

# NEET 2023 Solutions Code H6

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## Physics Questions and Solutions

**Question 2.** Let a wire be suspended from the ceiling (rigid support) and stretched by a weight  $W$  attached at its free end. The longitudinal stress at any point of cross-sectional area  $A$  of the wire is

(1)  $W/2A$  (2) Zero (3)  $2W/A$  (4)  **$W/A$**

**Answer.** (4)  $W/A$

**Solution.** The longitudinal stress at any point of cross-sectional area  $A$  of the wire under the given conditions can be calculated using the formula:

$$\text{Stress} = \text{Force} / \text{Area}$$

In this case, the force acting on the wire is the weight  $W$ , and the area is  $A$ .

Therefore, the longitudinal stress is given by:

$$\text{Stress} = W / A$$

So, the correct answer is (4)  $W/A$ .

**Question 4.** The venturi-meter works on

- (1) The principle of parallel axes
- (2) The principle of perpendicular axes
- (3) Huygen's principle
- (4) **Bernoulli's principle**

**Answer. (4) Bernoulli's principle**

**Solution.** The venturi meter works based on Bernoulli's principle, so the correct answer is (4) Bernoulli's principle.

According to Bernoulli's principle, there is a relationship between the velocity of a fluid and its pressure. When fluid flows through a constriction in a pipe, such as the narrow throat of a venturi meter, the velocity of the fluid increases, and as a result, the pressure decreases. This principle is utilized in a venturi meter to measure the flow rate of a fluid by measuring the pressure difference between the narrow throat and the wider sections of the meter.

So, the venturi meter operates on the principle of Bernoulli's equation and the pressure difference created by the change in fluid velocity.

**Question 5.** 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 when it is stretched is given by the formula:

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

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

Let's assume that the potential energy of the spring when stretched by 2 cm is U.

$$U = (1/2) k(0.02)^2$$

Now, we need to find the potential energy stored in the spring when it is stretched by 8 cm. Let's denote it as U'.

$$U' = (1/2) k(0.08)^2$$

To find the ratio between  $U'$  and  $U$ , we can divide  $U'$  by  $U$ :

$$\begin{aligned}U' / U &= [(1/2) k(0.08)^2] / [(1/2) k(0.02)^2] \\&= (0.08)^2 / (0.02)^2 \\&= (0.08 / 0.02)^2 \\&= 4^2 \\&= 16\end{aligned}$$

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

So, the correct answer is (2) 16  $U$ .

**Question 7.** The amount of energy required to form a soap bubble of radius 2 cm from a soap solution is nearly (surface tension of soap solution =  $0.03 \text{ N m}^{-1}$ )  
(1)  $3.01 \times 10^{-4} \text{ J}$  (2)  $50.1 \times 10^{-4} \text{ J}$  (3)  $30.16 \times 10^{-4} \text{ J}$  (4)  $5.06 \times 10^{-4} \text{ J}$

**Answer.** (1)  $3.01 \times 10^{-4} \text{ J}$

**Solution.** The energy required to form a soap bubble can be calculated using the formula:

$$E = 4\pi r^2 T$$

where  $E$  is the energy,  $r$  is the radius of the bubble, and  $T$  is the surface tension of the soap solution.

Substituting the given values:

$$r = 2 \text{ cm} = 0.02 \text{ m}$$

$$T = 0.03 \text{ N/m}$$

$$E = 4\pi(0.02)^2(0.03) = 0.03 \times 0.001256 = 3.768 \times 10^{-5} \text{ J}$$

The closest option is (1)  $3.01 \times 10^{-4}$  J.

**Question 8.** 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 radius of gyration of a solid sphere of mass M and radius R about its own axis is given by:

$$k_{\text{solid}} = \sqrt{\frac{2}{5}} * R$$

The radius of gyration of a thin hollow sphere of the same mass and radius about its axis is given by:

$$k_{\text{hollow}} = \sqrt{\frac{2}{3}} * R$$

To find the ratio of  $k_{\text{solid}}$  to  $k_{\text{hollow}}$ , we can divide the two equations:

$$\left(\frac{k_{\text{solid}}}{k_{\text{hollow}}}\right) = \left[\frac{\left(\sqrt{\frac{2}{5}} * R\right)}{\left(\sqrt{\frac{2}{3}} * R\right)}\right]$$

Simplifying the expression:

$$\left(\frac{k_{\text{solid}}}{k_{\text{hollow}}}\right) = \left(\frac{\sqrt{\frac{2}{5}}}{\sqrt{\frac{2}{3}}}\right)$$

Taking the square of both the numerator and denominator to eliminate the square root:

$$\left(\frac{k_{\text{solid}}}{k_{\text{hollow}}}\right) = \left[\frac{\left(\frac{2}{5}\right)}{\left(\frac{2}{3}\right)}\right]$$

$$\left(\frac{k_{\text{solid}}}{k_{\text{hollow}}}\right) = \left(\frac{2}{5}\right) * \left(\frac{3}{2}\right) = \frac{3}{5}$$

Therefore, the ratio of the radius of gyration of the solid sphere to the radius of gyration of the thin hollow sphere is 3 : 5. Option (3) 3 : 5 is correct.

**Question 9.** A bullet is fired from a gun at the speed of  $280 \text{ m s}^{-1}$  in the direction  $30^\circ$  above the horizontal. The maximum height attained by the bullet is ( $g = 9.8 \text{ m s}^{-2}$ ,  $\sin 30^\circ = 0.5$ )

(1) 1000 m (2) 3000 m (3) 2800 m (4) 2000 m

**Answer. (1) 1000 m**

**Solution.** To find the maximum height attained by the bullet, we can use the kinematic equations of motion.

Let's break down the initial velocity of the bullet into horizontal and vertical components.

The horizontal component of velocity remains constant throughout the motion and is given by:

$$V_x = V \cdot \cos\theta$$

$$V_x = 280 \text{ m/s} \cdot \cos(30^\circ)$$

$$V_x = 280 \text{ m/s} \cdot 0.866$$

$$V_x = 242.48 \text{ m/s}$$

The vertical component of velocity changes due to the acceleration due to gravity and is given by:

$$V_y = V \cdot \sin\theta$$

$$V_y = 280 \text{ m/s} \cdot \sin(30^\circ)$$

$$V_y = 280 \text{ m/s} \cdot 0.5$$

$$V_y = 140 \text{ m/s}$$

To find the time of flight, we can use the vertical component of motion:

$$V_y = u + at$$

$$0 = 140 \text{ m/s} - 9.8 \text{ m/s}^2 \cdot t$$

$$t = 14.29 \text{ s}$$

The time of flight for the projectile is  $2t$  since the motion is symmetric.

The maximum height attained by the bullet can be calculated using the formula:

$$H = \frac{V_y^2}{2g}$$

$$H = \frac{(140 \text{ m/s})^2}{2 * 9.8 \text{ m/s}^2}$$

$$H = \frac{19600 \text{ m}^2/\text{s}^2}{19.6 \text{ m/s}^2}$$

$$H = 1000 \text{ m}$$

Therefore, the maximum height attained by the bullet is 1000 m. Option (1) 1000 m is correct.

**Question 10.** In a plane electromagnetic wave travelling in free space, the electric field component oscillates sinusoidally at a frequency of  $2.0 \times 10^{10}$  Hz and amplitude  $48 \text{ V m}^{-1}$ . 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, the electric and magnetic fields are related by the equation:

$$c = E/B$$

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

Given:

$$\text{Electric field amplitude (E)} = 48 \text{ V/m}$$

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

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

We can rearrange the equation to solve for the magnetic field amplitude (B):

$$B = E/c$$

Substituting the given values:

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

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

Therefore, the amplitude of the oscillating magnetic field is approximately  $1.6 \times 10^{-7}$  T. Option (1)  $1.6 \times 10^{-7}$  T is correct.

**Question 11.** The net magnetic flux through any closed surface is  
(1) Infinity (2) Negative **(3) Zero** (4) Positive

**Answer. (3) Zero**

**Solution.** The net magnetic flux through any closed surface is zero. This is known as Gauss's Law for magnetism. It states that the total magnetic flux passing through a closed surface is always zero, which means that the sum of the magnetic field lines entering the surface is equal to the sum of the magnetic field lines exiting the surface. In other words, the magnetic field lines form closed loops, and there are no magnetic monopoles (isolated magnetic charges). Therefore, the correct option is (3) Zero.

**Question 13.** 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. As a result, the capacitor smoothens out the variations in the rectified output voltage by storing charge during the conducting periods and releasing it during the non-conducting periods.

Therefore, the correct answer is (1) Capacitor.

**Question 15.** . In a series LCR circuit, the inductance L is 10 mH, capacitance C is 1 F and resistance R is 100 . The frequency at which resonance occurs is

(1) 1.59 rad/s (2) **1.59 kHz** (3) 15.9 rad/s (4) 15.9 kHz

**Answer. (2) 1.59 kHz**

**Solution.** The resonance frequency in a series LCR circuit can be calculated using the formula:

$$f_{\text{res}} = \frac{1}{2\pi \sqrt{LC}}$$

Given that the inductance L is 10 mH (0.01 H) and the capacitance C is 1 μF ( $1 \times 10^{-6}$  F), we can substitute these values into the formula:

$$f_{\text{res}} = \frac{1}{2\pi \sqrt{0.01 \times 10^{-6}}}$$

Simplifying the expression:

$$f_{\text{res}} = \frac{1}{2\pi \times 10^{-3}}$$

$$f_{\text{res}} = \frac{1}{6.28 \times 10^{-3}}$$

$$f_{\text{res}} \approx 159.15 \text{ Hz}$$

Therefore, the resonance frequency is approximately 159.15 Hz.



The closest option to this value is (2) 1.59 kHz (which is equivalent to 1590 Hz).

## Chemistry Questions and Solutions

**Question 52.** The conductivity of centimolar solution of KCl at 25°C is  $0.0210 \text{ ohm}^{-1} \text{ cm}^{-1}$  and the resistance of the cell containing the solution at 25°C is 60 ohm.

The value of cell constant is

- (1)  $1.26 \text{ cm}^{-1}$
- (2)  $3.34 \text{ cm}^{-1}$
- (3)  $1.34 \text{ cm}^{-1}$
- (4)  $3.28 \text{ cm}^{-1}$

**Answer. (1)  $1.26 \text{ cm}^{-1}$**

**Solution.** The cell constant (K) is calculated using the formula:

$$K = \text{conductivity} \times \text{resistance}$$

Given:

$$\text{conductivity} = 0.0210 \text{ ohm}^{-1} \text{ cm}^{-1}$$

$$\text{resistance} = 60 \text{ ohm}$$

$$K = 0.0210 \text{ ohm}^{-1} \text{ cm}^{-1} \times 60 \text{ ohm}$$

$$K = 1.26 \text{ cm}^{-1}$$

Therefore, the value of the cell constant is  $1.26 \text{ cm}^{-1}$ .

The correct answer is (1)  $1.26 \text{ cm}^{-1}$ .

**Question 54.** The number of bonds, bonds and lone pair of electrons in pyridine, respectively are:

(1) 11, 3, 1 (2) 12, 2, 1 (3) 11, 2, 0 (4) 12, 3, 0

**Answer. (1) 11, 3, 1**

**Solution.** The correct answer is (1) 11, 3, 1.

In pyridine, there are 11  $\sigma$  bonds, which include the single bonds between carbon and nitrogen atoms, and carbon-carbon single bonds in the ring.

There are 3  $\pi$  bonds in pyridine, which are formed by the overlapping of p orbitals on the carbon atoms in the ring.

There is 1 lone pair of electrons on the nitrogen atom in pyridine.

**Question 55.** The element expected to form largest ion to achieve the nearest noble gas configuration is

(1) N (2) Na (3) O (4) F

**Answer. (1) N**

**Solution.** The correct answer is (1) N.

To achieve a noble gas configuration, elements tend to gain or lose electrons to either completely fill or empty their outermost electron shell. Among the options given, nitrogen (N) is the element that is expected to form the largest ion to achieve the nearest noble gas configuration.

Nitrogen has 5 valence electrons in its outermost shell. By gaining 3 electrons, it can achieve the electron configuration of the noble gas neon (2, 8). This results in the formation of the  $N^{3-}$  ion, which has a total of 10 electrons, the same as the noble gas neon.

**Question 56.** Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R Assertion A : Helium is used to dilute oxygen in diving apparatus. Reason R : Helium has high solubility in O<sub>2</sub>. 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 correct explanation of A
- (4) Both A and R are true and R is NOT the correct explanation of A**

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

**Solution.** The correct answer is (4) Both A and R are true and R is NOT the correct explanation of A.

Assertion A is true. Helium is used to dilute oxygen in diving apparatus because it has low solubility in blood compared to nitrogen. This helps to reduce the risk of decompression sickness, also known as "the bends," which can occur when divers ascend too quickly and dissolved gases come out of solution and form bubbles in the body.

Reason R is false. Helium does not have high solubility in oxygen. In fact, helium has very low solubility in blood and tissues, which makes it an ideal choice for diluting oxygen in diving apparatus.

**Question 63.** 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 correct answer is (1) A, B, C, E are correct.

Intermolecular forces are forces of attraction and repulsion between interacting particles, such as molecules or ions. The options that correctly represent types of intermolecular forces are:

A. Dipole-dipole forces: These occur between molecules with permanent dipoles, where the positive end of one molecule attracts the negative end of another.

B. Dipole-induced dipole forces: These occur between a molecule with a permanent dipole and a molecule without a permanent dipole. The permanent dipole induces a temporary dipole in the other molecule, leading to an attraction.

C. Hydrogen bonding: This is a special type of dipole-dipole force that occurs when hydrogen is bonded to a highly electronegative atom (such as nitrogen, oxygen, or fluorine) and forms an additional weak bond with another electronegative atom.

E. Dispersion forces (also known as London dispersion forces or van der Waals forces): These forces arise from temporary fluctuations in electron distribution, creating temporary dipoles in molecules and inducing dipoles in neighboring molecules, leading to attraction.

D. Covalent bonding, on the other hand, is an intramolecular force and refers to the sharing of electrons between atoms within a molecule, rather than the interactions between different molecules.

Therefore, option (1) A, B, C, E are correct.

**Question 64.** The stability of  $\text{Cu}^{2+}$  is more than  $\text{Cu}^{+}$  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**

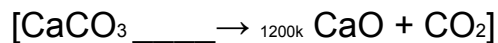
**Solution.** The correct answer is (1) Hydration energy.

In aqueous solutions,  $\text{Cu}^{2+}$  ions have greater stability compared to  $\text{Cu}^{+}$  ions. This is primarily due to hydration energy. When  $\text{Cu}^{2+}$  ions are dissolved in water, they undergo hydration, where water molecules surround the ions and form a coordination sphere. This hydration process releases energy, known as hydration energy, which stabilizes the  $\text{Cu}^{2+}$  ions in solution.

On the other hand,  $\text{Cu}^{+}$  ions have a larger size and a lower charge compared to  $\text{Cu}^{2+}$  ions. As a result, they have weaker interactions with water molecules and experience less hydration energy. This makes  $\text{Cu}^{+}$  ions less stable in aqueous solutions compared to  $\text{Cu}^{2+}$  ions.

Therefore, the greater stability of  $\text{Cu}^{2+}$  compared to  $\text{Cu}^{+}$  salts in aqueous solution is primarily attributed to hydration energy.

**Question 67.** The right option for the mass of  $\text{CO}_2$  produced by heating 20 g of 20% pure limestone is (Atomic mass of Ca = 40)



- (1) 2.64 g
- (2) 1.32 g
- (3) 1.12 g
- (4) **1.76 g**

**Answer. 4) 1.76 g**

**Solution.** To calculate the mass of CO<sub>2</sub> produced, we need to determine the molar mass of CaCO<sub>3</sub> and use stoichiometry.

The molar mass of CaCO<sub>3</sub> is calculated as follows:

1 atom of Ca = 40 g/mol

1 atom of C = 12 g/mol

3 atoms of O = 16 g/mol each

Molar mass of CaCO<sub>3</sub> = 40 + 12 + (16 × 3) = 100 g/mol

Now, let's calculate the amount of CaCO<sub>3</sub> in the given 20 g of limestone:

Mass of CaCO<sub>3</sub> = 20 g × 0.20 (20% purity) = 4 g

Using stoichiometry, we can see that 1 mole of CaCO<sub>3</sub> produces 1 mole of CO<sub>2</sub>. Therefore, the mass of CO<sub>2</sub> produced is also 4 g.

So, the correct option is (4) 1.76 g.

**Question 68.** Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R

Assertion A : In equation  $rG = -nFE_{\text{cell}}$  value of  $rG$  depends on  $n$ .

Reasons R :  $E_{\text{cell}}$  is an intensive property and  $rG$  is an extensive property.

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 and R is NOT the correct explanation of A**

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

**Solution.** The correct answer is (4) Both A and R are true and R is NOT the correct explanation of A.

Assertion A is true because the change in Gibbs free energy ( $\Delta rG$ ) in the given equation depends on the number of moles of electrons transferred ( $n$ ). This is evident from the equation itself, where  $n$  is multiplied by the Faraday constant ( $F$ ) to calculate the electrical work done.

Reason R is also true.  $E_{\text{cell}}$ , which represents the cell potential or electromotive force, is an intensive property because it depends on the nature of the electrodes and the concentrations of the species involved in the redox reaction. On the other hand,  $\Delta rG$  is an extensive property because it depends on the amount (moles) of reactants and products involved in the reaction.

However, Reason R does not provide a correct explanation for Assertion A. The relationship between the two is not directly dependent on the intensive or extensive nature of the properties. Instead, the relationship is established through the equation itself, which relates  $\Delta rG$  to the cell potential and the number of moles of electrons transferred.

**Question 70.** 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 correct answer is (1) Increase by a factor of nine.

According to the given rate law, the rate of the reaction is directly proportional to the square of the concentration of A ( $[A]^2$ ) and the concentration of B ( $[B]$ ).

If the initial concentration of A is tripled while keeping the concentration of B constant, the new concentration of A becomes  $3[A]$ . Substituting this new concentration into the rate equation, we have:

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

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

**Question 73.** 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.** The correct option is (2) Veronal.

Barbiturates are a class of drugs that act as central nervous system depressants and have sedative, hypnotic, and anticonvulsant properties. Veronal, also known as barbital, is a barbiturate that was historically used as a sedative and hypnotic medication.

Valium (diazepam) belongs to the class of drugs called benzodiazepines, not barbiturates. Chlordiazepoxide is also a benzodiazepine. Meprobamate is a non-barbiturate sedative-hypnotic medication.



## **Botany Questions and Solutions**

**Question 101.** Identify the pair of heterosporous pteridophytes among the following :

- (1) Psilotum and Salvinia
- (2) Equisetum and Salvinia
- (3) Lycopodium and Selaginella
- (4) Selaginella and Salvinia**

**Answer. (4) Selaginella and Salvinia**

**Solution.** The correct option is (4) Selaginella and Salvinia.

Heterospory refers to the production of two different types of spores, typically male and female, in the same plant. Among the given options, Selaginella and Salvinia are examples of heterosporous pteridophytes.

Psilotum is a homosporous pteridophyte, meaning it produces only one type of spore. Equisetum and Lycopodium are also homosporous.

**Question 102.** The reaction centre in PS II has an absorption maxima at

- (1) 660 nm (2) 780 nm **(3) 680 nm** (4) 700 nm

**Answer. (3) 680 nm**

**Solution.** The correct option is (3) 680 nm.

The reaction center in Photosystem II (PS II) has an absorption maximum at approximately 680 nm. This is the wavelength of light that is most efficiently

absorbed by the reaction center pigments in PS II, allowing for the initiation of the light-dependent reactions of photosynthesis.

**Question 104.** Family Fabaceae differs from Solanaceae and Liliaceae. With respect to the stamens, pick out the characteristics specific to family Fabaceae but not found in Solanaceae or Liliaceae.

- (1) Monoadelphous and Monothealous anthers
- (2) Epiphyllous and Dithecous anthers
- (3) Diadelphous and Dithecous anthers**
- (4) Polyadelphous and epipetalous stamens

**Answer. (3) Diadelphous and Dithecous anthers**

**Solution.** The characteristic specific to the family Fabaceae but not found in Solanaceae or Liliaceae is:

- (3) Diadelphous and Dithecous anthers

In the family Fabaceae, the stamens are diadelphous, meaning they are fused into two groups (9 + 1). Additionally, the anthers in Fabaceae are dithecous, meaning each anther consists of two thecae or lobes.

In Solanaceae and Liliaceae, the stamens do not exhibit these specific characteristics.

**Question 105.** Given below are two statements :

Statement I : The forces generated transpiration can lift a xylem-sized column of water over 130 meters height.

Statement II : Transpiration cools leaf surfaces sometimes 10 to 15 degrees, by evaporative cooling.

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 most appropriate answer is:

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

Statement I is correct. The forces generated by transpiration, specifically the cohesion-tension mechanism, can indeed lift a xylem-sized column of water over 130 meters in height. This is due to the cohesive properties of water molecules and the tension created by transpiration pull.

Statement II is also correct. Transpiration can result in evaporative cooling of leaf surfaces. As water is lost through the stomata during transpiration, it leads to the evaporation of water from the leaf surface. This evaporation causes a cooling effect, reducing the temperature of the leaf surface by sometimes 10 to 15 degrees.

**Question 106.** Given below are two statements : One is labelled as Assertion A and the other is labelled as Reason R :

Assertion A : Late wood has fewer xylary elements with narrow vessels.

Reason R : Cambium is less active in winters.

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

**Solution.** The correct answer is:

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

Late wood does indeed have fewer xylary elements with narrow vessels. This is because late wood is formed during the later part of the growing season when the cambium, the tissue responsible for secondary growth, becomes less active. As the cambium activity decreases, the production of xylary elements, including vessels, is reduced, resulting in narrower vessels in the late wood. Therefore, Assertion A is true.

Reason R is also true and provides the correct explanation for Assertion A. The cambium, which is responsible for the production of xylary elements, including vessels, is less active during winters. This reduced activity of the cambium during the winter season leads to fewer xylary elements being produced, resulting in narrower vessels in the late wood.

**Question 107.** In the equation  $GPP - R = NPP$ ,  $GPP$  is Gross Primary Productivity,  $NPP$  is Net Primary Productivity,  $R$  here is \_\_\_\_\_.

- (1) Respiratory loss
- (2) Reproductive allocation
- (3) Photosynthetically active radiation
- (4) Respiratory quotient

**Answer. (1) Respiratory loss**

**Solution.** In the given equation  $GPP - R = NPP$ , the term "R" represents respiratory loss.

Respiratory loss refers to the energy expended by organisms through cellular respiration, which is the process of breaking down organic compounds to release energy. It is a metabolic process that occurs in all living cells, including plants. During respiration, some of the energy generated through photosynthesis is used

by the plant for its own metabolic activities, such as growth, maintenance, and reproduction. This energy loss is represented by the term "R" in the equation.

Therefore, the correct answer is (1) Respiratory loss.

**Question 109.** Which hormone promotes internode/petiole elongation in deep water rice?

(1) Ethylene (2) 2, 4-D (3) GA3 (4) Kinetin

**Answer. (1) Ethylene**

**Solution.** The hormone that promotes internode/petiole elongation in deep water rice is ethylene. Deep water rice is a type of rice that grows in flooded conditions, and ethylene plays a crucial role in adapting to this environment. Ethylene stimulates the elongation of internodes and petioles, allowing the plant to grow taller and keep the leaves above water. This adaptation helps the plant survive in flooded conditions by preventing submergence and ensuring sufficient access to oxygen. Therefore, option (1) "Ethylene" is the correct answer.

**Question 110.** The phenomenon of pleiotropism refers to

(1) A single gene affecting multiple phenotypic expression

(2) More than two genes affecting a single character

(3) Presence of several alleles of a single gene controlling a single crossover

(4) Presence of two alleles, each of the two genes controlling a single trait

**Answer. (1) A single gene affecting multiple phenotypic expression**

**Solution.** The correct answer is (1) A single gene affecting multiple phenotypic expression.

Pleiotropism is a phenomenon in genetics where a single gene can influence multiple phenotypic traits or characteristics. In other words, a single gene has

multiple effects on the phenotype of an organism. This can manifest as seemingly unrelated traits being affected by the same gene.

An example of pleiotropism is seen in human genetic disorders like Marfan syndrome, where a mutation in the FBN1 gene can result in various phenotypic effects such as tall stature, long limbs, cardiovascular abnormalities, and skeletal deformities. In this case, a single gene mutation affects multiple aspects of the phenotype.

Therefore, option (1) "A single gene affecting multiple phenotypic expression" accurately describes the phenomenon of pleiotropism.

**Question 111.** What is the role of RNA polymerase III in the process of transcription in Eukaryotes?

- (1) Transcription of precursor of mRNA
- (2) Transcription of only snRNAs
- (3) Transcription of rRNAs (28S, 18S and 5.8S)
- (4) Transcription of tRNA, 5S rRNA and snRNA**

**Answer. (4) Transcription of tRNA, 5S rRNA and snRNA**

**Solution.** The correct answer is (4) Transcription of tRNA, 5S rRNA, and snRNA.

RNA polymerase III is one of the three main types of RNA polymerases involved in transcription in eukaryotes. It is responsible for transcribing specific classes of RNA molecules. RNA polymerase III transcribes several types of non-coding RNAs, including transfer RNA (tRNA), 5S ribosomal RNA (5S rRNA), and small nuclear RNA (snRNA).

tRNA is involved in protein synthesis and carries amino acids to the ribosome during translation. 5S rRNA is a component of the ribosome and plays a role in protein synthesis. snRNAs are involved in the processing of pre-mRNA molecules and their splicing.

Therefore, RNA polymerase III is responsible for transcribing these specific types of RNAs, namely tRNA, 5S rRNA, and snRNA.

**Question 112.** Expressed Sequence Tags (ESTs) refers to

- (1) All genes whether expressed or unexpressed.
- (2) Certain important expressed genes.
- (3) All genes that are expressed as RNA.**
- (4) All genes that are expressed as proteins.

**Answer. (3) All genes that are expressed as RNA.**

**Solution.** Expressed Sequence Tags (ESTs) refer to (3) All genes that are expressed as RNA.

ESTs are short sequences of DNA derived from the transcribed region of a gene. They are obtained through a technique called cDNA (complementary DNA) sequencing. ESTs represent fragments of expressed genes and are useful for studying gene expression patterns and identifying genes that are active in specific tissues or under certain conditions.

Since ESTs are derived from the transcribed region of genes, they specifically represent genes that are expressed as RNA. They provide valuable information about the identity and expression levels of genes in a particular organism or tissue. However, ESTs do not provide information about the complete sequence of a gene or its corresponding protein.

## **Zoology Questions and Answers**

**Question 152.** 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: Vas deferens receives a duct from seminal vesicle and opens into urethra as the ejaculatory duct.

This statement is true. The vas deferens, also known as the ductus deferens, is a tube that carries sperm from the epididymis to the urethra. Prior to reaching the urethra, the vas deferens receives a duct from the seminal vesicle, and together they form the ejaculatory duct, which transports sperm and seminal fluid during ejaculation.

Statement II: The cavity of the cervix is called cervical canal which along with vagina forms birth canal.

This statement is also true. The cervix is the lower part of the uterus that connects it to the vagina. It has a central cavity called the cervical canal, which allows the passage of menstrual flow and serves as a channel for sperm to enter the uterus. During childbirth, the cervical canal dilates to allow the passage of the baby through the birth canal, which includes the vagina.

Therefore, both Statement I and Statement II are true.

**Question 153.** Match List I with List II.

List I

- A. Taenia
- B. Paramoecium
- C. Periplaneta



D. Pheretima

List II

I. Nephridia

II. Contractile vacuole

III. Flame cells

IV. Urecose gland

Choose the correct answer from the options given below:

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

(2) A-II, B-I, C-IV, D-III

(3) A-I, B-II, C-III, D-IV

(4) A-I, B-II, C-IV, D-III

**Answer. (1) A-III, B-II, C-IV, D-I**

**Solution.** The correct answer is (1) A-III, B-II, C-IV, D-I.

List I

A. Taenia

B. Paramoecium

C. Periplaneta

D. Pheretima

List II

III. Flame cells

II. Contractile vacuole

IV. Urecose gland

I. Nephridia

Based on the characteristics given, the correct matching would be:

A. Taenia - III. Flame cells

B. Paramoecium - II. Contractile vacuole

C. Periplaneta - IV. Urecose gland

D. Pheretima - I. Nephridia

Therefore, the correct answer is (1) A-III, B-II, C-IV, D-I.

**Question 154.** 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.** The correct answer is (4) Gonorrhoea.

Gonorrhoea is a sexually transmitted infection caused by the bacterium *Neisseria gonorrhoeae*. When detected early and treated properly with appropriate antibiotics, gonorrhoea can be completely cured. It is important to seek medical attention and adhere to the prescribed treatment regimen to ensure effective treatment and prevent further transmission. Other sexually transmitted diseases mentioned in the options, such as Hepatitis-B, HIV infection, and genital herpes, are not currently curable, although treatment can help manage symptoms and slow disease progression in some cases.

**Question 155.** Given below are two statements: one is labelled as Assertion A and other is labelled as Reason R.

Assertion A : Amniocentesis for sex determination is one of the strategies of Reproductive and Child Health Care Programme.

Reason R : Ban on amniocentesis checks increasing menace of female foeticide. 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 and R is NOT the correct explanation of A

**Answer. (2) A is false but R is true.**

**Solution.** The correct answer is (2) A is false but R is true.

Amniocentesis is a medical procedure in which a small amount of amniotic fluid is sampled from the amniotic sac surrounding the developing fetus. It is primarily used for prenatal diagnosis of genetic disorders, chromosomal abnormalities, and certain birth defects. However, it is not used for sex determination in the context of the Reproductive and Child Health Care Programme.

The reason (R) mentioned is true, as there has been a ban on amniocentesis in some regions due to the misuse of the procedure for sex-selective abortions. This ban aims to address the issue of female foeticide, which refers to the deliberate abortion of female fetuses due to cultural preferences for male children. While the reason explains the context of the ban, it does not accurately relate to the assertion about amniocentesis being a strategy of the Reproductive and Child Health Care Programme. Hence, option (2) is the correct answer.

**Question 159.** 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 answer is (4) Numbat, Spotted cuscus, Flying phalanger.

Adaptive radiation refers to the diversification of a group of organisms into different forms to occupy different ecological niches. In the context of Australian marsupials, the group that exhibits adaptive radiation includes the numbat, spotted cuscus, and flying phalanger.

The numbat (*Myrmecobius fasciatus*) is a small marsupial that feeds primarily on termites. It has adapted to a specialized diet and foraging behavior.

The spotted cuscus (*Spilocuscus maculatus*) is a marsupial that exhibits arboreal adaptations. It is found in various habitats and has diversified into different species with adaptations for climbing and living in trees.

The flying phalanger, or sugar glider (*Petaurus breviceps*), is a marsupial that has adaptations for gliding. It has a membrane of skin between its limbs that allows it to glide between trees.

These three species represent examples of Australian marsupials that have undergone adaptive radiation, diversifying into different ecological niches and developing specialized adaptations for their respective lifestyles.

**Question 160.** Which of the following statements is correct?

- (1) Presence of large amount of nutrients in water restricts 'Algal Bloom'
- (2) Algal Bloom decreases fish mortality
- (3) Eutrophication refers to increase in domestic sewage and waste water in lakes.
- (4) Biomagnification refers to increase in concentration of the toxicant at successive trophic levels.**

**Answer. (4) Biomagnification refers to increase in concentration of the toxicant at successive trophic levels.**

**Solution.** The correct statement is:

- (4) Biomagnification refers to an increase in the concentration of a toxicant at successive trophic levels.

Biomagnification is the process by which certain substances, such as pesticides or heavy metals, increase in concentration as they move up the food chain. This means that organisms at higher trophic levels, such as top predators, tend to accumulate higher levels of these substances in their bodies compared to organisms lower in the food chain. This can lead to significant health risks for animals, including humans, at the top of the food chain.

The other statements are incorrect:

- (1) Presence of a large amount of nutrients in water can actually promote algal bloom. Excess nutrients, such as nitrogen and phosphorus, can lead to excessive growth of algae, resulting in algal bloom. This can have negative effects on aquatic ecosystems.

(2) Algal bloom can actually increase fish mortality. When there is an overgrowth of algae, it can lead to a decrease in dissolved oxygen levels in the water, causing hypoxia or even anoxia. This lack of oxygen can be harmful to fish and other aquatic organisms, leading to mortality.

(3) Eutrophication refers to the excessive nutrient enrichment of water bodies, typically from sources like agricultural runoff, industrial discharges, and sewage. While domestic sewage and wastewater can contribute to eutrophication, it is not limited to these sources alone. Eutrophication can lead to algal bloom and other negative impacts on water quality and ecosystem health.

**Question 161.** Which of the following are NOT considered as the part of endomembrane system?

- A. Mitochondria
- B. Endoplasmic reticulum
- C. Chloroplasts
- D. Golgi complex
- E. Peroxisomes

Choose the most appropriate answer from the options given below:

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

**Answer. (4) A, C and E only**

**Solution.** The most appropriate answer is:

(4) A, C and E only

Mitochondria, chloroplasts, and peroxisomes are not considered part of the endomembrane system. The endomembrane system includes the endoplasmic reticulum, Golgi complex, and vesicles involved in the synthesis, modification, and transport of proteins and lipids within the cell.

Mitochondria are responsible for energy production through cellular respiration and have their own membrane system.

Chloroplasts are found in plant cells and are responsible for photosynthesis. They also have their own membrane system.

Peroxisomes are involved in various metabolic processes, such as the breakdown of fatty acids. They also have their own membrane system.

Therefore, options A, C, and E (mitochondria, chloroplasts, and peroxisomes) are not considered part of the endomembrane system.

**Question 162.** 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.

The other options mentioned are all cloning vectors commonly used in genetic engineering:

(1) pBR322: pBR322 is a plasmid vector that was one of the first widely used cloning vectors. It contains genes for antibiotic resistance and multiple restriction sites for inserting foreign DNA.

(3) BAC: BAC stands for Bacterial Artificial Chromosome. It is a cloning vector used to clone large fragments of DNA, typically up to 300 kilobases in size.

(4) YAC: YAC stands for Yeast Artificial Chromosome. It is another cloning vector used for cloning large DNA fragments. YACs can accommodate DNA fragments of several hundred kilobases to a few megabases in size.

On the other hand, a probe is not a cloning vector. It is a short, labeled DNA or RNA molecule used to detect specific sequences of nucleic acids in a sample. Probes are used in techniques like hybridization and nucleic acid amplification, but they are not vectors used for cloning DNA.

**Question 166.** Given below are two statements:

Statement I: A protein is imagined as a line, the left end represented by first amino acid (C-terminal) and the right end represented by last amino acid (N-terminal).

Statement II: Adult human haemoglobin, consists of 4 subunits (two subunits of  $\alpha$  type and two subunits of  $\beta$  type.)

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

**Solution.** The correct answer is:

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

Statement I is incorrect. A protein is not imagined as a line with the left end represented by the first amino acid (C-terminal) and the right end represented by the last amino acid (N-terminal). In reality, the N-terminal end of a protein corresponds to the left end, while the C-terminal end corresponds to the right end.

Statement II is correct. Adult human hemoglobin consists of four subunits, specifically two subunits of  $\alpha$  type and two subunits of  $\beta$  type. This tetrameric structure allows hemoglobin to efficiently bind and transport oxygen in the bloodstream.

**Question 167.** Given below are two statements:

Statement I: RNA mutates at a faster rate.

Statement II: Viruses having RNA genome and shorter life span mutate and evolve faster. 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. (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 true. RNA molecules generally have a higher mutation rate compared to DNA molecules. This is because RNA polymerases, the enzymes responsible for copying RNA sequences, have a higher error rate than DNA polymerases. Additionally, RNA molecules are more prone to chemical degradation and have fewer mechanisms for error correction.

Statement II is also true. Viruses that have an RNA genome and shorter life spans tend to mutate and evolve at a faster rate. This is because their shorter generation time allows for more rapid accumulation of mutations, and the high mutation rate of RNA contributes to their genetic variability. This rapid evolution can help viruses adapt to changing environments and evade host immune responses.