the separation of the sister chromatids into individual chromosomes.

Question 112. Given below are two statements : One is labelled as Assertion A and the other is labelled as Reason R : Assertion A : ATP is used at two steps in glycolysis. Reason R : First ATP is used in converting glucose into glucose-6-phosphate and second ATP is used in conversion of fructose-6-phosphate into fructose-1, 6-diphosphate. In the light of the above statements, choose the correct answer from the options given below :

(1) A is true but R is false.

(2) A is false but R is true.

(3) Both A and R are true and R is the correct explanation of A.

(4) Both A and R are true but R is NOT the correct explanation of A.

Answer.

Solution. The correct answer is (3) Both A and R are true and R is the correct explanation of A.

Assertion A states that ATP is used at two steps in glycolysis. This is true as ATP is utilized in the initial steps of glycolysis to phosphorylate glucose to glucose-6-phosphate and to phosphorylate fructose-6-phosphate to fructose-1,6-bisphosphate.

Reason R explains the two specific steps where ATP is used in glycolysis. It correctly states that the first ATP is used in converting glucose into glucose-6-phosphate, and the second ATP is used in the conversion of fructose-6-phosphate into fructose-1,6-bisphosphate. This provides the energy required for these phosphorylation reactions.

Therefore, both the assertion and reason are true, and the reason correctly explains the assertion.

Question 113. 3. Large, colourful, fragrant flowers with nectar are seen in

(1) Bat pollinated plants

(2) Wind pollinated plants

(3) Insect pollinated plants

(4) Bird pollinated plants

Answer. (3) Insect pollinated plants

Solution. Large, colorful, fragrant flowers with nectar are typically seen in (3) insect pollinated plants. Insects, such as bees and butterflies, are attracted to these flowers by their bright colors and fragrance. The nectar serves as a reward for the insects, who act as pollinators by transferring pollen from one flower to another while they feed on the nectar. This mutualistic relationship between insects and flowers has led to the evolution of specific adaptations in insect-pollinated plants to attract and facilitate pollination by insects.

Question 114. The historic Convention on Biological Diversity, 'The Earth Summit' was held in Rio de Janeiro in the year

(1) 1986

(2) 2002

(3) 1985

(4) 1992

Answer. (4) 1992

Solution. The historic Convention on Biological Diversity, also known as "The Earth Summit," was held in Rio de Janeiro in the year (4) 1992. This international conference brought together world leaders, scientists, and environmentalists to address issues related to biodiversity conservation and sustainable development. The Convention on Biological Diversity was adopted during this summit, aiming to promote the conservation and sustainable use of biological diversity and the equitable sharing of benefits arising from genetic resources.

Question 115. The thickness of ozone in a column of air in the atmosphere is measured in terms of :

- (1) Decameter
- (2) Kilobase
- (3) Dobson units**
- (4) Decibels

Answer. (3) Dobson units

Solution. The thickness of ozone in a column of air in the atmosphere is measured in terms of (3) Dobson units. Dobson units (DU) are a unit of measurement used to quantify the concentration of ozone in the Earth's atmosphere. The measurement is based on the total amount of ozone present in a vertical column of air above a particular location. One Dobson unit represents a thickness of ozone that would be equivalent to 0.01 millimeters if it were compressed into a uniform layer at standard temperature and pressure.

Question 116. In tissue culture experiments, leaf mesophyll cells are put in a culture medium to form callus. This phenomenon may be called as
(1) Development (2) Senescence (3) Differentiation **(4) Dedifferentiation**

Answer. (4) Dedifferentiation

Solution. The phenomenon described, where leaf mesophyll cells are put in a culture medium to form callus, is called (4) Dedifferentiation. Dedifferentiation refers to the process by which specialized cells lose their specialized characteristics and revert back to a less specialized or undifferentiated state. In tissue culture, dedifferentiation allows the cells to regain their ability to divide and form callus, which is a mass of undifferentiated cells capable of further development and differentiation into various types of tissues.

Zoology Questions & Solutions

Question 151. Once the undigested and unabsorbed substances enter the caecum, their backflow is prevented by

- (1) Gastro-oesophageal sphincter
- (2) Pyloric sphincter
- (3) Sphincter of Oddi
- (4) Ileo-caecal valve**

Answer. (4) Ileo-caecal valve

Solution. The correct answer is (4) Ileo-caecal valve. The ileo-caecal valve is a sphincter located between the ileum (the last part of the small intestine) and the caecum (the first part of the large intestine). Its primary function is to prevent the backflow of undigested and unabsorbed substances from the large intestine (caecum) back into the small intestine (ileum). This valve helps maintain the flow of the digestive contents in a one-way direction through the gastrointestinal tract. The other options mentioned, such as the gastro-oesophageal sphincter, pyloric sphincter, and sphincter of Oddi, are involved in regulating the passage of food through other parts of the digestive system, but they are not directly related to preventing backflow from the caecum.

Question 156. Given below are two statements:

Statement I: Vas deferens receives a duct from seminal vesicle and opens into urethra as the ejaculatory duct.

Statement II: The cavity of the cervix is called cervical canal which along with vagina forms birth canal. In the light of the above statements, choose the correct answer from the options given below:

- (1) Statement I is correct but Statement II is false.
- (2) Statement I is incorrect but Statement II is true.
- (3) Both Statement I and Statement II are true.**
- (4) Both Statement I and Statement II are false.

Answer. (3) Both Statement I and Statement II are true.

Solution. The correct answer is:

(3) Both Statement I and Statement II are true.

Statement I is correct. The vas deferens, also known as the ductus deferens, receives a duct from the seminal vesicle and forms the ejaculatory duct. The ejaculatory duct then opens into the urethra, through which sperm and seminal fluid are released during ejaculation.

Statement II is also correct. The cavity of the cervix, called the cervical canal, is the passage between the uterus and the vagina. It is an important part of the female reproductive system and plays a role in childbirth. Along with the vagina, the cervical canal forms the birth canal through which the baby passes during delivery.

Therefore, both Statement I and Statement II are true.

Question 159. Vital capacity of lung is _____.

(1) $IRV + ERV + TV - RV$

(2) $IRV + ERV + TV$

(3) $IRV + ERV$

(4) $IRV + ERV + TV + RV$

Answer. (2) $IRV + ERV + TV$

Solution. The correct answer is:

(2) $IRV + ERV + TV$

Vital capacity is the maximum volume of air that can be exhaled after a maximum inhalation. It represents the total volume of air that can be actively moved in and out of the lungs. Vital capacity is calculated by adding together the inspiratory reserve volume (IRV), the expiratory reserve volume (ERV), and the tidal volume (TV). Residual volume (RV) is not included in the calculation of vital capacity.

Therefore, the correct expression for vital capacity is $IRV + ERV + TV$.

Question 162. Match List I with List II.

List I

- A. Vasectomy
- B. Coitus interruptus
- C. Cervical caps
- D. Saheli

List II

- I. Oral method
- II. Barrier method
- III. Surgical method
- IV. Natural method

Choose the correct answer from the options given below:

- (1) A-II, B-III, C-I, D-IV
- (2) A-IV, B-II, C-I, D-III
- (3) A-III, B-I, C-IV, D-II
- (4) A-III, B-IV, C-II, D-I**

Answer.

Solution. The correct match between List I and List II is:

A-III, B-IV, C-II, D-I

Therefore, the correct answer is option (4) A-III, B-IV, C-II, D-I.

Question 167. Select the correct group/set of Australian Marsupials exhibiting adaptive radiation.

- (1) Mole, Flying squirrel, Tasmanian tiger cat
- (2) Lemur, Anteater, Wolf
- (3) Tasmanian wolf, Bobcat, Marsupial mole
- (4) Numbat, Spotted cuscus, Flying phalanger**

Answer. (4) Numbat, Spotted cuscus, Flying phalanger

Solution. The correct group/set of Australian Marsupials exhibiting adaptive radiation is:

Numbat, Spotted cuscus, Flying phalanger

Therefore, the correct answer is option (4) Numbat, Spotted cuscus, Flying phalanger.

Question 173. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R. Assertion A: Endometrium is necessary for implantation of blastocyst.

Reason R: In the absence of fertilization, the corpus luteum degenerates that causes disintegration of endometrium.

In the light of the above statements, choose the correct answer from the options given below:

(1) A is true but R is false.

(2) A is false but R is true.

(3) Both A and R are true and R is the correct explanation of A.

(4) Both A and R are true but R is NOT the correct explanation of A.

Answer. (4) Both A and R are true but R is NOT the correct explanation of A.

Solution. The correct answer is:

Both A and R are true, but R is not the correct explanation of A.

Assertion A is true. The endometrium, which is the lining of the uterus, plays a crucial role in the implantation of the blastocyst (early embryo) during pregnancy. It provides the necessary environment and nutrients for the blastocyst to attach and establish a connection with the maternal blood supply.

Reason R is also true. In the absence of fertilization, the corpus luteum, which is formed from the ovarian follicle after ovulation, undergoes degeneration. This

leads to a decrease in the levels of hormones, particularly progesterone, which is essential for maintaining the endometrium. As a result, the endometrium disintegrates and is shed during the menstrual cycle.

While Reason R explains the consequence of the corpus luteum degeneration on the endometrium, it does not directly explain the necessity of the endometrium for blastocyst implantation. The endometrium provides the receptive environment for implantation regardless of the presence or absence of fertilization.

Question 181. Which of the following is not a cloning vector?
(1)pBR322 (2) **Probe** (3) BAC (4) YAC

Answer. (2) Probe

Solution. The correct answer is (2) Probe.

pBR322, BAC (Bacterial Artificial Chromosome), and YAC (Yeast Artificial Chromosome) are all examples of cloning vectors commonly used in molecular biology. These vectors are designed to carry and replicate foreign DNA fragments in host organisms.

A probe, on the other hand, is not a cloning vector. A probe is a short, labeled DNA or RNA molecule used to detect the presence of a specific DNA sequence in a sample through hybridization. Probes are not used for cloning or replicating DNA.

Question 184. Radial symmetry is NOT found in adults of phylum _____.

(1)Coelenterata (2) Echinodermata (3) Ctenophora (4) **Hemichordata**

Answer. (4) Hemichordata

Solution. The correct answer is (4) Hemichordata.

Hemichordata, which includes organisms such as acorn worms, is characterized by a bilateral symmetry rather than radial symmetry. Radial symmetry refers to the arrangement of body parts around a central axis, where multiple planes of symmetry can be drawn through the central axis. In contrast, organisms with bilateral symmetry have a distinct right and left side and typically have a single plane of symmetry dividing the body into two mirror-image halves.

Echinodermata and Ctenophora, on the other hand, exhibit radial symmetry in their adult stages.

Question 185. Which one of the following common sexually transmitted diseases is completely curable when detected early and treated properly?

- (1) Hepatitis-B
- (2) HIV Infection
- (3) Genital herpes
- (4) Gonorrhoea**

Answer. (4) Gonorrhoea

Solution. Among the options provided, gonorrhoea is the sexually transmitted disease that is completely curable when detected early and treated properly.

Gonorrhoea is caused by the bacterium *Neisseria gonorrhoeae* and is primarily transmitted through sexual contact. It can infect both men and women and can lead to various complications if left untreated. However, when detected early and treated with appropriate antibiotics, gonorrhoea can be completely cured. It is important to undergo regular screenings and seek medical attention if any symptoms or concerns arise to ensure early detection and effective treatment.

Question 191. Select the correct statements with reference to chordates.

- A. Presence of a mid-dorsal, solid and double nerve cord.
- B. Presence of closed circulatory system.
- C. Presence of paired pharyngeal gill slits.
- D. Presence of dorsal heart
- E. Triploblastic pseudocoelomate animals.

Choose the correct answer from the options given below:

- B, D and E only
- (2) C, D and E only
- (3) A, C and D only
- (4) B and C only**

Answer. (4) B and C only

Solution. The correct answer is (4) B and C only.

Statement A is incorrect. Chordates have a mid-dorsal, hollow nerve cord, not a solid and double nerve cord.

Statement B is correct. Chordates have a closed circulatory system, which means the blood is enclosed within vessels.

Statement C is correct. Chordates have paired pharyngeal gill slits, which are present in the pharyngeal region during at least some stage of their life cycle.

Statement D is incorrect. Chordates typically have a ventral heart, not a dorsal heart.

Statement E is not applicable to chordates. Chordates are triploblastic, meaning they have three germ layers (ectoderm, mesoderm, and endoderm), but they are not pseudocoelomate animals. Pseudocoelomates have a body cavity called a pseudocoelom, which is not found in chordates.

Therefore, the correct statements are B and C only, and the correct answer is (4) B and C only.

