# NEET - 2021
## Questions with Solutions

**Important Instructions:**

1. The Answer Sheet is inside this Test Booklet. When you directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars on OFFICE Copy carefully with blue/black ball point pen only

2. The test is of 3 hours during and the Test Booklet contains 200 multiple - choice questions (four options with a single correct answer) from Physics, Chemistry and Biology (Botany and Zoology). 50 questions in each subject are divided into two Sections (A and B) as per details given below:

   (a) Section A shall consist of 35 (thirty-five) Questions in each subject (Questions Nos. - 1 to 35, 51 to 85, 101 to 135 and 151 to 185). All questions are compulsory.

   (b) Section B shall consist of 15 (Fifteen) questions in each subject (Questions Nos - 36 to 50, 86 to 100), 136 to 150 and 186 to 200). In Section B, a candidate needs to attempt any 10 (Ten) questions out of 15 (Fifteen) in each subject.

   Candidates are advised to read all 15 questions in each subject of Section B before they start attempting the questions paper. In the event of a candidate attempting more than ten questions, the first ten questions answered by the candidate shall be evaluated.

3. Each questions carries 4 marks. For each correct response, the candidate will get 4 marks. for each incorrect response. One mark will be deducted from the total scores. The maximum marks are 720.

4. Use Blue / Black Ball Point Pen only for writing particulars on this page / marking responses on Answer Sheet.

5. Rough work is to be done in the space provided for this purpose in the Test Booklet only.

6. On completion of the test, the candidate must hand over the Answer Sheet (ORIGINAL and OFFICE Copy) to the Invigilator before leaving the Room / Hall. The candidates are allowed to take away this Test Booklet with them.

7. The CODE for this Booklet is O6. Make sure that the CODE printed on the Original Copy of the Answer Sheet is the same as that on this Test Booklet. in case of discrepancy, the candidate should immediately report the matter to the Invigilator for replacement of both the Test Booklet and the Answer Sheet .

8. Use of white fluid for correction is NOT permissible on the Answer Sheet.

9. Each candidate must show on demand his/her Admit Card to the Invigilator.

10. No candidate, without special permission of the centre Superintendent or Invigilator, would leave his / her seat.

11. The candidates should not leave the Examination Hall without handing over their Answer Sheet to the Invigilator on duty and sign (with time) the Attendance Sheet twice. Cases, where a candidate has not Signed the Attendance Sheet second time, will be deemed not to have handed over the Answer Sheet and dealt with as an Unfair Means care.

12. Use of Electronic / Manual Calculator is prohibited.

13. The candidates are governed by all Rules and Regulations of the examination with regard to their conduct in the Examination Room /Hall. All cases of unfair means will be dealt with as per the Rules and Regulations of this examination.

14. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.

# PHYSICS

**Q 1. The escape velocity from the Earth's Surface is v. The escape velocity from the surface of another planet having a radius, four times that of Earth and same mass density is:**

Option A      4 v

Option B      v

Option C      2 v

Option D      3 v

Correct Option A

Solution:

As we know the relation for escape velocity of satellites can be expressed as shown below

$$v_e = \sqrt{\frac{2GM}{R}}$$

$$\therefore v_e = \sqrt{\frac{2G4\times\pi R^3 \rho}{3}{R}} \Rightarrow v_e \propto R$$

**Q 2. A cup of coffee cools from 90 ᵒC to 80 ᵒC in t minutes, when the room temperature is 20 ᵒC. The time taken by a similar cup of coffee to cool from 80 ᵒC to 60 ᵒC at a room temperature same at 20 ᵒC is:**

Option A      $\frac{5}{13}t$

Option B      $\frac{13}{10}t$

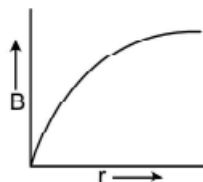Option C      $\frac{13}{5}t$

Option D      $\frac{10}{13}t$

Correct Option C

Solution:

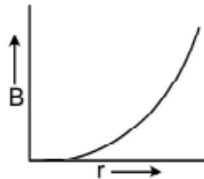$$\frac{\frac{80-60}{t'}}{\frac{90-80}{t}} = \frac{(\frac{80+60}{2}-20)}{(\frac{90+80}{2}-20)}$$

$$\Rightarrow \frac{20}{t'}\times\frac{t}{10} = \frac{50}{65} \Rightarrow t = 2t \times \frac{65}{50} = \frac{13}{5}t$$

**Q 3. A thick current carrying cable of radius 'R' carries current 'I' uniformly distributed across its cross-section. The variation of magnetic field B(r) due to the cable with the distance 'r' from the axis of the cable is represented by:**
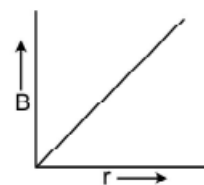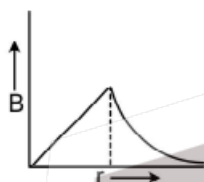


Option A

Option B



Option C



Option D

**Correct Option D**
**Solution:**
$B \propto r \ (0 \leq r \leq R)$
$B \propto \frac{1}{r} (r \geq R)$

**Q 4. Polar molecules are the molecules:**

Option A  having a permanent electric dipole moment.

Option B  having zero dipole moment

Option C  acquire a dipole moment only in the presence of electric field due to displacement of charges.

Option D  acquire a dipole moment only when magnetic field is absent.

**Correct Option A**
**Solution:**
Polar dielectric molecules have a permanent dipole moment. In the absence of an electric field, these dipoles align at random due to thermal agitation. As a result, the total dipole moment is equal to zero. When an electric field is applied, these randomly aligned dipoles try to align in the direction of the electric field. As a result, there is a net dipole moment in the direction of the electric field.

**Q 5. Find the value of the angle of emergence from the prism. Refractive index of the glass is $\sqrt{3}$.**
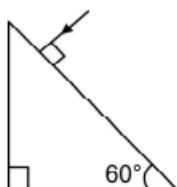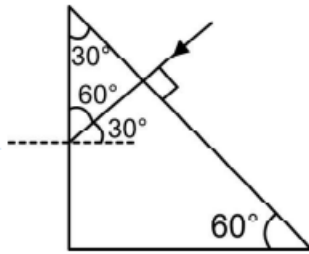


Option A  90°
Option B  60°
Option C  30°

Option D      45°

**Correct Option B**

**Solution:**



$\frac{\sin e}{\sin 30°} = \sqrt{3}$

$\Rightarrow \sin e = \frac{\sqrt{3}}{2}$

$e = 60°$

**Q 6.** A parallel plate capacitor has a uniform electric field ' E ' in the space between the plates. If the distance between the plates is 'd' and the area of each plate is 'A', the energy stored in the capacitor is: ($\varepsilon_0$ = permittivity of free space)

Option A      $\frac{E^2 Ad}{\epsilon_0}$

Option B      $\frac{1}{2}\epsilon_0 E^2$

Option C      $\epsilon_0 E Ad$

Option D      $\frac{1}{2}\epsilon_0 E^2 Ad$

**Correct Option D**

**Solution:**

$Energy\ density, U = \frac{1}{2}\epsilon_0 E^2$

$Total\ energy\ stored, U = u \times (Ad) = \frac{1}{2}\epsilon_0 E^2 Ad$

**Q 7.** A particle is released from height S from the surface of the Earth. At a certain height its kinetic energy is three times its potential energy. The height from the surface of earth and the speed of the particle at that instant are respectively:

Option A      $\frac{S}{4}, \sqrt{\frac{3gS}{2}}$

Option B      $\frac{S}{4}, \frac{3gS}{2}$

Option C      $\frac{S}{4}, \frac{\sqrt{3gS}}{2}$

Option D      $\frac{S}{2}, \frac{\sqrt{3gS}}{2}$

**Correct Option A**

**Solution:**

Conserving energy,

$K + U = mgs \Rightarrow 3U + U = mgs$

$\therefore K = \frac{3mgS}{4}$

$\Rightarrow \frac{1}{2}mv^2 = \frac{3}{4}mgs \Rightarrow v = \sqrt{\frac{3gs}{2}}$

**Q 8.** The velocity of a small ball of mass M and density d, when dropped in a container filled with glycerine becomes constant after some time. If the density of glycerine is $\frac{d}{2}$, then the viscous force acting on the ball will be:

Option A      2Mg

Option B      $\frac{Mg}{2}$

Option C      $Mg$

Option D      $\frac{3}{2}Mg$

**Correct Option B**

**Solution:**

$F_0 + B = Mg$

$\Rightarrow F_0 + \left(\frac{d}{2}\right)\left(\frac{M}{d}\right)g = Mg \Rightarrow F_D = \frac{Mg}{2}$

**Q 9.** The electron concentration in an n-type semiconductor is the same as hole concentration in a p-type semiconductor. An external field (electric) is applied across each of them. Compare the currents in them.

Option A      No current will flow in p-type, current will only flow in n-type.

Option B      $current\ in\ n - type\ =\ current\ in\ p - type.$

Option C      current in p-type > current in n-type.

Option D      current in n-type > current in p-type.

**Correct Option D**

**Solution:**

$I_N$ = Current in N-type semiconductor

= $(\mu_e N_e + \mu_h N_h)eAE$

$I_P$ = Current in P-type semiconductor

= $(\mu_e N_e + \mu_h N_h)eAE$

Now $N_e = N_h$ and $n_e = n_h$

Also, $\mu_e > \mu_h$ and $N_e \gg n_e$, $N_h \gg n_e$

Were,

$N_e$ = electron concentration in N-type

$N_h$ = Hole concentration P-type

& $N_e = N_h$

$n_h$ = hole concentration in N-type

$n_e$ = Electron concentration P- type

$\therefore I_N - I_P = [(\mu_e - \mu_h)N_e + (\mu_h - \mu_e)n_e]eAE$

= $(\mu_e - \mu_h)(N_e - n_e)eAE$

Since, $\mu_e > \mu_h\ and\ N_e > n_e$

From this we can conclude that, $I_N > I_p$

**Q 10.** An infinitely long straight conductor carries a current of 5 A as shown. An electron is moving with a speed of 105m/s parallel to the conductor. The perpendicular distance between the electron and the conductor is 20 cm at an instant. Calculate the magnitude of the force experienced by the electron at that instant.

Electron v = $10^5$ m/s

20 cm

P

5 A    Q
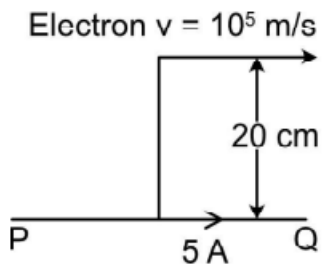
| Option A | $8 \times 10^{-20}$ N |
|---|---|
| Option B | $4 \times 10^{-20}$ N |
| Option C | $8\pi \times 10^{-20}$ N |
| Option D | $4\pi \times 10^{-20}$ N |

**Correct Option A**

**Solution:**

$B = \frac{\mu_0 i}{2\pi r}$

$F = evB = ev \times \frac{\mu_0 i}{2\pi r}$

$= \frac{(1.6 \times 10^{-19}) \times 10^5 \times 4\pi \times 10^{-7} \times 5}{2\pi \times 0.2} N$

$= 1.6 \times 2 \times \frac{5}{2} \times 10^{-20} N$

$\Rightarrow F = 8 \times 10^{-20} N$

**Q 11. An electromagnetic wave of wavelength ' $\lambda$ ' is incident on a photosensitive surface of negligible work function. If 'm' mass is of photoelectron emitted from the surface has de-Broglie wavelength $\lambda_d$, then:**

| Option A | $\lambda = \frac{2h}{mc} \times \lambda_d^2$ |
|---|---|
| Option B | $\lambda = \frac{2m}{hc} \times \lambda_d^2$ |
| Option C | $\lambda_d = \frac{2mc}{h} \times \lambda^2$ |
| Option D | $\lambda = \frac{2mc}{h} \times \lambda_d^2$ |

**Correct Option 4**

**Solution:**

$K_{max} = \frac{hc}{\lambda}$

$\Rightarrow \lambda_d = \frac{h}{p} = h\sqrt{\frac{\lambda}{2mhc}} = \sqrt{\frac{\lambda h}{2mc}}$

$\therefore \lambda = \left(\frac{2mc}{h}\right)\lambda_d^2$

**Q 12. Two charged spherical conductors of radius R1 and R2are connected by a wire. Then the ratio of surface charge densities of the spheres ($\sigma_1 / \sigma_2$) is:**

| Option A | $\frac{R_1^2}{R_2^2}$ |
|---|---|
| Option B | $\frac{R_1}{R_2}$ |
| Option C | $\frac{R_2}{R_1}$ |
| Option D | $\sqrt{\left(\frac{R_1}{R_2}\right)}$ |

**Correct Option C**

**Solution:**

$$\frac{Q_1}{4\pi\epsilon_0 R_1} = \frac{Q_2}{4\pi\epsilon_0 R_2} = V$$

$$\therefore \frac{Q_1}{Q_2} = \frac{R_1}{R_2}$$

$$\therefore \frac{\sigma_1}{\sigma_2} = \frac{Q_1/4\pi R_1^2}{Q_2/4\pi R_2^2} = \frac{Q_1}{Q_2} \times \left(\frac{R_2}{R_1}\right)^2 = \left(\frac{R_1}{R_2}\right)\left(\frac{R_2}{R_1}\right)^2$$

$$\Rightarrow \frac{\sigma_1}{\sigma_2} = \frac{R_2}{R_1}$$

**Q 13. An inductor of inductance L, a capacitor of capacitance C and a resistor of resistance 'R' are connected in series to an ac source of potential difference V volts as shown in figure. Potential difference across L, C and R is 40 V, 10 V and 40 V, respectively. The amplitude of current flowing through LCR series circuit is 10 2 A. The impedance of the circuit is:**
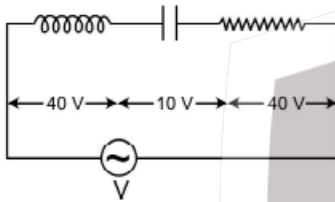


Option A      $5\,\Omega$

Option B      $4\sqrt{2}\,\Omega$

Option C      $\frac{5}{\sqrt{2}}\,\Omega$

Option D      $4\,\Omega$

**Correct Option A**

**Solution:**

Supply voltage, $V = \sqrt{(V_L - V_C)^2 + V_R^2}$

$\Rightarrow V = \sqrt{(40-10)^2 + 40}\,V = 50\,Volt$

Thus, peak values of supply voltage $= 50\sqrt{2}\,Volt$

$\therefore Z = \frac{50\sqrt{2}}{10\sqrt{2}} = 5\,\Omega$

**Q 14. For a plane electromagnetic wave propagating in x direction, which one of the following combinations gives the correct possible directions for electric field (E) and magnetic field (B) respectively?**

Option A      $-\hat{j} + \hat{k}, -\hat{j} + \hat{k}$

Option B      $\hat{j} + \hat{k}, \hat{j} + \hat{k}$

Option C      $-\hat{j} + \hat{k}, -\hat{j} - \hat{k}$

Option D      $\hat{j} + \hat{k}, -\hat{j} - \hat{k}$

**Correct Option C**

**Solution:**

$(\vec{E} \times \vec{B})$ gives the direction of propagation

$\vec{E} = -\hat{j} + \hat{k}, \ \vec{B} = -\hat{j} - \hat{k},$

$$\vec{E} \times \vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & -1 & 1 \\ 0 & -1 & -1 \end{vmatrix} = 2\hat{i}$$

Also $\vec{E}.\vec{B} = (-\hat{j} + \hat{k})(-\hat{j} - \hat{k}) = 0$

**Q 15. Consider the following statements (A) and (B) and identify the correct answer.**
**(A): A Zener diode is connected in reverse bias, when used as a voltage regulator.**
**(B): The potential barrier of p-n junction lies between 0.1 V to 0.3 V**

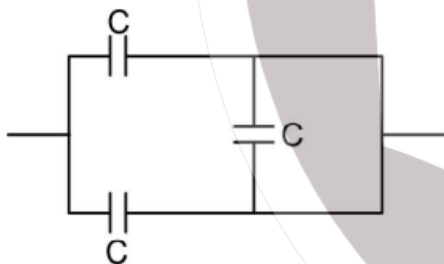| | |
|---|---|
| Option A | (A) is incorrect but (B) is correct. |
| Option B | (A) and (B) both are correct. |
| Option C | (A) and (B) both are incorrect. |
| Option D | (A) is correct and (B) is incorrect. |

**Correct Option D**
**Solution:**
Both (A) and (B) are correct.
For Ge P-N junction, potential barrier is 0.3 volt.

**Q 16. The equivalent capacitance of the combination shown in the figure is :**



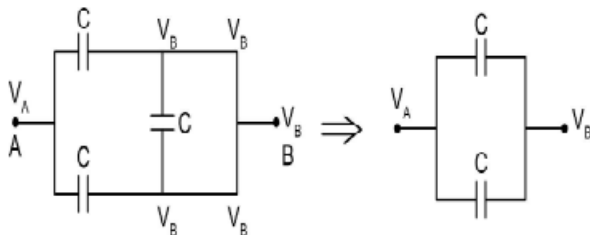| | |
|---|---|
| Option A | 3C/2 |
| Option B | 3C |
| Option C | 2C |
| Option D | C/2 |

**Correct Option C**
**Solution:**



Two capacitors are in parallel combination.
Hence equivalent capacitance $C_{eq} = C_1 + C_2 = C + C = 2C$

**Q 17. A capacitor of capacitance 'C', is connected across an ac source of voltage V, given by $V = V_0 \sin \omega t$.**

**The displacement current between the plates of the capacitor, would then be given by:**

Option A $\qquad I_d = V_0 \omega C \sin \omega t$

Option B $\qquad I_d = V_0 \omega C \cos \omega t$

Option C $\qquad I_d = \frac{V_0}{\omega C} \cos \omega t$

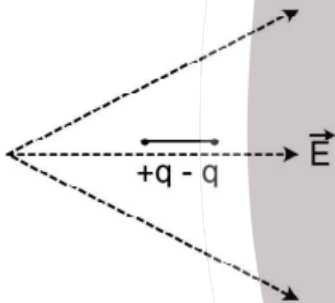Option D $\qquad I_d = \frac{V_0}{\omega C} \sin \omega t$

**Correct Option B**

**Solution:**

The displacement current is given by

$I_d = \frac{CdV}{dt} = C \frac{d}{dt}(V_0 \sin \omega t)$

$I_d = CV_0 \, \omega \cos \omega t = V_0(\omega C) \cos \omega t$

**Q 18. A dipole is placed in an electric field as shown. In which direction will it move?**



Option A $\qquad$ towards the right as its potential energy will increase

Option B $\qquad$ towards the left as its potential energy will increase.

Option C $\qquad$ towards the right as its potential energy will decrease.

Option D $\qquad$ towards the left as its potential energy will decrease.

**Correct Option C**

**Solution:**

**As the electric field will lose its strength in the rightward direction. So, the force on (+q) will be more than the force on (-q).**
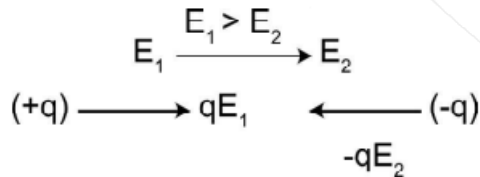


$|\vec{F_1}| > |\vec{F_2}|$

**Q 19. In a potentiometer circuit a cell of EMF 1.5 V gives balance point at 36 cm length of wire. If another cell of EMF 2.5 V replaces the first cell, then at what length of the wire, the balance point occurs?**

Option A $\qquad$ 62 cm

Option B $\qquad$ 60 cm

Option C $\qquad$ 21.6 cm

Option D $\qquad$ 64 cm

**Correct Option B**

**Solution:**

$$Potential\ gradient = \frac{1.5}{36}$$

$$\therefore \frac{25}{I_2} = \frac{1.5}{36}$$

$$\Rightarrow I_2 = \frac{36 \times 2.5}{1.5} = 60\ cm$$

**Q 20.** The number of photons per second on an average emitted by the source of monochromatic light of wavelength 600 nm, when it delivers the power of $3.3 \times 10^{-3}$ watt will be: ( $h \approx 6.6 \times 10^{-34}$ Js)

Option A      $10^{15}$

Option B      $10^{18}$

Option C      $10^{17}$

Option D      $10^{16}$

**Correct Option D**

**Solution:**

The number of protons delivered per second is given by

$$\frac{n}{t} = \frac{IA\lambda}{hc} = \frac{P\lambda}{hc} \Rightarrow \frac{n}{t} = \frac{3.3 \times 10^{-3} \times 600 \times 10^{-9}}{3 \times 10^8 \times 6.6 \times 10^{-34}}$$

$$\frac{n}{t} = 10^{16}$$

**Q 21.** A small block slides down on a smooth inclined plane, **starting from rest at time t=0.** Let Sn be the distance travelled by the block in the interval t= n - 1 to t = n. Then, the ratio $\frac{S_n}{S_{n+1}}$ is:

Option A      $\frac{2n}{2n-1}$

Option B      $\frac{2n-1}{2n}$

Option C      $\frac{2n-1}{2n+1}$

Option D      $\frac{2n+1}{2n-1}$

**Correct Option C**

**Solution:**

$$S_n = 0 + \frac{1}{2}a(2n-1)$$

$$S_{n+1} = 0 + \frac{1}{2}a(2(n+1)-1)$$

$$= \frac{1}{2}a(2n+1)$$

$$\frac{S_n}{S_{n+1}} = \frac{(2n-1)}{(2n+1)}$$

**Q 22.** A screw gauge gives the following readings when used to measure the diameter of a wire

**Main scale reading: 0 mm**

Circular scale reading: 52 divisions

Given that 1 mm on main scale corresponds to 100divisions on the circular scale. The diameter of the wire from the above data is:

Option A      0.052 cm

Option B      0.52 cm

Option C      0.026 cm

Option D      0.26 cm

**Correct Option B**

**Solution:**

$Least\ count = \dfrac{1}{100} = 0.01\ mm$

Diameter of the wire = CSR × LC

= 52 × 0.01 mm

= 0.52 mm
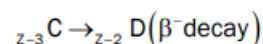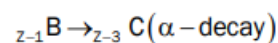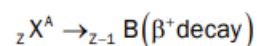
d = 0.052 cm

**Q 23.** A radioactive nucleus $_{Z}^{A}X$ undergoes spontaneous decay in the sequence $_{Z}^{A}X \rightarrow_{Z-1} B \rightarrow_{Z-3} C \rightarrow_{Z-2} D$ , where Z is the atomic number of element X. The possible decay particles in the sequence are:

Option A      $\beta^-$, $\alpha$, $\beta^+$

Option B      $\alpha$, $\beta^-$, $\beta^+$

Option C      $\alpha$, $\beta^+$, $\beta^-$

Option D      $\beta^+$, $\alpha$, $\beta^-$

**Correct Option D**

**Solution:**

$_{Z}X^{A} \rightarrow_{Z-1} B\left(\beta^+ decay\right)$

$_{Z-1}B \rightarrow_{Z-3} C\left(\alpha - decay\right)$

$_{Z-3}C \rightarrow_{Z-2} D\left(\beta^- decay\right)$

**Q 24.** A lens of large focal length and large aperture is best suited as an objective of an astronomical telescope since:

Option A      a large aperture contributes to the quality and visibility of the images.

Option B      a large area of the objective ensures better light gathering power.

Option C      a large aperture provides a better resolution.
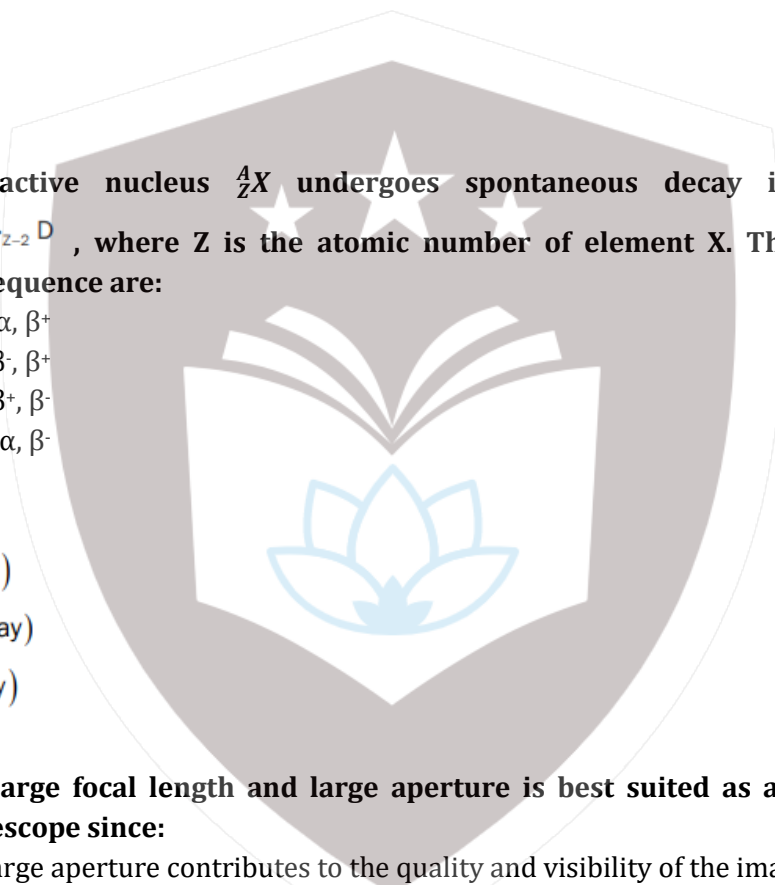
Option D      all of the above.

**Correct Option D**

**Solution:**

All of the above

**Q 25.** A body is executing simple harmonic motion with frequency 'n', the frequency of its potential energy is:

Option A      4n.

Option B      n

Option C      2n

Option D      3n

**Correct Option C**

**Solution:**

Potential energy of a particle executing SHM is given by $U = \frac{1}{2}m\omega^2 x^2$.

So, if the frequency of oscillation is n, then frequency of its potential energy will be 2n.

**Q 26. The half-life of a radioactive nuclide is 100 hours. The fraction of original activity that will remain after 150 hours would be:**

Option A      $\frac{2}{3\sqrt{2}}$

Option B      $1/2$

Option C      $\frac{1}{2\sqrt{2}}$

Option D      $2/3$

**Correct Option C**

**Solution:**

$$A = \frac{A_0}{2^{t/T_{1/2}}} \Rightarrow \frac{A}{A_0} = 2^{-t/T_{1/2}} = 2^{-\frac{150}{100}} = 2^{-3/2} = \frac{1}{2\sqrt{2}}$$

**Q 27. Match Column - I and Column - II and choose the correct match from the given choices.**

| List-I | List – II |
|---|---|
| (A) Root mean square speed of gas molecules | (P) $\frac{1}{3}nmv^{-2}$ |
| (B) Pressure exerted by ideal gas | (Q) $\sqrt{\frac{3RT}{M}}$ |
| (C) Average kinetic energy of a molecule | (R) $\frac{5}{2}RT$ |
| (D) Total internal energy of 1 mole of a diatomic gas | (S) $\frac{3}{2}k_BT$ |

Option A      (A) - (R), (B) - (Q),(C) - (P),(D) - (S),

Option B      (A) - (R), (B) - (P),(C) - (S),(D) - (Q),

Option C      (A) - (Q), (B) - (R),(C) - (S),(D) - (P),

Option D      (A) - (Q), (B) - (P),(C) - (S),(D) - (R),

**Correct Option D**

**Solution:**

$A \rightarrow Q$

$B \rightarrow P$

$C \rightarrow S$

$D \rightarrow R$

**Q 28. If force [F], acceleration [A] and time [T] are chosen as the fundamental physical quantities. Find the dimensions of energy.**

Option A      [F] [A$^{-1}$] [T]

Option B      [F] [A] [T]

Option C      [F] [A] [T$^2$]

Option D      [F] [A] [T$^{-1}$]

**Correct Option C**

**Solution:**

$$\text{Energy} = F.S = F\frac{S}{T^2}T^2 = \left[FAT^2\right]$$

**Q 29.** Water falls from a height of 60 m at the rate of 15 kg/s to operate a turbine. The losses due to frictional force are 10% of the input energy. How much power is generated by the turbine? (g = 10 m/s²)

| | |
|---|---|
| Option A | 7.0 kW |
| Option B | 10.2 kW |
| Option C | 8.1 kW |
| Option D | 12.3 kW |

**Correct Option C**

**Solution:**

Energy imparted to the turbine per unit time= mgh
= 15 × 10 × 60 = 9000 J/s.
10% loss = 900 J/s
Power to the turbine = (9000 - 900) = 8100 J/s
P = 8.1 kW

**Q 30.** The effective resistance of a parallel connection that consists of four wires of equal length, equal area of cross-section and same material is 0.25 $\Omega$ . What will be the effective resistance if they are connected in series?

| | |
|---|---|
| Option A | 4 $\Omega$ |
| Option B | 0.25 $\Omega$ |
| Option C | 0.5 $\Omega$ |
| Option D | 1 $\Omega$ |

**Correct Option A**

**Solution:**

If the wires are connected in parallel then

$R_{eq} = R/4 = 0.25$

$\Rightarrow R = 1\Omega$

So, after they are connected in series

$R_{eq} = 4R = 4\Omega$

**Q 31.** Column - I gives certain physical terms associated with flow of current through a metallic conductor.
Column-II gives some mathematical relations involving electrical quantities.
Match Column-I and Column-II with appropriate relations.

| Column- I | Column – II |
|---|---|
| A) Drift Velocity | P) $\dfrac{m}{ne^2\rho}$ |
| B) Electrical Resistivity | Q) $nev_d$ |
| C) Relaxation Period | R) $\dfrac{eE}{m}\tau$ |
| D) Current Density | S) $\dfrac{E}{j}$ |

Option A      (A) – (R), (B) – (Q), (C) – (S), (D) – (P)
Option B      (A) – (R), (B) – (S), (C) – (P), (D) – (Q)
Option C      (A) – (R), (B) – (S), (C) – (Q), (D) – (P)
Option D      (A) – (R), (B) – (P), (C) – (S), (D) – (Q)
**Correct Option B**
**Solution:**

$j = nev_d = \sigma E$
$\sigma = j/E \Rightarrow \rho = E/j$
$(A) \rightarrow (R)$
$(B) \rightarrow (S)$
$(C) \rightarrow (P)$
$(D) \rightarrow (Q)$

**Q 32. A nucleus with mass number 240 breaks into two fragments each of mass number 120, the binding energy per nucleon of unframented nuclei is 7.6 MeV while that of fragments is 8.5 MeV. The total gain in the Binding Energy in the process is:**

Option A      216 MeV
Option B      0.9 MeV
Option C      9.4 MeV
Option D      804 MeV
**Correct Option A**
**Solution:**
Final total binding energy
= 2 × 8.5 × 120 MeV = 2040 MeV
Initial total binding energy
= 240 × 7.6 MeV = 1824 MeV
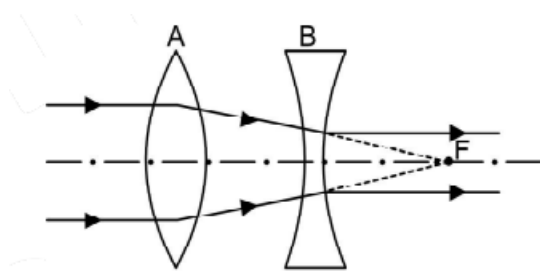Gain = (2040 - 1824) MeV = 216 MeV

**Q 33. A convex lens 'A' of focal length 20 cm and a concave lens 'B' of focal length 5 cm are kept along the same axis with a distance 'd' between them. If a parallel beam of light falling on 'A' leaves 'B' as a parallel beam, then the distance 'd' in cm will be:**
Option A      30
Option B      25
Option C      15
Option D      50

**Correct Option C**
**Solution:**



Point F is the second focal length of A and first focal length of B.
d = 20 – 5 cm = 15 cm

**Q 34. A spring is stretched by 5 cm by a force 10 N. The time period of the oscillations when a mass of 2 kg is suspended by it is:**

Option A       0.629 s
Option B       0.0628 s
Option C       6.28 s
Option D       3.14 s
**Correct Option A**
**Solution:**

$$K = \frac{10}{5 \times 10^{-2}} N/m = 200 \ N/m$$

$$\therefore T = 2\pi\sqrt{\frac{m}{K}} = 2\pi\sqrt{\frac{2}{200}} s = \frac{\pi}{5} s$$

T = 0.628 s

**Q 35. If E and G respectively denote energy and gravitational constant, then $\frac{E}{G}$ has the dimensions of:**

Option A       $\left[ M^2 \right]\left[ L^{-2} \right]\left[ T^{-1} \right]$

Option B       $\left[ M^2 \right]\left[ L^{-1} \right]\left[ T^{0} \right]$

Option C       $\left[ M \right]\left[ L^{-1} \right]\left[ T^{-1} \right]$

Option D       $\left[ M \right]\left[ L^{0} \right]\left[ T^{0} \right]$

**Correct Option B**
**Solution:**

$$[E] = ML^2T^{-2}$$

$$[G] = \frac{\left[ Fr^2 \right]}{[m_1 m_2]} = \left[ \frac{MLT^{-2}L^2}{M^2} \right] = M^{-1}L^3T^{-2}$$

$$\therefore \left[ \frac{E}{G} \right] = \frac{ML^2T^{-2}}{M^{-1}L^3T^{-2}} = \left[ M^2L^{-1}T^0 \right]$$

**Q 36. Twenty-seven drops of same size are charged at 220 V each. They combine to form a bigger drop. Calculate the potential of the bigger drop.**

Option A        1980 V

Option B        660 V

Option C        1320 V

Option D        1520 V

**Correct Option A**

**Solution:**

If each drop has a charge 'q' and radius 'r'.

Then from conservation of charge, charge on the big drop is $nq = 27\,q$ $(n = 27)$

from conservation of volume $\frac{4}{3}\pi r^3 n = \frac{4}{3}\pi R^3$

$R = n^{1/3}\,r$

Now potential of the small drop $V = \dfrac{q}{4\pi\,\epsilon_0\,r} = 220\,V$

Potential of the big drop,

$V = \dfrac{nq}{4\pi\,\epsilon_0\,R} = \dfrac{nq}{4\pi\,\epsilon_0\,n^{1/3}r} = n^{2/3}\dfrac{q}{4\pi\,\epsilon_0\,r}$

$V = (27)^{2/3} \times 220\,V$

$= 9 \times 220 = 1980\,V$

**Q 37. A particle moving in a circle of radius R with a uniform speed takes a time T to complete one revolution. If this particle were projected with the same speed at an angle 'θ' to the horizontal, the maximum height attained by it equals 4R. The angle of projection, θ, is then given by:**

Option A
$$\theta = \sin^{-1}\left(\frac{2gT^2}{\pi^2 R}\right)^{\!1/2}$$

Option B
$$\theta = \cos^{-1}\left(\frac{gT^2}{\pi^2 R}\right)^{\!1/2}$$

Option C
$$\theta = \cos^{-1}\left(\frac{\pi^2 R}{gT^2}\right)^{\!1/2}$$

Option D
$$\theta = \sin^{-1}\left(\frac{\pi^2 R}{gT^2}\right)^{\!1/2}$$

**Correct Option A**

**Solution:**

Velocity of the particle $v = \dfrac{2\pi R}{T}$

When projected at angle $\theta$

$H = \text{maximum height} = \dfrac{v^2 \sin^2 \theta}{2g} = 4R$

$= \dfrac{4\pi^2 R^2}{T^2} \dfrac{\sin^2 \theta}{2g} = 4R$

$\sin^2 \theta = \dfrac{2gRT^2}{\pi^2 R^2}$

$\sin^2 \theta = \dfrac{2gT^2}{\pi^2 R}$

$\sin\theta = \left( \dfrac{2gT^2}{\pi^2 R} \right)^{1/2}$

$\theta = \sin^{-1} \left( \dfrac{2gT^2}{\pi^2 R} \right)^{1/2}$

**Q 38. From a circular ring of mass 'M' and radius 'R' an arc corresponding to a 90° sector is removed. The moment of inertia of the remaining part of the ring about an axis passing through the centre of the ring and perpendicular to the plane of the ring is 'K' times 'MR²'. Then the value of 'K' is:**

Option A $\quad \dfrac{1}{8}$

Option B $\quad \dfrac{3}{4}$

Option C $\quad \dfrac{7}{8}$

Option D $\quad \dfrac{1}{4}$

**Correct Option B**

**Solution:**

If 90° arc is removed, remaining part is 270° and mass of the remaining part is 3/4 M and moment of inertia is

$\dfrac{3}{4} MR^2 = KMR^2$

$K = \dfrac{3}{4}$

**Q 39. A uniform conducting wire of length 12a and resistance 'R' is wound up as a current carrying coil in the shape of,**
**(i)  an equilateral triangle of side 'a'.**
**(ii) a square of side 'a'.**
**The magnetic dipole moments of the coil in each case respectively are:**

Option A $\qquad 4\,Ia^2 \text{ and } 3\,Ia^2$

Option B $\qquad \sqrt{3}\,Ia^2 \text{ and } 3\,Ia^2$

Option C      $3Ia^2$ and $Ia^2$

Option D      $3Ia^2$ and $4Ia^2$

**Correct Option B**

**Solution:**

(i) If it is an equilateral triangle of side 'a' no. of triangular

loops formed $\dfrac{12a}{3a} = 4$

and magnetic moment $4.\dfrac{\sqrt{3}a^2}{4}I = \sqrt{3}\,Ia^2$

(ii) Side of the square if it is a.

No. of square formed $\dfrac{12a}{4a} = 3$

Magnetic moment of the square loop is $3a^2I$.

★ ★ ★

**Q 40. Two conducting circular loops of radii R1 and R2 are placed in the same plane with their centers coinciding. If $R_1 \gg R_2$, the mutual inductance M between them will be directly proportional to:**
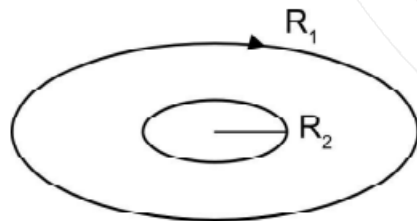
Option A      $\dfrac{R_2^2}{R_1}$

Option B      $\dfrac{R_1}{R_2}$

Option C      $\dfrac{R_2}{R_1}$

Option D      $\dfrac{R_1^2}{R_2}$

**Correct Option A**

**Solution:**



Magnetic field due to $R_1$ at the center.

$$B = \frac{\mu_0 i}{2R_1}$$

Flux linked with $R_2$

$$\phi = BA_2 = \frac{\mu_0 i}{2R_1} \times \pi R_2^2 = Mi$$

$$M = \frac{\mu_0 \pi R_2^2}{2R_1}$$

$$M \propto \frac{R_2^2}{R_1}$$

**Q 41. A particle of mass 'm' is projected with a velocity $V = kV_B (k < 1)$ from the surface of the earth. ($V_e$= escape velocity) The maximum height above the surface reached by the particle is:**

Option A      $\frac{Rk^2}{1-k^2}$

Option B      $R\left(\frac{k}{1-k}\right)^2$

Option C      $R\left(\frac{k}{1+k}\right)^2$

Option D      $\frac{R^2 k}{1+k}$

**Correct Option A**

**Solution:**

As the particle is projected with a velocity less than escape velocity, it will go to a maximum height and come back.

From conservation of energy

$$\frac{mgRh}{R+h} = \frac{1}{2}m(kV_e)^2$$

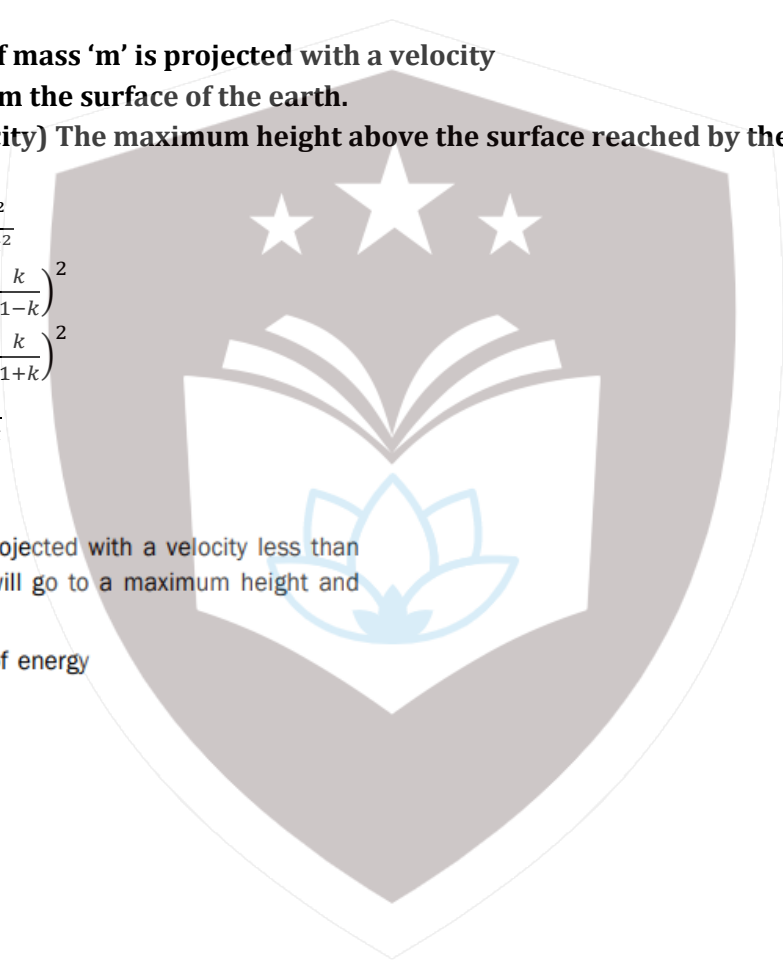$$\frac{2gRh}{R+h} = k^2(2gR)$$

$$\frac{h}{R+h} = k^2$$

$$\frac{R+h}{h} = \frac{1}{k^2}$$

$$\frac{R}{h} + 1 = \frac{1}{k^2}$$

$$\frac{R}{h} = \frac{1}{k^2} - 1$$

$$h = \frac{Rk^2}{1-k^2}$$

**Q 42. A step-down transformer connected to an ac mains supply of 220 V is made to operate at 11 V, 44 W lamp. Ignoring power losses in the transformer, what is the current in the primary circuit?**

Option A    4 A

Option B    0.2 A

Option C    0.4 A

Option D    2 A

**Correct Option B**

**Solution:**

$V_p = 220\,V$        $V_s = 11\,V$        $P = 44\,W$
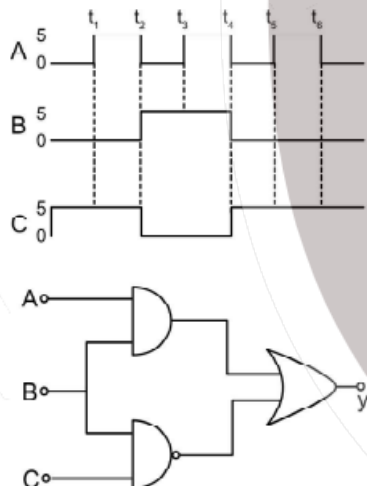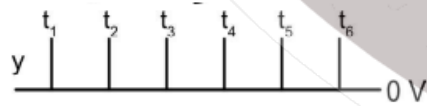
As it is an ideal transformer

$V_p i_p = V_s i_s = 44\,W$

$220 \times i_p = 44$

$i_p = \dfrac{44}{220} = \dfrac{1}{5} = 0.2\,A$

**Q 43. For the given circuit, the input digital signals are applied at the terminals A, B and C. What would be the output at the terminal y?**
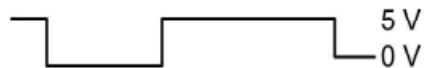


Option A

Option B

Option C

Option D

**Correct Option C**

**Solution:**

The logic operation

$$Y = AB + \overline{BC}$$
$$= AB + \overline{B} + \overline{C}$$

Now input

| A | B | C | Y |
|---|---|---|---|
| 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 1 |
| 0 | 1 | 0 | 1 |
| 1 | 1 | 0 | 1 |

**Q 44. A ball of mass 0.15 kg is dropped from a height 10 m, strikes the ground and rebounds to the same height. The magnitude of impulse imparted to the ball is (g =10 m/s²) nearly:**

Option A      1.4 kg m/s

Option B      0 kg m/s

Option C      4.2 kg m/s

Option D      2.1 kg m/s

**Correct Option B**

**Solution:**

Velocity while hitting the ground

$$v = \sqrt{2 \times 10 \times 10} = 10\sqrt{2}$$

As it goes to the same height it will return with same speed.

So change in velocity v-(-v) = 2v

Change in momentum or impulse

= 2mv

$$= 2 \times 0.15 \times 10\sqrt{2} = 3\sqrt{2} = 4.2 \text{ kg m/s}$$

**Q 45. A car starts from rest and accelerates at 5 m/s². At t =4 s, a ball is dropped out of a window by a person sitting in the car. What is the velocity and acceleration of the ball at t = 6 s?**

(Take, g = 10 m/s²)

Option A      $20\sqrt{2} \, m/s, 10 \, m/s^2$

Option B      $20 \, m/s, 5 \, m/s^2$

Option C      $20 \, m/s, 0 \, m/s^2$

Option D      $20\sqrt{2} \, m/s, 0 \, m/s^2$

**Correct Option A**

**Solution:**

Velocity of the car at t = 4 sec is

$V_x = at = 4 \times 5 = 20$ m/s

So horizontal velocity = 20 m/s (remain constant)

Vertical velocity at t = 6 sec

i.e. after 2 sec of free fall

$V_y = gt = 20$ m/s

So net velocity $= \sqrt{20^2 + 20^2} = 20\sqrt{2}$ m/s

and once it starts falling acceleration is only 'g'

i.e., 10 m/s$^2$

**Q 46. A point object is placed at a distance of 60 cm from a convex lens of focal length 30 cm. If a plane mirror were put perpendicular to the principal axis of the lens and at a distance of 40 cm from it, the final image would be formed at a distance of:**
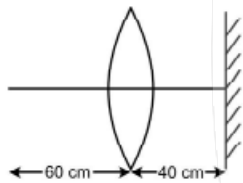


| Option A | 20 cm from the plane mirror, it would be a virtual image |
| Option B | 20 cm from the lens, it would be a real image. |
| Option C | 30 cm from the lens, it would be a real image. |
| Option D | 30 cm from the plane mirror, it would be a virtual image. |

**Correct Option A**

**Solution:**

Final refracted rays

Position of the image formed by lens.

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

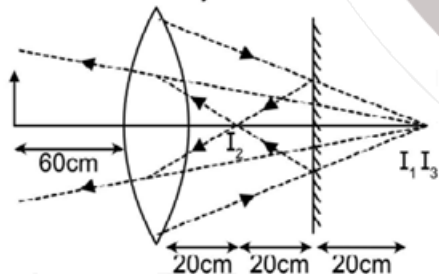$$\frac{1}{v} + \frac{1}{60} = \frac{1}{30}$$

$$\frac{1}{v} = \frac{1}{30} - \frac{1}{60} = \frac{1}{60}$$

v = 60 cm

So, position of the image is (60 - 40) = 20 cm behind the plane mirror, it acts as a virtual object. So final image is a real image 20 cm from the plane mirror.

This real image will act as an object for the lens and final image is

$$\frac{1}{v} + \frac{1}{20} = \frac{1}{30}$$

$$\frac{1}{v} = \frac{-1}{60}$$

v = −60cm from lens

i.e., 20 cm behind the plane mirror.

## Q 47.
In the product

$$\vec{F} = q(\vec{v} \times \vec{B}) = q\vec{v} \times (B\hat{i} + B\hat{j} + B_0\hat{k})$$

For q = 1 and $\vec{v} = 2\hat{i} + 4\hat{j} + 6\hat{k}$ and $\vec{F} = 4\hat{i} - 20\hat{j} + 12\hat{k}$

What will be the complete expression for $\vec{B}$ ?
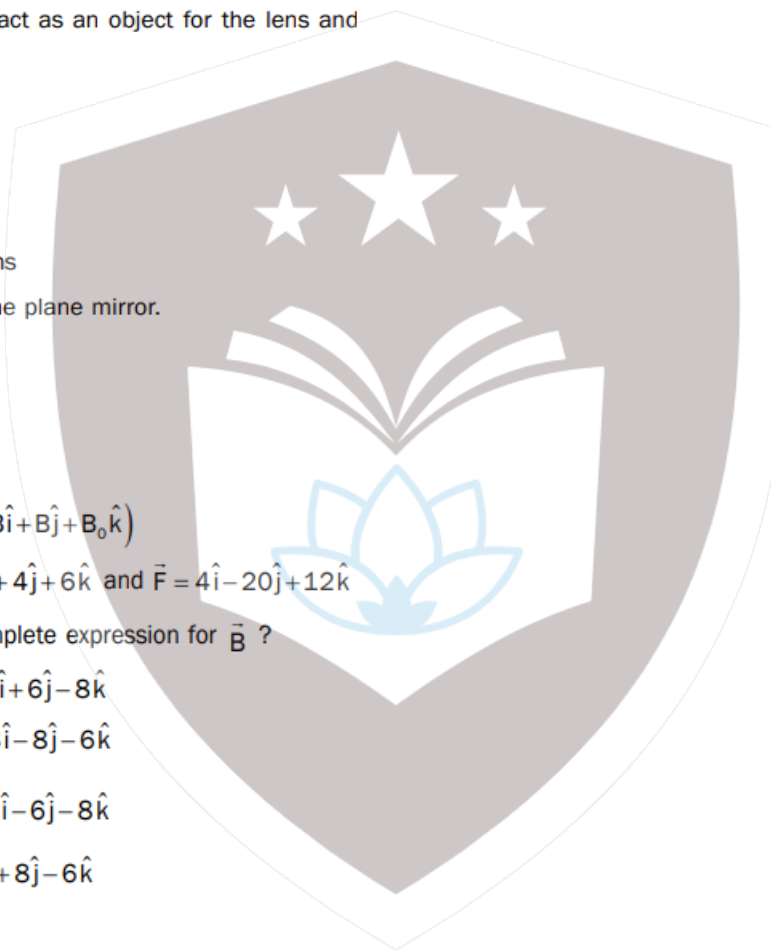
Option A  $6\hat{i} + 6\hat{j} - 8\hat{k}$

Option B  $-8\hat{i} - 8\hat{j} - 6\hat{k}$

Option C  $-6\hat{i} - 6\hat{j} - 8\hat{k}$

Option D  $8\hat{i} + 8\hat{j} - 6\hat{k}$

**Correct Option C**
**Solution:**

$$\vec{F} = q(\vec{V} \times \vec{B})$$

$$\vec{F}.\vec{B} = 0$$

$$\vec{V} \times \vec{B} = \hat{i}[4B_0 - 6B] + \hat{j}[6B - 2B_0] + \hat{k}[2B - 4B]$$

$$= \hat{i}[4B_0 - 6B] + \hat{j}(6B - 2B_0) - \hat{k}(2B)$$

$$4B_0 - 6B = 4 \qquad \qquad ...(1)$$

$$6B - 2B_0 = -20 \qquad \qquad ...(2)$$

$$-2B = 12 \qquad \qquad ...(3)$$

Solving (1), (2) and (3) we get

$$B = -6 \text{ and } B_0 = -8$$

**Q 48. A series LCR circuit containing 5.0 H inductor, 80 µF capacitor and 40 Ω resistor is connected to 230 V variable frequency ac sources. The angular frequencies of the source at which power transferred to the circuit is half the power at the resonant angular frequency are likely to be :**

Option A      42 rad/s and 58 rad/s

Option B      25 rad/s and 75 rad/s

Option C      50 rad/s and 25 rad/s

Option D      46 rad/s and 54 rad/s

**Correct Option D**

**Solution:**

$$\omega_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{5 \times 80 \times 10^{-6}}}$$

$$= \frac{1}{\sqrt{4 \times 10^{-4}}} = \frac{10^2}{2} = 50$$

Half power frequency band width is $\dfrac{R}{L}$

$$= \frac{40}{5} = 8$$

Half power frequencies

50 - 4 = 46 Hz and 50 + 4 = 54 Hz

**Q 49. Three resistors having resistances $r_1$, $r_2$ and $r_3$ are connected as shown in the given circuit. The ratio $\dfrac{i_3}{i_1}$ of currents in terms of resistances used in the circuit is:**
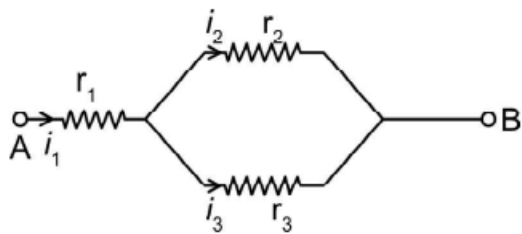
Option A $\quad \dfrac{r_2}{r_1+r_3}$

Option B $\quad \dfrac{r_1}{r_2+r_3}$

Option C $\quad \dfrac{r_2}{r_2+r_3}$

Option D $\quad \dfrac{r_1}{r_1+r_2}$

**Correct Option C**

**Solution:**

$$\frac{i_2}{i_3}=\frac{r_3}{r_2} \quad \text{and} \quad i_2+i_3=i_1$$

$$\frac{i_2}{i_3}+1=\frac{r_3+r_2}{r_2}$$

$$\frac{i_2+i_3}{i_3}=\frac{r_2+r_3}{r_2}$$

$$\frac{i_1}{i_3}=\frac{r_2+r_3}{r_2}$$

$$\frac{i_3}{i_1}=\frac{r_2}{r_2+r_3}$$

**Q 50.** A uniform rod of length 200 cm and mass 500 g is balanced on a wedge placed at 40 cm mark. A mass of 2 kg is suspended from the rod at 20 cm and another unknown mass 'm' is suspended from the rod at 160 cm mark as shown in the figure. Find the value of 'm' such that the rod is in equilibrium. (g = 10 m/s²)
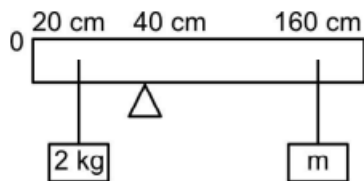


Option A $\quad \dfrac{1}{12}\, kg$

Option B $\quad \dfrac{1}{2}\, kg$

Option C $\quad \dfrac{1}{3}\, kg$

Option D $\quad \dfrac{1}{6}\, kg$

**Correct Option A**
**Solution:**
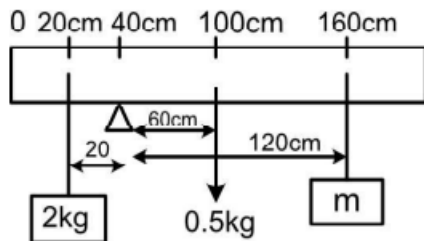


From principle of moments

$2 \times 20 = 0.5 \times 60 + m \times 120$

$2 = 1.5 + 6m$

$0.5 = 6m$

$m = \dfrac{1}{12} kg$

# CHEMISTRY

**Q 51. Dihedral angle of least stable conformer of ethane is :**

Option A      $0°$

Option B      $120°$

Option C      $180°$

Option D      $60°$

**Correct Option A**

**Solution: Eclipsed conformer is highly unstable Dihedral angle is zero**
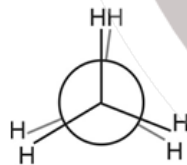


**Q 52. The structures of beryllium chloride in solid state and vapour phase, are:**

Option A      Chain in both

Option B      Chain and dimer, respectively

Option C      Linear in both

Option D      Dimer and Linear, respectively

**Correct Option B**

**Solution: Beryllium chloride has chain structure in solid state. Vapour phase forms chlorobridged dimer.**

(Solid)


(Vapour)
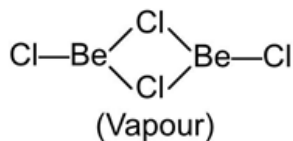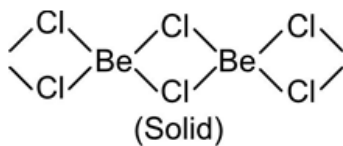
**Q 53. Identify the compound that will react with Hinsberg's reagent to give a solid which dissolves in alkali**

Option A

Option B

Option C

Option D



**Correct Option D**

**Solution:**

**1° amines react with Hingsberg's reagent to give a solid, which dissolve in alkali.**

**Q 54. The molar conductance of NaCl, HCl and CH₃COONa at infinite dilution are 126.45, 426.16 and 91.0 Scm²mol⁻¹ respectively. The molar conductance of CH₃COOH at infinite dilution is. Choose the right option for your answer**

Option A      540.48 Scm²mol⁻¹

Option B      201.28 Scm²mol⁻¹

Option C      390.71 Scm²mol⁻¹

Option D      698.28 Scm²mol⁻¹

**Correct Option C**

**Solution:**

$$\Lambda^{\infty}_{CH_3COOH} = \left[ \Lambda^{\infty}_{CH_3COONa} + \Lambda^{\infty}_{HCl} \right] - \left[ \Lambda^{\infty}_{NaCl} \right]$$

$$\Lambda^{\infty}_{CH_3COOH} = (91 + 426.16) - (126.45) = 390.71 \ ohm^{-1}cm^2mol^{-1}$$

**Q 55. Right option for the number of tetrahedral and octahedral voids in hexagonal primitive unit cell are**

Option A      12, 6

Option B      8, 4

Option C      6, 12

Option D      2, 1

**Correct Option A**

**Solution:**

Number of tetrahedral voids = 2N
Number of octahedral voids = N
N = effective atoms
for Hexagonal effective atoms = 6
Tetrahedral voids = 2 × 6 = 12
Octahedral voids = 6

**Q 56. Tritium, a radioactive isotope of hydrogen, emits which of the following particles?**

Option A        Neutron (n)
Option B        Beta (β)
Option C        Alpha(α)
Option D        Gamma(γ)

**Correct Option B**

Solution: Tritium isotope of hydrogen is radioactive and emits low energy β− particles.

**Q 57. An organic compound contains 78% (by wt.) carbon and remaining percentage of hydrogen. The right option for the empirical formula of this compound is : [Atomic wt. of C is 12, H is 1]**

Option A        $CH_4$
Option B        $CH$
Option C        $CH_2$
Option D        $CH_3$

**Correct Option D**

**Solution:**

| Element | % | At.weight | $\frac{\%}{At.weight}$ | simplest ratio |
|---------|-----|-----------|------------------------|----------------|
| C | 78 | 12 | 6.5 | 1 |
| H | 22 | 1 | 22 | = 3 |

Empirical formula of this compound is $CH_3$

**Q 58. What is the IUPAC name of the organic compound formed in the following chemical reaction?**

$$Acetone \xrightarrow[H_2O, H^+]{C_2H_5MgBr . dryether} product$$
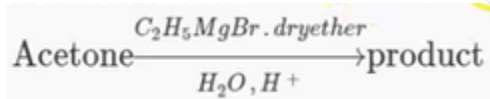
Option A        2-methyl butan-2-ol
Option B        2-methyl propan-2-ol
Option C        pentan-2-ol
Option D        pentan-3-ol

**Correct Option A**

**Solution:**

$$CH_3-\overset{\overset{O}{\|}}{C}-CH_3 \xrightarrow[H_2O/H^+]{C_2H_5MgBr} CH_3-\overset{\overset{OH}{|}}{\underset{\underset{CH_3}{|}}{C}}-C_2H_5$$
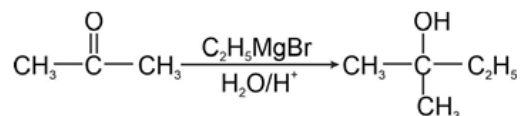
**Q 59. Choose the correct option for graphical representation of Boyle's law, which shows a graph of pressure vs. volume of a gas at different temperatures**

Option A
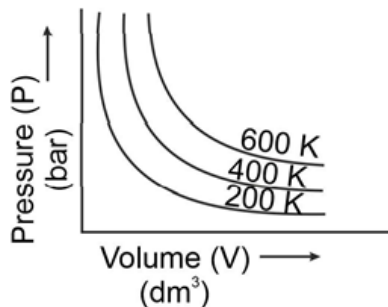


Option B
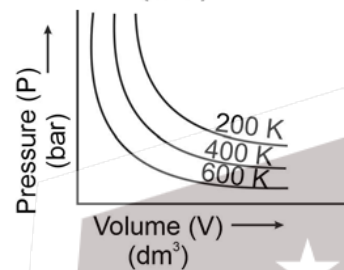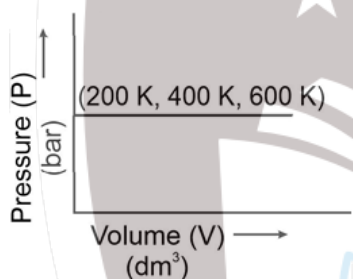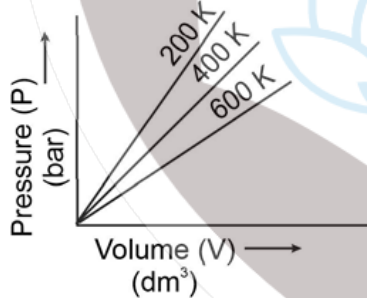


Option C



Option D



**Correct Option A**

**Solution:**

$$P \propto \frac{1}{V}$$

at constant temperature $PV = K$

Greater the temperature greater the magnitude of PV

**Q 60 . The correct structure of 2,6-Dimethyl-dec-4-ene is:**

Option A
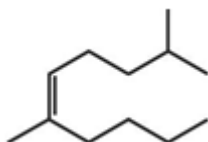
Option B
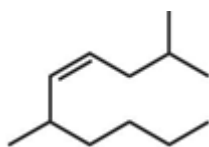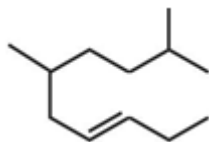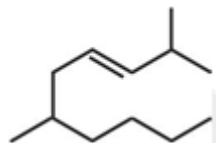


Option C



Option D



**Correct Option B**
**Solution:**
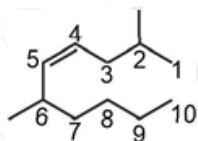


**Q 61. Match List - I with List - II**

| List-I | List-II | |
|---|---|---|
| (a) $PCl_5$ | (i) | Square pyramidal |
| (b) $SF_6$ | (ii) | Trigonal planar |
| (c) $BrF_5$ | (iii) | Octahedral |
| (d) $BF_3$ | (iv) | Trigonal bipyramidal |

**Choose the correct answer from the options given below**

| | | a | b | c | d |
|---|---|---|---|---|---|
| Option | A | iv | iii | ii | I |
| Option | B | Iv | iii | i | ii |
| Option | C | ii | iii | iv | I |
| Option | D | iii | i | iv | ii |

**Correct Option B**
**Solution:**

$PCl_5$ - Trigonal bipyramidal (5 bond pairs)

$SF_6$ - Octahedral (6 bond pairs)

$BrF_5$ - Square pyramidal (5 bond pairs + 1 lone pair)

$BF_3$ - Trigonal planar (3 bond pairs)

**Q 62. The maximum temperature that can be achieved in blast furnace is:**

Option A  upto 5000 K

Option B  upto 1200 K

Option C  upto 2200 K

Option D  upto 1900 K

**Correct Option C**

Solution: Temperature about 2200 K. This temperature is attained at the bottom near tuyers.

**Q 63. Which one among the following is the correct option for right relationship between Cp and CV for one mole of ideal gas?**

Option A        $C_V = RC_P$

Option B        $C_P + C_V = R$

Option C        $C_P - C_V = R$

Option D        $C_P = RC_V$

**Correct Option C**

**Solution:** For one mole of an ideal gas $C_p - C_v = R$.

**Q 64. Statement I :  Acid strength increases in the order given as HF << HCl << HBr << HI**

**Statement II:    As the size of the elements F, Cl, Br, I increases down the group, the bond strength of HF, HCl, HBr and HI decreases and so the acid strength increases.**

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

Option A        Statement I is incorrect but Statement II is true

Option B        Both Statement I and Statement II are true

Option C        Both Statement I and Statement II are false

Option D        Statement I is correct but Statement II is false

**Correct Option B**

**Solution:** Down the group acidic strength increases as bond length increases and bond strength decreases due to which ease of release of H+ increases. Acidic strength increases.

**Q 65. The right option for the statement "Tyndall effect is exhibited by" is**

Option A        Urea solution

Option B        NaCl Solution

Option C        Glucose Solution

Option D        Starch Solution

**Correct Option D**

**Solution:** Colloidal sol shows Tyndall effect. Starch is a colloid

**Q 66. The correct option for the number of body centred unit cells in all 14 types of Bravais lattice unit cells is:**

Option A        3

Option B        7

Option C        5

Option D        2

**Correct Option A**

**Solution:**  The number of Body centred unit cells in all 14 types of Bravais lattice unit cells is 3.

**Q 67. Which of the following reactions is the metal displacement reaction? Choose the right option.**

| | |
|---|---|
| Option A | $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2\uparrow$ |
| Option B | $2KClO_3 \xrightarrow{\Delta} 2KCl + 3O_2$ |
| Option C | |
| Option D | $Cr_2O_3 + 2Al \xrightarrow{\Delta} Al_2O_3 + 2Cr$ |
| | $Fe + 2HCl \rightarrow FeCl_2 + H_2\uparrow$ |

**Correct Option C**

**Solution:**

More electropositive element displaces less electropositive metal.

**Q 68. For a reaction A $\rightarrow$ B, enthalpy of reaction is -4.2 kJ mol-1 and enthalpy of activation is 9.6 kJ mol-1. The correct potential energy profile for the reaction is shown in option:**

Option A

Option B
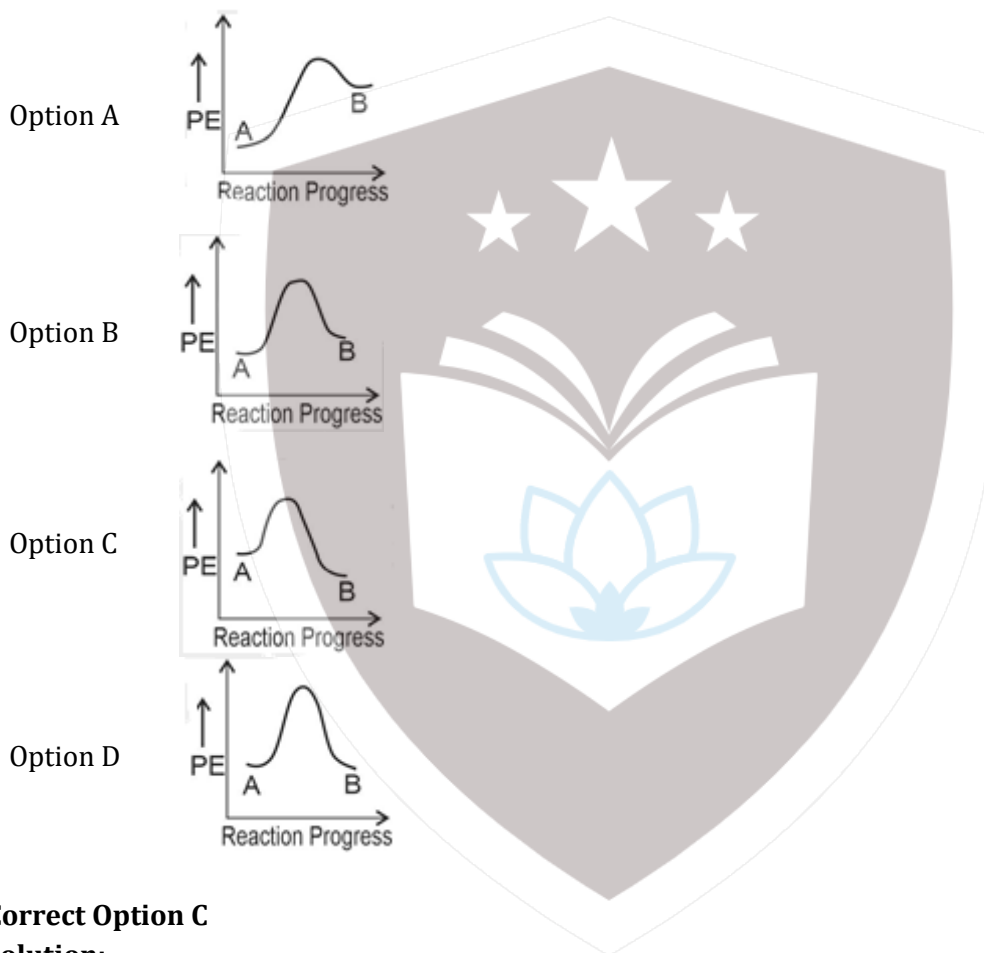
Option C

Option D

**Correct Option C**

**Solution:**

It is an exothermic reaction

For exothermic reaction, energy of reactants is greater than energy of products. By inspection option 3 is correct.

**Q 69. The $p^{kb}$ of dimethylamine and $p^{ka}$ of acetic acid are 3.27 and 4.77 respectively at T (K). The correct option for the pH of dimethylammonium acetate solution is:**

Option A     6.25

Option B     8.50

Option C     5.50

Option D     7.75

**Correct Option D**

**Solution:** Dimethylammonium acetate is a weak acid & weak base type of salt

$$pH = 7 + \frac{1}{2}pK_a - \frac{1}{2}pK_b$$

$$= 7 + \frac{1}{2} \times 4.77 - \frac{1}{2} \times 3.27$$

$$= 7.75$$

**Q 70. The major product formed in dehydrohalogenation reaction of 2-Bromo pentane is Pent-2-ene. This product formation is based on?**

Option A        Huckel's Rule

Option B        Saytzeff's Rule

Option C        Hund's Rule

Option D        Hofmann Rule

**Correct Option B**

**Solution:** During dehydrohalogenation most stable alkene is formed by Saytzeff rule. According to Saytzeff's rule an alkene with more number of hyperconjugated hydrogens is the major product.
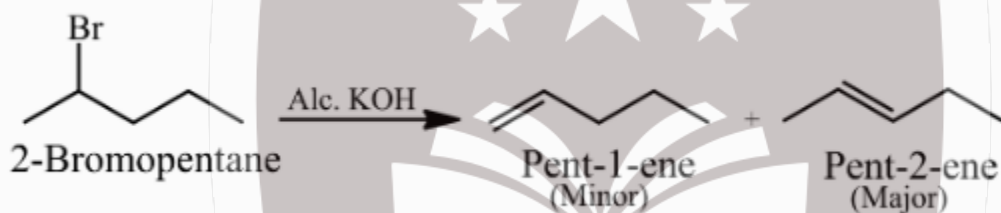


**Q 71. Which one of the following polymers is prepared by addition polymerisation?**

Option A        Dacron

Option B        Teflon

Option C        Nylon-66

Option D        Novolac

**Correct Option B**

**Solution:** Teflon is formed by addition polymerisation of Tetrafluoro ethylene

$$nCF_2 = CF_2 \xrightarrow[\text{Under pres}]{\text{Peroxide}} \left( CF_2 - CF_2 \right)_n$$
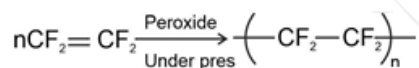
**Q 72. The RBC deficiency is deficiency disease of:**

Option A        Vitamin $B_2$

Option B        Vitamin $B_{12}$

Option C        Vitamin $B_6$

Option D        Vitamin $B_1$

**Correct Option B**

**Solution:**

Deficiency of vitamin $B_{12}$ causes Megaloblastic Anaemia/Pernicious anaemia

**Q 73. The following solutions were prepared by dissolving 10 g of glucose ($C_6H_{12}O_6$) in 250 ml of water ($P_1$), 10 g of urea ($CH_4N_2O$) in 250 ml of water ($P_2$) and 10 g of sucrose ($C_{12}H_{22}O_{11}$)**

in 250 ml of water (P₃). **The right option for the decreasing order of osmotic pressure of these solutions is:**

Option A          $P_3 > P_1 > P_2$
Option B          $P_2 > P_1 > P_3$
Option C          $P_1 > P_2 > P_3$
Option D          $P_2 > P_3 > P_1$

**Correct Option B**

**Solution:**

$\pi = iCRT$

$P_1 = 1 \times \dfrac{10}{180} \times R \times T$   (For Glucose)

$P_2 = 1 \times \dfrac{10}{60} \times R \times T$   (For Urea)

$P_3 = 1 \times \dfrac{10}{342} \times R \times T$   (For Sucrose)

$\therefore P_2 > P_1 > P_3$

**Q 74. A particular station of All India Radio, New Delhi, broadcasts on a frequency of 1,368 kHz(kilohertz). The wavelength of the electromagnetic radiation emitted by the transmitter is: [speed of light, c = 3.0 × 10⁸ ms⁻¹]**

Option A          21.92 cm
Option B          219.3 m
Option C          219.2 m
Option D          2192 m

**Correct Option B**

**Solution:**

$\lambda = \dfrac{c}{v}$

$\lambda = \dfrac{3 \times 10^8}{1368 \times 10^3} = 219.298m = 219.3\,m$

**Q 75. Noble gases are named because of their inertness towards reactivity. Identify the incorrect statement about them.**

Option A          Noble gases have large positive values of electron gain enthalpy
Option B          Noble gases are sparingly soluble in water
Option C          Noble gases have very high melting and boiling points
Option D          Noble gases have weak dispersion forces

**Correct Option C**

**Solution:** Noble gases have very high melting and boiling points due to weak london dispersion forces.

**Q 76. Given statements are two statements:**

**Statement-I     Aspirin and Paracetamol belong to the class of narcotic analgesics.**

**Statement-II    Morphine and Heroin are non-narcotic analgesics.**

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

Option A      Statement I is incorrect but statement II is true

Option B      Both statement I and II are true.

Option C      Both statement I and II are false.

Option D      Statement I is correct but statement II is false.

**Correct Option C**

**Solution:** Aspirin and Paracetamol are non-narcotic where as Morphine and Heroin are narcotic analgesics.

**Q 77. Which one of the following methods can be used to obtain highly pure metal which is liquid at room temperature?**

Option A      Zone refining

Option B      Electrolysis

Option C      Chromatography

Option D      Distillation

**Correct Option D**

**Solution:** Only metal stable in liquid state at room temperature is Hg. It has non volatile impurity. Therefore, it is purified by distillation.

**Q 78. The correct sequence of bond enthalpy of 'C-X' bond is-**

Option A      $CH_3\text{-}Cl > CH_3\text{-}F > CH_3\text{-}Br > CH_3\text{-}I$

Option B      $CH_3\text{-}F < CH_3\text{-}Cl < CH_3\text{-}Br < CH_3\text{-}I$

Option C      $CH_3\text{-}F > CH_3\text{-}Cl > CH_3\text{-}Br > CH_3\text{-}I$

Option D      $CH_3\text{-}F < CH_3\text{-}Cl > CH_3\text{-}Br > CH_3\text{-}I$

**Correct Option C**

**Solution:** Atomic size $F < Cl < Br < I$

From R-F to R-I bond length increases where as bond enthalpy decreases.

**Q 79. The compound which shows metamerism is-**

Option A      $C_4H_{10}O$

Option B      $C_5H_{12}$

Option C      $C_3H_8O$

Option D      $C_3H_6O$

**Correct Option A**

**Solution:**

$C_4H_{10}O$ shows metamerism.

With the formula $C_4H_{10}O$ the possible ethers are-

(1) diethyl ether

(2) methyl n-propyl ether

(3) iso propyl methyl ether

**Q 80. Ethylene diaminetetraacetate (EDTA) is-**

Option A      Tridentate ligand with three "N" donor atoms

Option B      Hexadentate ligand with four "O" and two "N" donor atoms

Option C      Unidentate ligand

Option D      Bidentate ligand with two "N" donor atoms

**Correct Option B**
**Solution:**
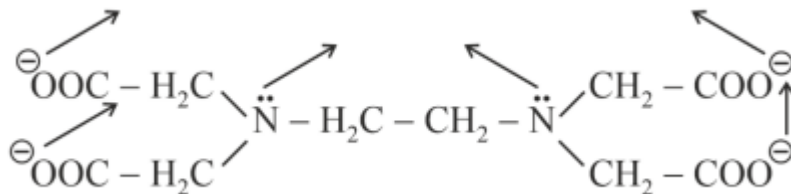


## Q 81. Zr(Zr=40) and Hf(Z=72) have similar atomic and ionic radii because of
Option A      having similar chemical properties
Option B      belonging to same group
Option C      diagonal relationship
Option D      lanthanoid contraction
**Correct Option D**
**Solution: Zr and Hf have same size due to lanthanoid contraction.**

## Q 82. $BF_3$ is a planar and electron deficient compound. Hybridization and number of electrons around the central atom, respectively are-
Option A      $sp^2$ and 8
Option B      $sp^3$ and 4
Option C      $sp^3$ and 6
Option D      $sp^2$ and 6
**Correct Option D**
**Solution:**

Sol:



$sp^2$ and 6
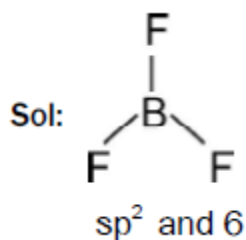
## Q 83. The major product of the following chemical reaction is-
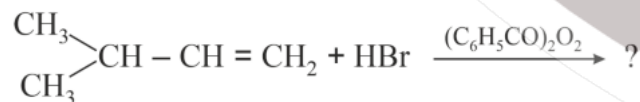


Option A



Option B



Option C

Option D

$$\underset{CH_3}{\overset{CH_3}{>}}CH - \underset{\underset{Br}{|}}{CH} - CH_3$$

**Correct Option B**
**Solution:**

$$\underset{CH_3}{\overset{CH_3}{>}}CH - CH = CH_2 + HBr \xrightarrow{(C_6H_5CO)_2O_2} \underset{CH_3}{\overset{CH_3}{>}}CH - CH_2 - \underset{\underset{Br}{|}}{CH_2}$$
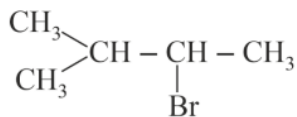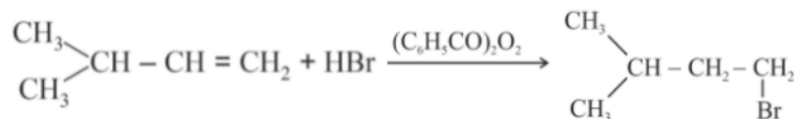
**Q 84. The incorrect statement among the following is-**

Option A  Actinoids are highly reactive metals, especially when finely divided.
Option B  Actinoid contraction is greater for element to element than Lanthanoid contraction.
Option C  Most of the trivalent lanthanoid ions are colourless
Option D  Lanthanoids are good conductors of heat and electricity

**Correct Option C**
**Solution:**

Most of the Lanthanoids are in trivalent state are coloured due to unpaired electrons in f-subshell. $La^{+3}$, $Lu^{+3}$ are colourless.

**Q 85. Among the following alkaline earth metal halides, one which is covalent and soluble in organic solvent is-**

Option A  Berylium chloride
Option B  Calcium chloride
Option C  Strontium chloride
Option D  Magnesium chloride

**Correct Option A**
**Solution:**

Due to high polarising power of $Be^{+2}$ ion, all berylium halides are predominantly covalent. They are soluble in organic solvents.

# Section- B

**Q 86 . The correct option for the value of vapour pressure of a solution at 45° C with benzene to octane in molar ratio 3:2 is-**
**[At 45°C, vapour pressure of benzene is 280mm Hg and that of octane is 420 mm of Hg. Assume ideal gas]**

Option A  350 mm of Hg
Option B  160 mm of Hg
Option C  168 mm of Hg
Option D  336 mm of Hg

**Correct Option  D**
**Solution:** Applying Raoult's law,

$$P_{total} = P_A^{\,o} X_A + P_B^{\,o} X_B$$

$$X_A = \frac{3}{5}, \; X_B = \frac{2}{5}$$

$$P_{total} = 280 \times \left(\frac{3}{5}\right) + 420 \times \left(\frac{2}{5}\right)$$

$$= 336 \, mm \, of \, Hg$$

**Q 87. For irreversible expansion of an ideal gas under isothermal condition, the correct option is-**

Option A $\quad \Delta U \neq 0, \; \Delta S_{total} = 0$

Option B $\quad \Delta U = 0, \; \Delta S_{total} = 0$

Option C $\quad \Delta U \neq 0, \; \Delta S_{total} \neq 0$

Option D $\quad \Delta U = 0, \; \Delta S_{total} \neq 0$

**Correct Option D**

For an isothermal process, $\Delta T = 0$

$\Delta U = 0$

For an irreversible expansion, $\Delta S_{total} \neq 0$

**Q 88. The intermediate compound 'X' in the following chemical reaction is-**



Option A



Option B



Option C

Option D

**Correct Option B**

**Solution:**



Chromium complex
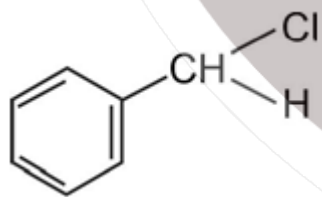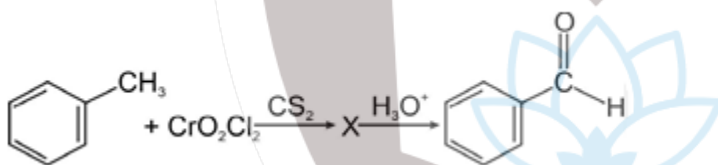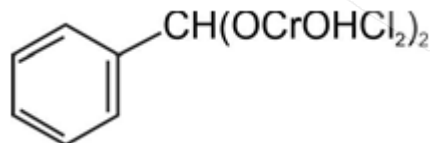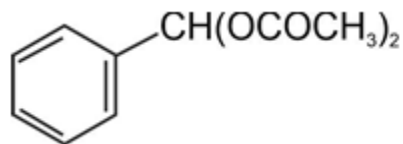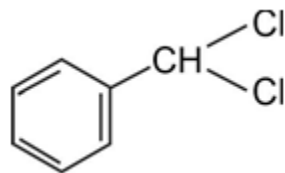
**Q 89. Choose the correct option for the total pressure (in atm) in a mixture of 4g $O_2$ and 2g $H_2$ confined in a total volume of one litre at 0°C is:[ Given R = 0.082 L atm mol$^{-1}$K$^{-1}$ , T = 273K]**

Option A    26.02
Option B    2.518
Option C    2.602
Option D    25.18

**Correct Option D**

**Solution:**

Given:
V = 1L
T = 273K
Let us find the Partial pressure of $O_2$.

No. of moles = 4/32 =0.125 moles
$P_1$= nRT/v =0 .125x0.082 x 273/1 =2.80 atm

Now let us find the partial pressure of $H_2$.

$P_2$ = nRT/v =1 x 0.082 x 273/1 =22.386 atm
Total pressure of the mixture = 2.80 + 22.38 =25.18 atm

**Q 90. From the following pairs of ions which one is not an iso - electronic pair ?**

Option A      $Fe^{2+}$, $Mn^{2+}$
Option B      $O^{2-}$, $F^-$
Option C      $Na^+$, $Mg^{2+}$
Option D      $Mn^{2+}$, $Fe^{3+}$

**Correct Option A**

**Solution:**

$Fe^{+2}$....$[Ar]3d^6$ ........ 24 electrons

$Mn^{+2}$....$[Ar]3d^5$ ........ 23 electrons

**Q 91. Consider the below reaction and identify the missing reagent/chemical:**

$$CH_3CH_2COO^-Na^+ \xrightarrow[\text{Heat}]{\text{NaOH, +?}} CH_3CH_3 + Na_2CO_3$$
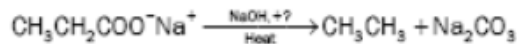
Option A      DIBAL - H

Option B      $B_2H_6$

Option C      Red Phosphorus

Option D      CaO

**Correct Option D**

**Solution: This is a decarboxylation reaction**

$$CH_3CH_2COONa + NaOH \xrightarrow[\Delta]{\text{CaO}} CH_3 - CH_3 + Na_2CO_3$$

**Q 92. Which of the following molecules is non - polar in nature?**

Option A      $NO_2$

Option B      $POCl_3$

Option C      $CH_2O$

Option D      $SbCl_5$

**Correct Option D**

**Solution:** dipole moment ($\mu$) = 0
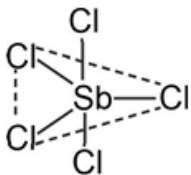


Trigonal bipyramidal

**Q 93. The slope of Arrhenius Plot ( In k v/s 1/T ) (In k v/s 1/T) of first order reaction is −5 × 10³ K. The value of Ea of the reaction is. Choose the correct option for your answer.**

**[Given R = 8.314 JK−1 mol−1]**

Option A      -83.0 kJ mol⁻

Option B      41.5 kJ mol⁻

Option C      83.0 kJ mol⁻

Option D      166 kJ mol⁻

**Correct Option B**

**Solution:**

$$\ell nK = \ell nA - \frac{Ea}{R}\left(\frac{1}{T}\right)$$

In $\ell nk$ v/s $\frac{1}{T}$ graph

$$\text{Slope} = -\frac{Ea}{R}$$

$$-5 \times 10^3 = \frac{-Ea}{8.314}$$

Ea = $5 \times 10^3 \times 8.314$

= 41500 J mol⁻¹ or 41.5 kJ mol⁻¹

**Q 94. Considering Ellingham diagram, which of the following metals can be used to reduce alumina?**

| List I | | List II | |
|---|---|---|---|
| a | $2SO_{2(g)}+O_{2(g)}\rightarrow 2SO_{3(g)}$ | i | Acid rain |
| b | $HOCl_{(g)} + h\nu\rightarrow \bullet OH+\bullet Cl$ | ii | Smog |
| c | $CaCO_3+H_2SO_4\rightarrow CaSO_4+H_2O+CO_2$ | iii | Ozone depletion |
| d | $NO_{2(g)} + h\nu \rightarrow NO_{(g)}+O_{(g)}$ | iv | Tropospheric pollution |

**Choose the correct answer from the options given below**

| | | a | b | c | d |
|---|---|---|---|---|---|
| Option | A | iii | ii | iv | i |
| Option | B | i | ii | iii | iv |
| Option | C | ii | iii | iv | i |
| Option | D | iv | iii | i | ii |

**Correct Option D**

**Solution:**
(a) $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g) \rightarrow$ (iv) Tropospheric pollution
(b) $HOCl(g) + h\nu \rightarrow OH^{\cdot} + Cl^{\cdot} \rightarrow$ (iii) Ozone depletion
(c) $CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2 \rightarrow$ (i) Acid rain
(d) $NO_2(g) + h\nu \rightarrow NO(g) + O(g) \rightarrow$ (ii) Smog

**Q 95. Match List - I with List - II**

List-I                                    List-II
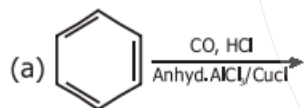
(a) 〔benzene ring〕 $\xrightarrow[\text{Anhyd.AlCl}_3/\text{CuCl}]{\text{CO, HCl}}$         (i) Hell-Vollard
                                          Zelinsky reaction
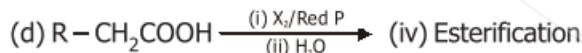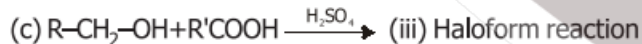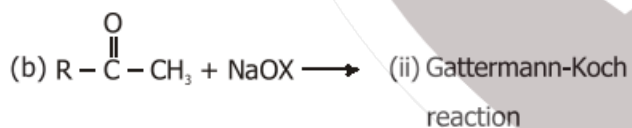
(b) $R - \overset{\overset{\displaystyle O}{\|}}{C} - CH_3 + NaOX \longrightarrow$         (ii) Gattermann-Koch reaction

(c) $R-CH_2-OH+R'COOH \xrightarrow{H_2SO_4}$ (iii) Haloform reaction

(d) $R - CH_2COOH \xrightarrow[\text{(ii) H}_2\text{O}]{\text{(i) X}_2/\text{Red P}}$ (iv) Esterification

**Choose the correct answer from the options given below**

| | | a | b | c | d |
|---|---|---|---|---|---|
| Option | A | ii | iii | iv | I |
| Option | B | iv | i | ii | Iii |
| Option | C | iii | ii | i | Iv |
| Option | D | i | iv | iii | ii |

**Correct Option A**

## Q 96. Match List - I with List - II

| | List - I | | List - II |
|---|---|---|---|
| a) | $[Fe(CN)_6]^{3-}$ | i) | 5.92 BM |
| b) | $[Fe(H_2O)_6]^{3+}$ | ii) | 0 BM |
| c) | $[Fe(CN)_6]^{4-}$ | iii) | 4.90 BM |
| d) | $[Fe(H_2O)_6]^{2+}$ | iv) | 1.73 BM |

| | | a | b | c | d |
|---|---|---|---|---|---|
| Option | A | iv | i | ii | Iii |
| Option | B | iv | ii | i | Iii |
| Option | C | ii | iv | iii | I |
| Option | D | i | iii | iv | ii |

**Correct Option A**

## Q 97. The product formed in the following chemical reaction is :



$$\xrightarrow[C_2H_5OH]{NaBH_4} ?$$

Option A



Option B



Option C



Option D



**Correct Option A**

Solution:

NaBH₄
C₂H₅OH
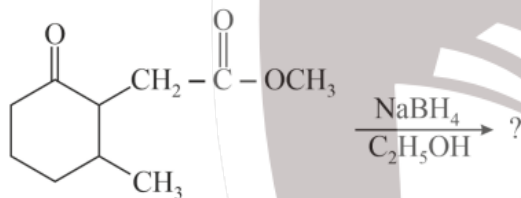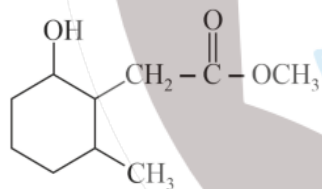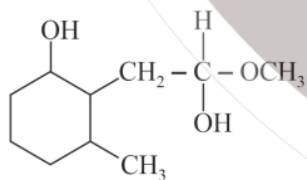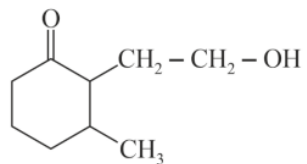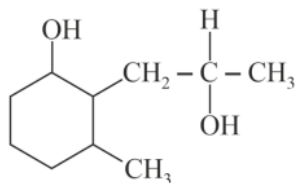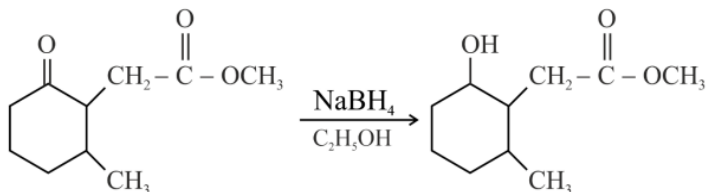
## Q 98. In which of the following arrangements the given sequence is not strictly according to the properties indicated against it ?

Option A $\quad CO_2 < SiO_2 < SnO_2 < PbO_2$ : Increasing oxidizing power

Option B $\quad HF < HCl < HBr < HI$ : Increasing acidic strength

Option C $\quad H_2O < H_2S < H_2Se < H_2$ : Increasing a pK values

Option D $\quad NH_3 < PH_3 < AsH_3 < SbH_3$ : Increasing acidic character

**Correct Option C**

**Solution:**

$H_2O < H_2S < H_2Se < H_2Te$ from going down the group bond length increase so bond strength decreases therefore acidic nature of these will increase but $pKa$ will decrease.

## Q 99. The molar conductivity of 0.007 M acetic acid is 20 S cm²mol⁻¹. What is the dissociation constant of acetic acid? Choose the correct option.

$$\left[ \Lambda^\circ_{H^+} = 350 \text{ S cm}^2 \text{ mol}^{-1} \right.$$
$$\left. \Lambda^\circ_{CH_3COO^-} = 50 \text{ S cm}^2 \text{ mol}^{-1} \right]$$

Option A $\quad$ 2.50 × 10⁻⁴ mol L⁻¹

Option B $\quad$ 1.75 × 10⁻⁴ mol L⁻¹

Option C $\quad$ 2.50 × 10⁻⁵ mol L⁻¹

Option D $\quad$ 1.75 × 10⁻⁵ mol L⁻¹

**Correct Option D**

**Solution:**

$$\Lambda^\circ_{CH_3COOH} = \Lambda^\circ_{CH_3COO^-} + \Lambda^\circ_{H^+}$$

$$\Lambda^\circ_{CH_3COOH} = 350 + 50 = 400 \text{ } Scm^2 \text{ } mol^{-1}$$

$$\Lambda_{CH_3COOH} = 20 \text{ } Scm^2 \text{ } mol^{-1} \text{ Given}$$

$$\alpha = \frac{\Lambda_{CH_3COOH}}{\Lambda^\circ_{CH_3COOH}} = \frac{20}{400} = 5 \times 10^{-2}$$

$$K_a = c\alpha^2 = 0.007 \times (5 \times 10^{-2})^2 = 1.75 \times 10^{-5} \text{ } mol \text{ } L^{-1}$$

## Q 100. The reagent 'R' in the given sequence of chemical reaction is :



NaNO₂,HCl
0.5°C

R
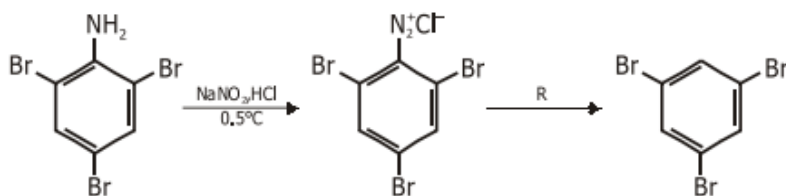
Option A $\quad$ CuCN/KCN

Option B      H2O
Option C      $CH_3CH_2OH$
Option D      HI

**Correct Option C**

**Solution:**



---
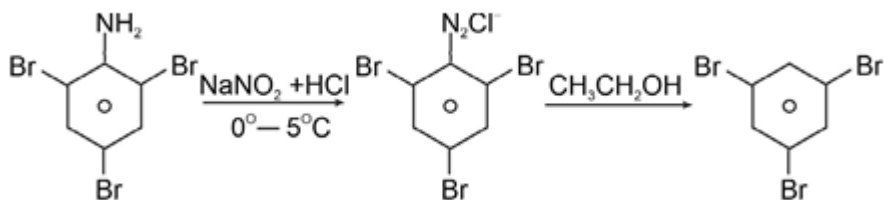
# BOTANY
## SECTION - A

**Q 101. Match List-I with List-II.**

| | List-I | | List-II |
|---|---|---|---|
| a) | Cells with active cell division capacity | (i) | Vascular tissues |
| b) | Tissue having all cells similar in structure and function | (ii) | Meristematic tissue |
| c) | Tissue having different types of cells | (iii) | Sclereids |
| d) | Dead cells with highly thickened walls and narrow lumen | (iv) | Simple tissue |

**Select the correct answer from the options given below.**

| | a | b | c | d |
|---|---|---|---|---|
| Option A | iii | ii | iv | i |
| Option B | ii | iv | i | iii |
| Option C | iv | iii | ii | i |
| Option D | i | ii | iii | iv |

**Correct Option B**

**Solution**: Cells with active cell division – Meristematic tissue

Tissue having all cells similar in structure and function– Simple tissue

Tissue having different types of cells – Vascular tissues

Dead cells with highly thickened walls and narrow lumen - Sclereids

**Q 102. Which of the following is an incorrect statement?**

Option A      Nuclear pores act as passages for proteins and RNA molecules in both directions between nucleus and cytoplasm.

Option B      Mature sieve tube elements possess a conspicuous nucleus and usual cytoplasmic organelles.

Option C        Microbodies are present both in plant and animal cells.
Option D        The perinuclear space forms a barrier between the materials present inside the nucleus and that of the cytoplasm.

**Correct Option B**

**Solution:** Mature sieve tube elements do not have nucleus but have cytoplasm. (Anucleated living cells).

**Q 103. When gene targeting involving gene amplification is attempted in an individual's tissue to treat disease, it is known as:**

Option A        Safety testing
Option B        Biopiracy
Option C        Gene therapy
Option D        Molecular diagnosis

**Correct Option C**

**Solution:** Gene therapy is a collection of methods that allows correction of a gene defect that has been diagnosed in a child/embryo. Here genes are inserted into a person's cells and tissues to treat a disease. Amplification is used to increase the expression of desired gene.

**Q 104. During the purification process for recombinant DNA technology, addition of chilled ethanol precipitates out:**

Option A        Polysaccharides
Option B        RNA
Option C        DNA
Option D        Histones

**Correct Option C**

**Solution:** Addition of chilled ethanol precipitates the genomic DNA during the isolation of DNA or genetic material.

**Q 105. Match List-I with List-II.**

|  | List-I |  | List-II |
|---|---|---|---|
| a) | Protoplast fusion | (i) | Totipotency |
| b) | Plant tissue culture | (ii) | Pomato |
| c) | Meristem culture | (iii) | Somaclones |
| d) | Micropropagation | (iv) | Virus free plants |

Choose the correct answer from the options given below.

|  | a | b | c | d |
|---|---|---|---|---|
| Option A | iv | iii | ii | i |
| Option B | iii | iv | ii | i |
| Option C | ii | i | iv | iii |
| Option D | iii | iv | i | ii |

**Correct Option C**

**Solution:** Protoplast fusion – Pomato
Plant tissue culture – Totipotency
Meristem culture – Virus free plants
Micropropagation – Somaclones

**Q 106. When the centromere is situated in the middle of two equal arms of chromosomes, the chromosome is referred as:**

Option A          Acrocentric

Option B          Metacentric

Option C          Telocentric

Option D          Sub-metacentric

**Correct Option B**

**Solution:** Metacentric chromosome has a median centromere, due to which it has two almost equal arms. It attains V shape in anaphase.

**Q 107. The factor that leads to Founder effect in a population is**

Option A          Genetic drift

Option B          Natural selection

Option C          Genetic recombination

Option D          Mutation

**Correct Option A**

**Solution:** Founder effect and bottleneck effect are two types of genetic drift. In a small isolated population change in gene frequency occurs by chance, it is called genetic drift. Sometimes the change in allele frequency is so different in the new sample of population that they become a different species. The original drifted population becomes founders and the effect is called founder effect.

**Q 108. Which of the following is a correct sequence of steps in a PCR (Polymerase Chain Reaction)?**

Option A          Annealing, Denaturation, Extension

Option B          Denaturation, Annealing, Extension

Option C          Denaturation, Extension, Annealing

Option D          Extension, Denaturation, Annealing

**Correct Option B**

**Solution:** The correct sequence of steps in PCR is Denaturation, Annealing and Extension.

**Q 109. In spite of interspecific competition in nature, which mechanism the competing species might have evolved for their survival?**

Option A          Predation

Option B          Resource partitioning

Option C          Competitive release

Option D          Mutualism

**Correct Option B**

**Solution:** Species facing competition might evolve mechanisms that promote co-existence rather than exclusion. One such mechanism is 'resource partitioning'. Mac Arthur showed that five closely related species of warblers living on the same tree were able to avoid competition and co-exist due to behavioural differences in their foraging activities.

**Q 110. A typical angiosperm embryo sac at maturity is:**

Option A          8-nucleate and 8-celled

Option B          8-nucleate and 7-celled

Option C          7-nucleate and 8-celled

Option D        7-nucleate and 7-celled

**Correct Option B**

**Solution:** A typical embryo sac is 8-nucleated and 7-celled. It is polygonum type.

**Q 111. The site of perception of light in plants during photoperiodism is :**

Option A        Leaf

Option B        Shoot apex

Option C        Stem

Option D        Axillary bud

**Correct Option A**

**Solution:** The site of perception of light in plants during photoperiodism is leaf

**Q 112. Which of the following plants is monoecious ?**

Option A        *Cycas circinalis*

Option B        *Carica papaya*

Option c        *Chara*

Option D        *Marchantia polymorpha*

**Correct Option C**

**Solution:** *Chara* is an alga with monoecious condition. It has male sex organ antheridium and female sex organ oogonium at the same node. *Cycas circinalis, Carica papaya* and *Marchantia polymorpha* are dioecious.

**Q 113. Match List-I with List-II.**

| List-I | List-II |
|---|---|
| a) Cristae | (i) Primary constriction in chromosome |
| b) Thylakoids | (ii) Disc-shaped sacs in Golgi apparatus |
| c) Centromere | (iii) Infoldings in mitochondria |
| d) Cisternae | (iv) Flattened membranous sacs in stroma of plastids |

Choose the correct answer from the options given below.

|  | a | b | c | d |
|---|---|---|---|---|
| Option A | ii | iii | iv | i |
| Option B | iv | iii | ii | i |
| Option C | i | iv | iii | ii |
| Option D | iii | iv | i | ii |

**Correct Option D**

**Solution:** Cristae – Infoldings in mitochondria (inner membrane)

Thylakoids – Flattened membranous sacs in stroma of plastids

Centromere – Primary constriction in chromosome

Cisternae – Disc shaped sacs in Golgi apparatus

**Q 114. Match List-I with List-II.**

| | List-I | | List-II |
|---|---|---|---|
| a) | Cohesion | (i) | More attraction in liquid phase |
| b) | Adhesion | (ii) | Mutual attraction among water molecules |
| c) | Surface tension | (iii) | Water loss in liquid phase |
| d) | Guttation | (iv) | Attraction towards polar surfaces |

**Choose the correct answer from the options given below.**

| | a | b | c | d |
|---|---|---|---|---|
| Option A | ii | i | iv | iii |
| Option B | ii | iv | i | iii |
| Option C | iv | iii | ii | i |
| Option D | iii | i | iv | ii |

**Correct option B**

**Solution:** Cohesion – Mutual attraction among water

Adhesion – Attraction towards polar surfaces

Surface tension – More attraction in liquid phase

Guttation – Water loss in liquid phase

**Q 115. Match List-I with List-II.**

| | List-I | | List-II |
|---|---|---|---|
| a) | Lenticels | (i) | Phellogen |
| b) | Cork cambium | (ii) | Suberin deposition |
| c) | Secondary cortex | (iii) | Exchange of gases |
| d) | Cork | (iv) | Phelloderm |

| | a | b | c | d |
|---|---|---|---|---|
| Option A | iv | ii | i | iii |
| Option B | iv | i | iii | ii |
| Option C | iii | i | iv | ii |
| Option D | ii | iii | iv | i |

**Correct Option C**

**Solution:** Lenticels – Exchange of gases

Cork cambium – Phellogen

Secondary cortex – Phelloderm

Cork – Suberin deposition

**Q 116. The term used for transfer of pollen grains from anthers of one plant to stigma of a different plant which, during pollination, brings genetically different types of pollen grains to stigma, is :**

Option A     Cleistogamy

Option B     Xenogamy

Option C     Geitonogamy

Option D     Chasmogamy

**Correct Option B**

**Solution:** Xenogamy is transfer of pollen grains from anthers of one plant to stigma of a different plant which, during pollination, brings genetically different types of pollen grains to stigma.

**Q 117. Which of the following is not an application of PCR (Polymerase Chain Reaction)?**

Option A      Detection of gene mutation

Option B      Molecular diagnosis

Option C      Gene amplification

Option D      Purification of isolated protein

**Correct Option D**

**Solution:** Purification of isolated protein is not an application of PCR (Polymerase Chain Reaction).

**Q 118. The production of gametes by the parents, formation of zygotes, the $F_1$ and $F_2$ plants, can be understood from a diagram called :**

Option A      Net square

Option B      Bullet square

Option C      Punch square

Option D      Punnett square

**Correct Option D**

**Solution:** <u>Punnet square</u>: It is a diagram which shows the production of gametes by parents, formation of zygotes, the $F_1$ and $F_2$ plants.

**Q 119. Which of the following algae produce Carrageen?**

Option A      Blue-green algae

Option B      Green algae

Option C      Brown algae

Option D      Red algae

**Correct Option D**

**Solution:** Carrageen is produced by Red algae.

**Q 120. Amensalism can be represented as :**

Option A      Species A (+) ; Species B (0)

Option B      Species A (-) ; Species B (0)

Option C      Species A (+) ; Species B (+)

Option D      Species A (+) ; Species B (+)

**Correct Option B**

**Solution:** In Amensalism one species is harmed (-) whereas the other is unaffected (0).

**Q 121. Which of the following stages of meiosis involves division of centromere?**

Option A      Telophase II

Option B      Metaphase I

Option C      Metaphase II

Option D      Anaphase II

**Correct Option D**

**Solution:** During meiosis centromere division is seen in Anaphase II.

**Q 122. Complete the flow chart on central dogma.**

(a) DNA $\xrightarrow{(b)}$ mRNA $\xrightarrow{(c)}$ (d)
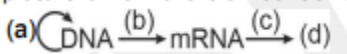
Option A      (a)-Transduction; (b)-Translation; (c)-Replication; (d)-protein
Option B      (a)-Replication; (b)-Transcription; (c)-Transduction; (d)-protein
Option C      (a)-Translation; (b)-Replication; (c)-Transcription; (d)-Transduction
Option D      (a)-Replication; (b)-Transcription; (c)-Translation; (d)-protein

**Correct Option D**

**Solution:** a – replication of DNA; b – Transcription; c- Translation; d - Protein

**Q 123. Mutations in plant cells can be induced by :**

Option A      Zeatin
Option B      Kinetin
Option C      Infrared rays
Option D      Gamma rays

**Correct Option D**

**Solution:** Gamma rays induce mutations.

**Q 124. In the equation GPP-R=NPP, R represents :**

Option A      Respiration losses
Option B      Radiant energy
Option C      Retardation factor
Option D      Environment factor

**Correct Option A**

**Solution:** Gross primary productivity minus respiration losses (R), is the net primary productivity (NPP).
GPP – R = NPP.

**Q 125. Plants follow different pathways in response to environment or phases of life to form different kinds of structures. This ability is called :**

Option A      Maturity
Option B      Elasticity
Option C      Flexibility
Option D      Plasticity

**Correct option D**

**Solution:** The ability of plants to form morphologically different structures by following different pathways in response to environment or phases of life is called Plasticity.

**Q 126. The plant hormone used to destroy weeds in a field is:**

Option A      IBA
Option B      IAA
Option C      NAA
Option D      2, 4-D

**Correct Option D**

**Solution:** The synthetic auxin 2, 4 – D is used to destroy weeds in a monocot field.

**Q 127. Which of the following statements is not correct?**

Option A       Pyramid of numbers in a grassland ecosystem is upright.

Option B       Pyramid of biomass in sea is generally inverted.

Option C       Pyramid of biomass in sea is generally upright.

Option D       Pyramid of energy is always upright.

**Correct Option C**

**Solution:** The pyramid of biomass in sea is generally inverted because the biomass of fishes far exceeds that of phytoplankton.

**Q 128. Gemmae are present in :**

Option A       Some Liverworts

Option B       Mosses

Option C       Pteridophytes

Option D       Some Gymnosperms

**Correct Option A**

**Solution:** Gemmae are formed in some liverworts like *Marchantia*.

**Q 129. The first stable product of $CO_2$ fixation in sorghum is :**

Option A       Phosphoglyceric acid

Option B       Pyruvic acid

Option C       Oxaloacetic acid

Option D       Succinic acid

**Correct Option C**

**Solution:** The first stable product of $CO_2$ fixation in Sorghum ($C_4$ plant) is Oxaloacetic acid.

**Q 130. Which of the following algae contains mannitol as reserve food material?**

Option A       *Ulothrix*

Option B       *Ectocarpus*

Option C       *Gracilaria*

Option D       *Volvox*

**Correct Option B**

**Solution:** *Ectocarpus* (Brown alga) has mannitol as reserve food material.

**Q 131. . DNA strands on a gel stained with ethidium bromide when viewed under UV radiation, appear as :**

Option A       Bright blue bands

Option B       Yellow bands

Option C       Bright orange bands

Option D       Dark red bands

**Correct Option C**

**Solution:** DNA strands on a gel stained with ethidium bromide when viewed under UV radiation appear as bright orange bands.

**Q 132. Diadelphous stamens are found in :**

Option A       China rose and citrus

Option B       China rose

Option C       Citrus

Option D        Pea
**Correct Option D**
**Solution:** Diadelphous stamens are seen in pea (Fabaceae).

## Q 133. Which of the following are not secondary metabolites in plants ?
Option A        Rubber, gums
Option B        Morphine, codeine
Option C        Amino acids, glucose
Option D        Vinblastin, curcumin
**Correct Option C**
**Solution:** Amino acids and Glucose are primary metabolites but not secondary metabolites as they have some known functions

## Q 134. The amount of nutrients, such as carbon, nitrogen, phosphorus and calcium present in the soil at any given time, is referred as :
Option A        Standing crop
Option B        Climax
Option C        Climax community
Option D        Standing state
**Correct Option D**
**Solution:** The amount of nutrients, such as carbon, nitrogen, phosphorus and calcium present in the soil at any given time is called standing state.

## Q 135. Genera like *Selaginella* and *Salvinia* produce two kinds of spores. Such plants are known as :
Option A        Heterosporous
Option B        Homosorus
Option C        Heterosorus
Option D        Homosporous
**Correct Option A**
**Solution:** Genera like *Selaginella* and *Salvinia* (Pteridophytes) form two types of spores microspores and megaspores and they are described as heterosporous.

## Q 136. Plasmid pBR322 has *PstI* restriction enzyme site within gene ampR that confers ampicillin resistance. If this enzyme is used for inserting a gene forβ –galactoside production and the recombinant plasmid is inserted in an *E.coli* strain
Option A        it will be able to produce a novel protein with dual ability.
Option B        it will not be able to confer ampicillin resistance to the host cell.
Option C        the transformed cells will have the ability to resist ampicilin as well as produce β - galactoside.
Option D        it will lead to lysis of host cell.
**Correct Option B**
**Solution:** Since the gene is inserted at *PstI* of ampR region ofpBR322, the ampR gene is inactivated which is called as insertional inactivation. Hence the genetically modified *E.coli* strain will not be able to confer ampicillin resistance.

**Q 137. In some member of which of the following pairs of families, pollen grains retain their viability for months after release ?**

Option A        Rosaceae; Leguminosae

Option B        Poaceae; Rosaceae

Option C        Poaceae; Leguminosae

Option D        Poaceae; Solanaceae

**Correct Option A**

**Solution:** In dicot families like Solanaceae, Rosaceae and Leguminosae the viability of pollen grains remain months together after their release.

**Q 138. Identify the correct statement.**

Option A        Split gene arrangement is characteristic of prokaryotes.

Option B        In capping, methyl guanosine triphosphate is added to the 3' end of hnRNA.

Option C        RNA polymerase binds with Rho factor to terminate the process of transcription in bacteria.

Option D        The coding strand in a transcription unit is copied to an mRNA.

**Correct Option C**

**Solution:** Transcription is terminated when Rho factor binds to RNA polymerase in bacteria

**Q 139. Which of the following statements is correct ?**

Option A        Some of the organisms can fix atmospheric nitrogen in specialized cells called sheath cells.

Option B        Fusion of two cells is called Karyogamy.

Option C        Fusion of protoplasms between two motile or non-motile gametes is called plasmogamy.

Option D        Organisms that depend on living plants are called saprophytes.

**Correct option C**

**Solution:** Fusion of protoplasms between two motile or non-motile gametes is called as plasmogamy

**Q 140. DNA fingerprinting involves identifying differences is some specific regions in DNA sequence, called as :**

Option A        Polymorphic DNA

Option B        Satellite DNA

Option C        Repetitive DNA

Option D        Single nucleotides

**Correct Option C**

**Solution:** DNA fingerprinting involves identifying differences in some specific regions in DNA sequence called as repetitive DNA, because in these sequences, a small stretch of DNA is repeated many times.

**Q 141. Select the correct pair.**

Option A        Loose parenchyma cells rupturing the epidermis and forming a lens-shaped opening in bark - Spongy parenchyma

Option B        Large colorless empty cell in the epidermis of grass leaves - Subsidiary cells

Option C        In dicot leaves, vascular bundles are surrounded by large thick-walled cells - Conjunctive tissue

Option D        Cells of medullary rays that form part of cambial ring - Interfascicular cambium
**Correct Option D**
**Solution:** Inter fascicular cambium is formed from medullary ray cells which is a part of vascular cambium in dicot stems.

## Q 142. Which of the following statements is incorrect ?
Option A        Oxidation -reduction reactions produce proton gradient in respiration.
Option B        During aerobic respiration, role of oxygen is limited to the terminal stage.
Option C        In ETC (Electron Transport Chain), one molecule of NADH + H$^+$ gives rise to 2ATP molecules, and one FADH$_2$ gives rise to 3ATP molecules
Option D        ATP is synthesized through complex V.
**Correct Option C**
**Solution:** In ETC of respiration, oxidation of one molecule of NADH + H$^+$ gives rise 3 ATP and FADH$_2$ produces 2 ATP.

## Q 143. Which of the following statements is incorrect?
Option A        Cyclic photophosphorylation involves both PS I and PS II.
Option B        Both ATP and NADPH + H$^+$ are synthesized during non-cyclic photophosphorylation.
Option C        Stroma lamellae have PS I only and lack NADP reductase.
Option D        Grana lamelllae have both PS I and PS II.
**Correct Option A**
**Solution:** In Cyclic photophosphorylation only PSI is involved but not PSII.

## Q 144. Match Column-I with Column-II.

| | Column-I | | Column-II |
|---|---|---|---|
| a) | *Nitrococcus* | (i) | Denitrification |
| b) | *Rhizobium* | (ii) | Conversion of ammonia to nitrite |
| c) | *Thiobacillus* | (iii) | Conversion of nitrite to nitrate |
| d) | *Nitrobacter* | (iv) | Conversion of atmospheric nitrogen to ammonia |

| | a | b | c | d |
|---|---|---|---|---|
| Option A | iv | iii | ii | i |
| Option B | ii | iv | i | iii |
| Option C | i | ii | iii | iv |
| Option D | iii | i | iv | ii |

**Correct Option B**
**Solution:** *Nitrococcus* – Conversion of ammonia to nitrite
*Rhizobium* – Conversion of atmospheric nitrogen to ammonia
*Thiobacillus* – Denitrification
*Nitrobacter* – Conversion of Nitrite to Nitrate

## Q 145. What is the role of RNA polymerase III in the process of transcription in eukaryotes?
Option A        Transcribes only snRNAs
Option B        Transcribes rRNAs (28S, 18S and 5.85S)
Option C        Transcribes tRNA, 5s rRNA and snRNA
Option D        Transcribes precursor of mRNA

**Correct Option C**

**Solution:** RNA polymerase III is involved in transcribing tRNA, 5srRNA and snRNA.

**Q 146. In the exponential growth equation**

**$N_t = N_0 e^{rt}$.e represents:**

Option A       The base of geometric logarithms

Option B       The base of number logarithms

Option C       The base of exponential logarithms

Option D       The base of natural logarithms

**Correct Option D**

**Solution:** The integral form of the exponential growth equation as $N_t = N_0 e^{rt}$

Where,

$N_t$ = Population density after time t

$N_0$ = Population density at time zero

r = intrinsic rate of natural increase

e = the base of natural logarithms (2.71828)

**Q 147. Now a days it is possible to detect the mutated gene causing cancer by allowing radioactive probe to hybridise its complimentary DNA in a clone of cells, followed by its detection using autoradiography because:**

Option A       mutated gene does not appear on photographic film as the probe has complementarity with it.

Option B       mutated gene partially appears on a photographic film

Option C       mutated gene completely and clearly appears on a photographic film.

Option D       mutated gene does not appear on a photographic film as the probe has no complementarity with it.

**Correct Option D**

**Solution:** A single stranded DNA or RNA, tagged with a radioactive molecule (probe) is allowed to hybridise to its complementary DNA in a clone of cells followed by detection using autoradiography. The clone having the mutated gene will hence not appear on the photographic film, because the probe will not have complementarity with the mutated gene

**Q 148. Match List-I with List-II.**

| List-I | List-II |
|---|---|
| a) Protein | (i) C = C double bonds |
| b) Unsaturated fatty acid | (ii) Phosphodiester bonds |
| c) Nucleic acid | (iii) Glycosidic bonds |
| d) Polysaccharide | (iv) Peptide bonds |

**Choose the correct answer from the options given below.**

|  | a | b | c | d |
|---|---|---|---|---|
| Option A | iv | iii | i | ii |
| Option B | iv | i | ii | iii |
| Option C | i | iv | iii | ii |
| Option D | ii | i | iv | iii |

**Correct Option B**

**Solution:** Protein – Peptide bonds

Unsaturated fatty acid – C = C double bonds

Nucleic acid – Phosphodiester bonds

Polysaccharide – Glycosidic bonds

**Q 149. Match List-I with List-II.**

| | List-I | | List-II |
|---|---|---|---|
| a) | S phase | (i) | Proteins are synthesized |
| b) | $G_2$ phase | (ii) | Inactive phase |
| c) | Quiescent stage | (iii) | Interval between mitosis and initiation of DNA replication |
| d) | $G_1$ phase | (iv) | DNA replication |

**Choose the correct answer from the options given below.**

| | a | b | c | d |
|---|---|---|---|---|
| Option A | ii | iv | iii | i |
| Option B | iii | ii | i | iv |
| Option C | iv | ii | iii | i |
| Option D | iv | i | ii | iii |

**Correct Option D**

**Solution:** S phase – DNA replication

$G_2$ phase – Proteins are synthesized

Quiescent stage – Inactive phase

$G_1$ phase – Interval between mitosis and initiation of DNA replication.

**Q 150. Match Column - I with Column – II.**

Column-I

a) $\% \oslash^{\!\!\!\!+} K_{(5)} C_{1+2+(2)} A_{(9)+1} \underline{G}_1$

b) $\oplus \oslash^{\!\!\!\!+} K_{(5)} \overparen{C_{(5)} A_5} \underline{G}_2$

c) $\oplus \oslash^{\!\!\!\!+} \overparen{P_{(3+3)} A_{3+3}} \underline{G}_{(3)}$

d) $\oplus \oslash^{\!\!\!\!+} K_{2+2} C_4 A_{2-4} \underline{G}_{(2)}$

Column-II

(i) Brassicaceae

(ii) Liliaceae

(iii) Fabaceae

(iv) Solanaceae

**Select the correct answer from the options given below.**

| | a | b | c | d |
|---|---|---|---|---|
| Option A | iv | ii | i | iii |
| Option B | iii | iv | ii | i |
| Option C | i | ii | iii | iv |
| Option D | ii | iii | iv | i |

**Correct Option B**

**Solution:** $\% \, \stackrel{\male}{\female} \, K_{(5)} C_{1+2+(2)} A_{(9)+1} \underline{G}_1$  **-** Fabaceae

$\oplus \, \stackrel{\male}{\female} \, K_{(5)} \overparen{C_{(5)} A_5} \underline{G}_2$  **-** Solanaceae

$\oplus \, \stackrel{\male}{\female} \, \overparen{P_{(3+3)} A_{3+3}} \underline{G}_{(3)}$  **-** Liliaceae

$\oplus \, \stackrel{\male}{\female} \, K_{2+2} C_4 A_{2\text{-}4} \underline{G}_{(2)}$  **-** Brassicaceae

<div align="center">

# ZOOLOGY
## SECTION – A

</div>

**Q 151. Receptors for sperm binding in mammals are present on :**
Option A       Zona pellucida
Option B       Corona radiata
Option C       Vitelline membrane
Option D       Perivitelline space
**Correct Option A**
**Solution:** One of the glycoproteins in the zona pellucida, called ZP3, acts as a sperm receptor.

**Q 152. Which stage of meiotic prophase shows terminalisation of chiasmata as its distinctive feature ?**
Option A       Pachytene
Option B       Leptotene
Option C       Zygotene
Option D       Diakinesis
**Correct Option D**
**Solution:** During Diakinesis of meiotic Prophase I, the distinctive feature of this stage, terminalisation of chiasmata is seen.

**Q 153. The organelles that are included in the endomembrane system are :**
Option A       Golgi complex, Endoplasmic reticulum, Mitochondria and Lysosomes
Option B       Endoplasmic reticulum, Mitochondria, Ribosomes and Lysosomes
Option C       Endoplasmic reticulum, Golgi complex, Lysosomes and Vacuoles
Option D       Golgi complex, Mitochondria, Ribosomes and Lysosomes
**Correct Option C**
**Solution:** Endomembrane system includes Endoplasmic Reticulum, Golgi complex, Lysosomes and Vacuoles.

**Q 154. A specific recognition sequence identified by endonucleases to make cuts at specific positions within the DNA is :**
Option A       Poly(A) tail sequences
Option B       Degenerate primer sequence

Option C        Okazaki sequences

Option D        Palindromic Nucleotide sequences

**Correct Option D**

**Solution:** Palindromic Nucleotide sequence is specific recognition sequence identified by endonucleases to cut the DNA strands at the specific positions.

**Q 155. Select the favourable conditions required for the formation of oxyhaemoglobin at the alveoli.**

Option A        Low $pO_2$, low $pCO_2$, more $H^+$, higher temperature

Option B        High $pO_2$, low $pCO_2$, Less $H^+$, lower temperature

Option C        Low $pO_2$, high $pCO_2$, more $H^+$, higher temperature

Option D        High $pO_2$, high $pCO_2$, Less $H^+$, lower temperature

**Correct Option B**

**Solution:** High $pO_2$, low $pCO_2$, lesser $H^+$ concentration and lower temperature are all favourable factors for the formation of oxyhaemoglobin at the alveoli.

**Q 156. Match the following :**

| List-I | List-II |
|---|---|
| a) *Physalia* | (i) Pearl oyster |
| b) *Limulus* | (ii) Portuguese Man of war |
| c) *Ancylostoma* | (iii) Living fossil |
| d) *Pinctada* | (iv) Hook worm |

Choose the correct answer from the options given below.

|  | a | b | c | d |
|---|---|---|---|---|
| Option A | i | iv | iii | ii |
| Option B | ii | iii | i | iv |
| Option C | iv | i | iii | ii |
| Option D | ii | iii | iv | i |

**Correct Option D**

**Solution:** *Physalia* - Portuguese man-of-war

*Limulus* (King crab). - Living fossil

*Ancylostoma* - (Hookworm)

*Pinctada* - Pearl oyster

**Q 157. Dobson units are used to measure thickness of :**

Option A        Troposphere

Option B        CFCs

Option C        Stratosphere

Option D        Ozone

**Correct Option D**

**Solution:** The thickness of the ozone in a column of air from the ground to the top of the atmosphere is measured in terms of Dobson units (DU).

**Q 158. Which one of the following belongs to the family Muscidae ?**

Option A       House fly

Option B       Fire fly

Option C       Grasshopper

Option D       Cockroach

**Correct Option D**

**Solution:** House fly belongs to family Muscidae.

**Q 159. Venereal diseases can spread through:**

**(a) Using sterile needles**

**(b) Transfusion of blood from infected person**

**(c) Infected mother to foetus**

**(d) Kissing**

**(e) Inheritance**

**Choose the correct answer from the options given below.**

Option A       (a) and (c) only

Option B       (a), (b) and (c) only

Option C       (b), (c) and (d) only

Option D       (b) and (c) only

**Correct Option D**

**Solution:** Venereal disease can spread through transfusion of blood from infected person, infected mother to foetus, etc. Kissing can also transmit a few STIs like CMV (cytomegalovirus), HSV (herpes simplex virus) and syphilis.

*Note: Kissing also can transmit a few STIs like CMV, herpes and syphilis.*

**Q 160. Which is the "Only enzyme" that has "Capability to catalyse Initiation, Elongation and Termination in the process of transcription in prokaryotes?**

Option A       DNase

Option B       DNA dependent DNA polymerase

Option C       DNA dependent RNA polymerase

Option D       DNA Ligase

**Correct Option C**

**Solution:** DNA dependent RNA polymerase of prokaryotes has the ability to initiate, elongate and terminate the process of transcription.

**Q 161. Match List-I with List-II.**

| List-I | List-II |
|---|---|
| a) Vaults | (i) Entry of sperm through cervix is blocked |
| b) IUDs | (ii) Removal of vas deferens |
| c) Vasectomy | (iii) Phagocytosis of sperms within the uterus |
| d) Tubectomy | (iv) Removal of fallopian tube |

**Choose the correct answer from the options given below.**

|  | a | b | c | d |
|---|---|---|---|---|
| Option A | iii | i | iv | ii |
| Option B | iv | ii | i | iii |

| | | | | |
|---|---|---|---|---|
| Option C | i | iii | ii | iv |
| Option D | ii | iv | iii | i |

**Correct Option C**

**Solution:** Vaults – Entry of sperms through cervix is blocked

IUDs – Phagocytosis of sperms within the uterus

Vasectomy – Removal of vas deferens

Tubectomy – Removal of fallopian tube

**Q 162. Match List-I with List-II.**

| List-I | List-II |
|---|---|
| a) *Aspergillus niger* | (i) Acetic Acid |
| b) *Acetobacter aceti* | (ii) Lactic Acid |
| c) *Clostridium butylicum* | (iii) Citric Acid |
| d) *Lactobacillus* | (iv) Butyric Acid |

**Choose the correct answer from the options given below.**

| | a | b | c | d |
|---|---|---|---|---|
| Option A | iv | ii | i | iii |
| Option B | iii | i | iv | ii |
| Option C | i | ii | iii | iv |
| Option D | ii | iii | i | iv |

**Correct Option B**

**Solution:** *Aspergillus niger* – Citric acid

*Acetobacter aceti* – Acetic acid

*Clostridium butylicum* – Butyric acid

*Lactobacillus* – Lactic acid

**Q 163. Identify the incorrect pair.**

| | |
|---|---|
| Option A | Drugs - Ricin |
| Option B | Alkaloids - Codeine |
| Option C | Toxin - Abrin |
| Option D | Lectins - Concanavalin A |

**Correct Option A**

**Solution:** Ricin is toxin but not drug.

**Q 164. The partial pressures (in mm Hg) of oxygen (O2) and carbon dioxide (CO2) at alveoli (the site of diffusion) are:**

| | |
|---|---|
| Option A | $pO_2$ = 159 and $pCO_2$ = 0.3 |
| Option B | $pO_2$ = 104 and $pCO_2$ = 40 |
| Option C | $pO_2$ = 40 and $pCO_2$ = 45 |
| Option D | $pO_2$ = 95 and $pCO_2$ = 40 |

**Correct Option B**

**Solution:** In the alveolar air, the partial pressures of oxygen ($pO_2$) is 104 mmHg and that of carbon dioxide ($pCO_2$) is 40 mmHg.

**Q 165. Sphincter of Oddi is present at :**

Option A         Junction of jejunum and duodenum

Option B         Ileo-caecal junction

Option C         Junction of hepato-pancreatic duct and duodenum

Option D         Gastro-oesophageal junction

**Correct Option C**

**Solution:** Sphincter of Oddi guards the opening of hepatopancreatic duct into duodenum.

**Q 166. Which of the following RNAs is not required for the synthesis of protein?**

Option A         siRNA

Option B         mRNA

Option C         tRNA

Option D         rRNA

**Correct Option A**

**Solution:** siRNA (smaller interference RNA) is involved in preventing the translation of mRNA to form protein. It is associated with pest resistance in plants by RNA interference.

**Q 167. Succus entericus is referred to as :**

Option A         Chyme

Option B         Pancreatic juice

Option C         Intestinal juice

Option D         Gastric juice

**Correct Option C**

**Solution:** Succus entericus is also called intestinal juice. The secretions of the brush border cells of the mucosa along with the secretions of the goblet cells constitute the intestinal juice.

**Q 168. Persons with 'AB' blood group are called as "Universal recipients". This is due to :**

Option A         Absence of antibodies, anti-A and anti-B, in plasma.

Option B         Absence of antigens A and B on the surface of RBCs.

Option C         Absence of antigens A and B in plasma.

Option D         Presence of antibodies, anti-A and anti-B, on RBCs.

**Correct Option A**

**Solution:** Persons with 'AB' group can accept blood from persons with AB as well as the other groups of Blood because they do not have anti A and anti B antibodies in their blood plasma.

**Q 169. Which of the following characteristics is incorrect with respect to cockroach?**

Option A         10th abdominal segment in both sexes, bears a pair of anal cerci.

Option B         A ring of gastric caeca is present at the junction of midgut and hind gut.

Option C         Hypopharynx lies within the cavity enclosed by the mouth parts.

Option D         In females, 7th-9th sterna together form a genital pouch.

**Correct Option B**

**Solution:** A ring of 6-8 blind tubules called hepatic or gastric caeca is present at the junction of foregut and midgut, which secrete digestive juice.

**Q 170. Which of the following statements wrongly represents the nature of smooth muscle?**
Option A        These muscles are present in the wall of blood vessels
Option B        These muscle have no striations
Option C        They are involuntary muscles
Option D        Communication among the cells is performed by intercalated discs
**Correct Option D**
**Solution:** Communication among the cells is performed by intercalated discs in cardiac muscle. Intercalated discs are absent in smooth muscle.

**Q 171. Which of the following organisms bears hollow and pneumatic long bones?**
Option A        *Ornithorhynchus*
Option B        *Neophron*
Option C        *Hemidactylus*
Option D        *Macropus*
**Correct Option B**
**Solution:** In Aves (e.g., Neophron), endoskeleton is fully ossified (bony) and the long bones are hollow with air cavities (pneumatic).

**Q 172. If Adenine makes 30% of the DNA molecule, what will be the percentage of Thymine, Guanine and Cytosine in it?**
Option A        T : 20 ; G : 25 ; C : 25
Option B        T : 20 ; G : 30 ; C : 20
Option C        T : 20 ; G : 20 ; C : 30
Option D        T : 30 ; G : 20 ; C : 20
**Correct Option D**
**Solution:** Thymine – 30%, Guanine – 20%, Cytosine – 20% (Chargaffs nitrogen base pairing rule which states that amount of Adenine is equal to Thymine and Guanine is equal to Cytosine.

**Q 173. Which enzyme is responsible for the conversion of inactive fibrinogens to fibrins ?**
Option A        Thrombokinase
Option B        Thrombin
Option C        Renin
Option D        Epinephrine
**Correct Option B**
**Solution:** The enzyme thrombin converts inactive fibrinogens in the plasma into fibrins.

**Q 174. In a cross between a male and female, both heterozygous for sickle cell anaemia gene, what percentage of the progeny will be diseased?**
Option A        100%
Option B        50%
Option C        75%
Option D        25%
**Correct Option D**
**Solution:**

Female
$Hb^{\wedge}Hb^{s}$     X     Male
$Hb^{\wedge}Hb^{s}$

$Hb^{\wedge}Hb^{\wedge}$    $Hb^{\wedge}Hb^{S}$    $Hb^{\wedge}Hb^{s}$    $Hb^{S}Hb^{S}$
(25%)    (50%)    (25%)
Sickle cell disease
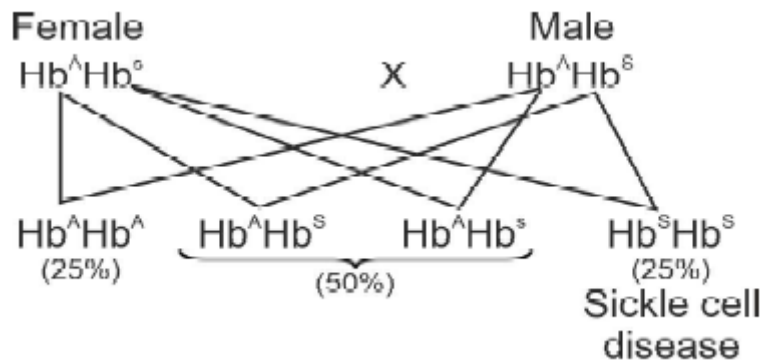
## Q 175. Which one of the following is an example of Hormone releasing IUD ?

Option A     Multiload 375
Option B     Cu T
Option C     LNG 20
Option D     Cu 7

**Correct Option C**

**Solution:** LNG 20 is a hormone-releasing intrauterine device. It releases 20 micrograms of levonorgestrel (synthetic progestogen) per day. Progestasert is also a hormone releasing IUD. Cu T, Cu 7 and Multiload 375 are copper-releasing IUDs.

## Q 176. The centriole undergoes duplication during

Option A     G2 phase
Option B     S-phase
Option C     Prophase
Option D     Metaphase

**Correct Option B**

**Solution:** Centrioles duplicate in S phase of cell cycle.

## Q 177. Chronic autoimmune disorder affecting neuro muscular junction leading to fatigue, weakening and paralysis of skeletal muscle is called as

Option A     Gout
Option B     Arthritis
Option C     Muscular dystrophy
Option D     Myasthenia gravis

**Correct Option D**

**Solution:** Myasthenia gravis is an autoimmune disorder affecting neuromuscular junction leading to fatigue, weakening and paralysis of skeletal muscle.

## Q 178. For effective treatment of the disease, early diagnosis and understanding its pathophysiology is very important. Which of the following molecular diagnostic techniques is very useful for early detection ?

Option A     Hybridization Technique
Option B     Western Blotting Technique
Option C     Southern Blotting Technique
Option D     ELISA Technique

**Correct Option D**

**Solution:** Recombinant DNA technology, Polymerase Chain Reaction (PCR) and Enzyme Linked Immunosorbent Assay (ELISA) are some of the techniques that serve the purpose of early diagnosis.

**Q 179. Read the following statements.**
**(a) Metagenesis is observed in Helminths.**
**(b) Echinoderms are triploblastic and coelomate animals.**
**(c) Round worms have organ-system level of body organization.**
**(d) Comb plates present in ctenophores help in digestion.**
**(e) Water vascular system is characteristic of Echinoderms.**
**Choose the correct answer from the options given below.**

Option A        (b), (c) and (e) are correct
Option B        (c), (d) and (e) are correct
Option C        (a), (b) and (c) are correct
Option D        (a), (d) and (e) are correct
**Correct Option A**
**Solution:** Metagenesis is exhibited by cnidarians (not helminths). Comb plates of ctenophores help in locomotion (not digestion).

**Q 180. Erythropoietin hormone which stimulates R.B.C. formation is produced by :**
Option A        Juxtaglomerular cells of the kidney
Option B        Alpha cells of pancreas
Option C        The cells of rostral adenohypophysis
Option D        The cells of bone marrow
**Correct Option A**
**Solution:** The juxtaglomerular cells of kidney produce a peptide hormone called erythropoietin which stimulates erythropoiesis (formation of RBC).

**Q 181. With regard to insulin choose correct options.**
**(a) C-peptide is not present in mature insulin.**
**(b) The insulin produced by rDNA technology has C peptide.**
**(c) The pro-insulin has C-peptide.**
**(d) A-peptide and B-peptide of insulin are interconnected by disulphide bridges.**
**Choose the correct answer from the options given below.**
Option A        (a) and (d) only
Option B        (b) and (d) only
Option C        (b) and (c) only
Option D        (a), (c) and (d) only
**Correct Option D**
**Solution:** C peptide present in proinsulin is removed during its maturation. The insulin produced by rDNA technology has only A peptide and B peptide.

## Q 182. Match List-I with List-II.

| | List-I | | List-II |
|---|---|---|---|
| a) | Metamerism | (i) | Coelenterata |
| b) | Canal system | (ii) | Ctenophora |
| c) | Comb plates | (iii) | Annelida |
| d) | Cnidoblasts | (iv) | Porifera |

Choose the correct answer from the options given below.

| | a | b | c | d |
|---|---|---|---|---|
| Option A | iv | i | ii | iii |
| Option B | iv | iii | i | ii |
| Option C | iii | iv | i | ii |
| Option D | iii | iv | ii | i |

**Correct Option D**

**Solution:** Metamerism – Annelida

Canal system – Porifera

Comb plates – Ctenophora

Cnidoblasts - Coelenterata

## Q 183. Which of the following is not an objective of Biofortification in crops ?

Option A        Improve micronutrient and mineral content.

Option B        Improve protein content.

Option C        Improve resistance to diseases.

Option D        Improve vitamin content.

**Correct Option C**

**Solution:** Improving resistance to disease in crop is not an objective of Biofortification of crops.

## Q 184. During the process of gene amplification using PCR, if very high temperature is not maintained in the beginning, then which of the following steps of PCR will be affected first ?

Option A        Ligation

Option B        Annealing

Option C        Extension

Option D        Denaturation

**Correct Option D**

**Solution:** During PCR process, if high temperature is not maintained, the initial step of the process known as denaturation of DNA is not done.

## Q 185. The fruit fly has 8 chromosomes (2n) in each cell. During interphase of Mitosis if the number of chromosomes at G1 phase is 8, what would be the number of chromosomes after S phase ?

Option A        32

Option B        8

Option C        16

Option D        4

**Correct Option B**

**Solution:** During mitotic cell cycle if the chromosome number in G1 phase is 8, it remains same till Metaphase. Hence, even after S phase same chromosome number 8 is maintained in the cell of fruit fly.

# (BIOLOGY : ZOOLOGY)
## SECTION - B

**Q 186.**
**Assertion-(A) : A person goes to high altitude and experiences 'altitude sickness' with symptoms like breathing difficulty and heart palpitations.**
**Reason-(R) : Due to low atmospheric pressure at high altitude, the body does not get sufficient oxygen.**
**In the light of the above statements, choose the correct answer from the options given below.**
Option A         (A) is false but (R) is true
Option B         Both (A) and (R) are true and (R) is the correct explanation of (A)
Option C         Both (A) and (R) are true and (R) is not the correct explanation of (A)
Option D         (A) is true but (R) is false
**Correct Option B**
**Solution:** A person goes to high altitude and experiences altitude sickness with symptoms like breathing difficulty and heart palpitations because in the low atmospheric pressure of high altitudes, the body does not get enough oxygen.

**Q 187.**
**Statement-I : The codon 'AUG' codes for methionine and phenylalanine.**
**Statement-II : 'AAA' and 'AAG' both codons code for the amino acid lysine.**
**In the light of the above statements, choose the correct answer from the options given below.**
Option A         Statement-I is incorrect but Statement-II is true
Option B         Both Statement-I and Statement-I are true
Option C         Both Statement-I and Statement-II are false
Option D         Statement-I is correct but Statement-II is false
**Correct Option A**
**Solution:** AUG codes for only methionine but not tryptophan. (A given codon codes for only one amino acid but not more than one amino acids.). AAG and AAA are the two codons for the amino acid Lysine.

**Q 188. Following are the statements about prostomium of earthworm.**
**(a) It serves as a covering for mouth.**
**(b) It helps to open cracks in the soil into which it can crawl.**
**(c) It is one of the sensory structures.**
**(d) It is the first body segment.**
**Choose the correct answer from the options given below.**
Option A         (b) and (c) are correct
Option B         (a), (b) and (c) are correct
Option C         (a), (b) and (d) are correct
Option D         (a), (b), (c) and (d) are correct
**Correct Option B**

**Solution:** Anterior end consists of the mouth and the prostomium, a lobe which serves as a covering for the mouth and as a wedge to force open cracks in the soil into which the earthworm may crawl. The prostomium is sensory in function. The first body segment is called the peristomium (buccal segment) which contains the mouth.

**Q 189. Which of the following is not a step in Multiple Ovulation Embryo Transfer Technology (MOET) ?**

Option A        Fertilized eggs are transferred to surrogate mothers at 8-32 cell stage
Option B        Cow is administered hormone having LH like activity for super ovulation
Option C        Cow yields about 6-8 eggs at a time
Option D        Cow is fertilized by artificial insemination

**Correct Option B**

**Solution:** In MOET a cow is administered hormones, with FSH-like activity, to induce follicular maturation and super ovulation.

**Q 190. Identify the types of cell junctions that help to stop the leakage of the substances across a tissue and facilitation of communication with neighbouring cells via rapid transfer of ions and molecules.**

Option A        Adhering junctions and Gap junctions, respectively
Option B        Gap junctions and Adhering junctions, respectively
Option C        Tight junctions and Gap junctions, respectively
Option D        Adhering junctions and Tight junctions, respectively

**Correct Option C**

**Solution:** Tight junctions help to stop substances from leaking across a tissue. Gap junctions facilitate the cells to communicate with each other by connecting the cytoplasm of adjoining cells, for rapid transfer of ions, small molecules and sometimes big molecules.

**Q191. Which of the following secretes the hormone, relaxin, during the later phase of pregnancy?**

Option A        Uterus
Option B        Graafian follicle
Option C        Corpus luteum
Option D        Foetus

**Correct Option: (C)**

**Solution.** Relaxin is produced first by the corpus luteum of the ovary and later by the placenta. It helps in parturition as it increases the flexibility of the pubic symphysis and helps dilate the uterine cervix.

**Q192. During muscular contraction which of the following events occur?**

**(a)  'H' zone disappears**
**(b)  'A' band widens**
**(c)  'I' band reduces in width**
**(d)  Myosin hydrolyzes ATP, releasing the ADP and Pi**
**(e)  Z-lines attached to actins are pulled inwards**

**Choose the correct answer from the options given below.**

Option A        (b), (d), (e), (a) only
Option B        (a), (c), (d), (e) only

Option C        (a), (b), (c), (d) only
Option D        (b), (c), (d), (e) only
**Correct Option: (B)**
**Solution.** During muscle contraction, the cross bridges pull the thin filaments towards the centre of A band. The Z line attached to the actins are also pulled inwards thereby causing a shortening of the sarcomere. The I bands get reduced, whereas the 'A' bands retain the length. Myosin head acts as ATPase.

**193.    The Adenosine deaminase deficiency results into:**
Option A        Addison's disease
Option B        Dysfunction of Immune system
Option C        Parkinson's disease
Option D        Digestive disorder
**Correct Option: (B)**
**Solution.** Adenosine deaminase (ADA) is crucial for the immune system to function. Its deficiency causes severe combined immunodeficiency.

**194.    Match List - I with List – II**

| List - I | List – II |
|---|---|
| (a)  **Adaptive radiation** | **(i) Selection of resistant varieties due to** |
| (b)  **Convergent evolution** | **excessive use of herbicides and pesticides** |
| (c)  **Divergent evolution** | **(ii) Bones of forelimbs in Man and Whale** |
| (d)  **Evolution by anthropogenic action** | **(iii) Wings of Butterfly and Bird** |
|  | **(iv) Darwin Finches** |

**Choose the correct answer from the options given below.**

|           | a | b | c | d |
|-----------|------|------|------|------|
| Option A  | (i)   | (iv)  | (iii) | (ii)  |
| Option B  | (iv)  | (iii) | (ii)  | (i)   |
| Option C  | (iii) | (ii)  | (i)   | (iv)  |
| Option D  | (ii)  | (i)   | (iv)  | (iii) |

**Correct Option: (B)**
**Solution.**

| Adaptive Radiation | Darwin Finches |
|---|---|
| Convergent evolution | Wings of Butterfly and Bird |
| Divergent evolution | Bone of forelimbs in Man and Whale |
| Evolution by anthropogenic action | Selection of resistant varieties due to excessive use of herbicides and pesticides |

**195. Which of these is not an important component of initiation of parturition in humans?**
Option A        Release of Prolactin
Option B        Increase in estrogen and progesterone ratio
Option C        Synthesis of prostaglandins
Option D        Release of Oxytocin
**Correct Option: (A)**
**Solution.** Release of Prolactin is not an important component of initiation of parturition in humans.

Towards the end of pregnancy, the increasing ratio of estrogen to progesterone promotes uterine contractions. Progesterone no longer inhibits them. High levels of estrogens increase the number oxytocin receptors and gap junctions in the myometrium. Prostaglandins induce the softening of uterine cervix and enhance uterine contractile strength.

**196.** Following are the statements with reference to 'lipids'.
**(a)** Lipids having only single bonds are called unsaturated fatty acids.
**(b)** Lecithin is a phospholipid.
**(c)** Trihydroxy propane is glycerol.
**(d)** Palmitic acid has 20 carbon atoms including carboxyl carbon.
**(e)** Arachidonic acid has 16 carbon atoms.
**Choose the correct answer from the options given below.**
Option A        (b) and (e) only
Option B        (a) and (b) only
Option C        (c) and (d) only
Option D        (b) and (c) only
**Correct Option :(D)**
**Solution**: Lecithin is a phospholipid. Glycerol is trihydroxy propane. Unsaturated fatty acids have double bonds in R group at one or more regions.

**197. Match List I With List II**

| List - I | | List – II | |
|---|---|---|---|
| **(a)** | **Allen's Rule** | **(i)** | **Kangaroo rat** |
| **(b)** | **Physiological adaptation** | **(ii)** | **Desert Lizard** |
| **(c)** | **Behavioural adaptation** | **(iii)** | **Marine Fish at depth** |
| **(d)** | **Biochemical adaptation** | **(iv)** | **Polar seal** |

**Choose the correct answer from the options given below.**

|  | **a** | **b** | **c** | **d** |
|---|---|---|---|---|
| Option A | (iv) | (iii) | (ii) | (i) |
| Option B | (iv) | (ii) | (iii) | (i) |
| Option C | (iv) | (i) | (iii) | (ii) |
| Option D | (iv) | (i) | (ii) | (iii) |

**Correct Option: (D)**
**Solution.**

| Allen's Rule | Polar seal |
|---|---|
| Physiological adaptation | Kangaroo rat |
| Behavioural adaptation | Desert Lizard |
| Biochemical adaptation | Marine Fish at depth |

## 198. Match List I With List II

| List - I | | List – II | |
|---|---|---|---|
| a) | Filariasis | i. | *Haemophilus influenzae* |
| b) | Amoebiasis | ii. | *Trichophyton* |
| c) | Pneumonia | iii. | *Wuchereria bancrofti* |
| d) | Ringworm | iv. | *Entamoeba histolytica* |

**Choose the correct answer from the options given below.**

| | a | b | c | d |
|---|---|---|---|---|
| Option A | (ii) | (iii) | (i) | (iv) |
| Option B | (iv) | (i) | (iii) | (ii) |
| Option C | (iii) | (iv) | (i) | (ii) |
| Option D | (i) | (ii) | (iv) | (iii) |

**Correct Option: (C)**

**Solution.**

| Filariasis | *Wuchereria bancrofti* |
|---|---|
| Amoebiasis | *Entamoeba histolytica* |
| Pneumonia | *Haemophilus influenzae* |
| Ringworm | *Trichophyton* |

## 199. Which one of the following statements about Histones is wrong?

| Option A | Histones carry positive charge in the side chain. |
|---|---|
| Option B | Histones are organised to form a unit of 8 molecules. |
| Option C | The pH of histones is slightly acidic. |
| Option D | Histones are rich in amino acids- Lysine and Arginine. |

**Correct Option: (C)**

**Solution.** Histones are basic proteins. Hence, they are alkaline or basic because of abundance of basic amino acids Lysine and Arginine.

## 200. Match List I With List II

| List - I | | List – II | |
|---|---|---|---|
| a. | Scapula | i. | Cartilaginous joints |
| b. | Cranium | ii. | Flat bone |
| c. | Sternum | iii. | Fibrous joints |
| d. | Vertebral Column | iv. | Triangular flat bone |

**Choose the correct answer from the options given below.**

| | a | b | c | d |
|---|---|---|---|---|
| Option A | (iv) | (iii) | (ii) | (i) |
| Option B | (i) | (iii) | (ii) | (iv) |
| Option C | (ii) | (iii) | (iv) | (i) |
| Option D | (iv) | (ii) | (iii) | (i) |

**Correct Option: (A)**

**Solution.**

| | |
|---|---|
| Scapula | Triangular flat bone |
| Cranium | Fibrous joints |
| Sternum | Flat bone |
| Vertebral Column | Cartilaginous joints |