PHYSICS

SECTION - A

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:

   (1) 4 v

   (2) v

   (3) 2 v

   (4) 3 v

Ans: (1)

Sol: $V_e = \sqrt{\frac{2GM}{R}} = \sqrt{\frac{2G\frac{4}{3}\pi R^3\rho}{R}} \Rightarrow V_e \propto R$

$\therefore \frac{V'}{V} = \frac{4R}{R} \Rightarrow V' = 4V$

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

   (1) $\frac{5}{13}t$

   (2) $\frac{13}{10}t$

   (3) $\frac{13}{5}t$

   (4) $\frac{10}{13}t$

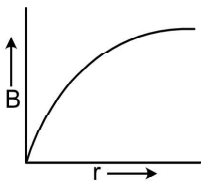
Ans: (3)

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

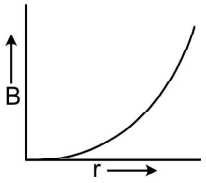
$\Rightarrow \frac{20}{t'} \times \frac{t}{10} = \frac{50}{65} \Rightarrow t_, = 2t \times \frac{65}{50} = \frac{13}{5}t$

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:

   (1)



   (2)



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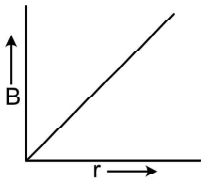
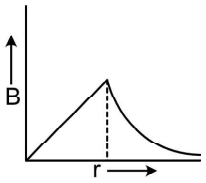


   (4)



Ans: (4)

Sol: $B \propto r\left(0 \le r \le R\right)$

$B \propto \frac{1}{r}\left(r \ge R\right)$

4. Polar molecules are the molecules:

   (1) having a permanent electric dipole moment.

   (2) having zero dipole moment.

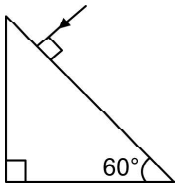
   (3) acquire a dipole moment only in the presence of electric field due to displacement of charges.

   (4) acquire a dipole moment only when magnetic field is absent.

Ans: (1)

Sol: Theory

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



   (1) 90°

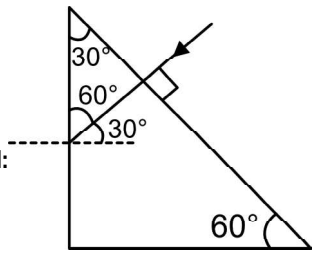
   (2) 60°

   (3) 30°

   (4) 45°

Ans: (2)

Sol:



$\frac{\sin e}{\sin 30^\circ} = \sqrt{3}$

$\Rightarrow \sin e = \frac{\sqrt{3}}{2} \Rightarrow e = 60^\circ$

6. A parallel plate capacitor has a uniform electric field '$\vec{E}$' 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 : (ε_0 = permittivity of free space)

(1) $\frac{E^2Ad}{\varepsilon_0}$

(2) $\frac{1}{2}\varepsilon_0E^2$

(3) ε_0EAd

(4) $\frac{1}{2}\varepsilon_0E^2Ad$

Ans: (4)

Sol: Energy density $u=\frac{1}{2}\varepsilon_0E^2$

Total energy stored, $U=u\times(Ad)=\frac{1}{2}\varepsilon_0E^2Ad$

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:

(1) $\frac{S}{4},\sqrt{\frac{3gS}{2}}$

(2) $\frac{S}{4},\frac{3gS}{2}$

(3) $\frac{S}{4},\frac{\sqrt{3gS}}{2}$

(4) $\frac{S}{2},\frac{\sqrt{3gS}}{2}$

Ans: (1)

Sol: Conserving energy,

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

$\Rightarrow 4mgh=mgs\Rightarrow h=S/4$

$\therefore K=3mg\frac{S}{4}$

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

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 :

(1) 2Mg

(2) $\frac{Mg}{2}$

(3) Mg

(4) $\frac{3}{2}Mg$

Ans: (2)

Sol: $F_D+B=Mg$

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

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.

(1) No current will flow in p-type, current will only flow in n-type.

(2) current in n-type = current in p-type.

(3) current in p-type > current in n-type.

(4) current in n-type > current in p-type.

Ans: (4)

Sol: I_N=Current in N-type semiconductor

$=(\mu_eN_e+\mu_hn_h)eAE$

I_P=Current in P-type semiconductor

$=(\mu_hN_h+\mu_en_e)eAE$

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

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

Where $N_e=$ electron concentration in N-type

$N_h=$ Hole concentration in P-type

and $N_e=N_h$

$n_h=$ hole concentration in N-type

$n_e=$ Electron concentration in P-type

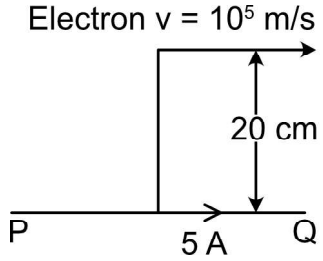
$\therefore I_N-I_P=\left[(\mu_e-\mu_h)N_e+(\mu_h-\mu_e)n_e\right]eAE$

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

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

We conclude $I_N>I_P$

10. An infinitely long straight conductor carries a current of 5 A as shown. An electron is moving with a speed of 10^5m/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.



(1) 8×10^{-20}N

(2) 4×10^{-20}N

(3) $8\pi\times10^{-20}$N

(4) $4\pi\times10^{-20}$N

Ans: (1)

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

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

$$=\frac{\left(1.6\times10^{-19}\right)\times10^5\times4\pi\times10^{-7}\times5}{2\pi\times0.2}N$$

$$=\frac{1.6\times2\times5}{2}\times10^{-20}N$$

$$\Rightarrow F=8\times10^{-20}N$$

11. An electromagnetic wave of wavelength 'λ' is incident on a photosensitive surface of negligible work function. If 'm' mass is of photoelectron emitted from the surface has de-Broglie wavelength λ_d, then :

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

(2) $\lambda=\left(\frac{2m}{hc}\right)\lambda_d^2$

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

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

Ans: (4)

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

$$\Rightarrow\frac{p^2}{2m}=\frac{hc}{\lambda}\Rightarrow p=\sqrt{\frac{2mhc}{\lambda}}$$

$$\Rightarrow\lambda_d=\frac{h}{p}=h\sqrt{\frac{\lambda}{2mhc}}=\sqrt{\frac{\lambda h}{2mc}}\Rightarrow\lambda=\left(\frac{2mc}{h}\right)\lambda_d^2$$

12. Two charged spherical conductors of radius R_1 and R_2 are connected by a wire. Then the ratio of surface charge densities of the spheres $\left(\sigma_1/\sigma_2\right)$ is :

(1) $\frac{R_1^2}{R_2^2}$

(2) $\frac{R_1}{R_2}$

(3) $\frac{R_2}{R_1}$

(4) $\sqrt{\left(\frac{R_1}{R_2}\right)}$

Ans: (3)

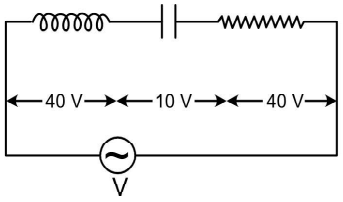
Sol: $\frac{Q_1}{4\pi\varepsilon_0R_1}=\frac{Q_2}{4\pi\varepsilon_0R_2}=V$

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

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

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

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 $10\sqrt{2}$ A. The impedance of the circuit is :



(1) 5Ω

(2) $4\sqrt{2}\Omega$

(3) $5/\sqrt{2}\Omega$

(4) 4Ω

Ans: (1)

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

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

So peak value of supply voltage $=50\sqrt{2}$ volt

$$\therefore Z=50\sqrt{2}/10\sqrt{2}$$

$$=5\Omega\qquad\qquad\therefore Z=5\Omega$$

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

(1) $-\hat{j}+\hat{k}, -\hat{j}+\hat{k}$

(2) $\hat{j}+\hat{k}, \hat{j}+\hat{k}$

(3) $-\hat{j}+\hat{k}, -\hat{j}-\hat{k}$

(4) $\hat{j}+\hat{k}, -\hat{j}-\hat{k}$

Ans: (3)

Sol: $\left(\vec{E}\times\vec{B}\right)$ 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 $\vec{E}.\vec{B}=\left(-\hat{j}+\hat{k}\right)\left(-\hat{j}-\hat{k}\right)=0$

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

(1) (A) is incorrect but (B) is correct.

(2) (A) and (B) both are correct.

(3) (A) and (B) both are incorrect.

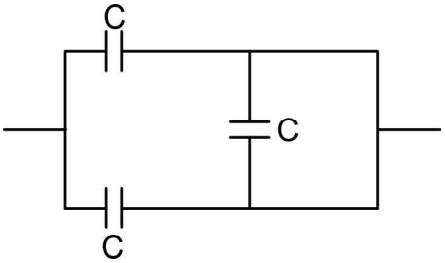
(4) (A) is correct and (B) is incorrect.

Ans: (4)

Sol: Both (A) and (B) are correct.

For Ge P-N junction, potential barrier is 0.3 volt.

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



(1) 3C/2

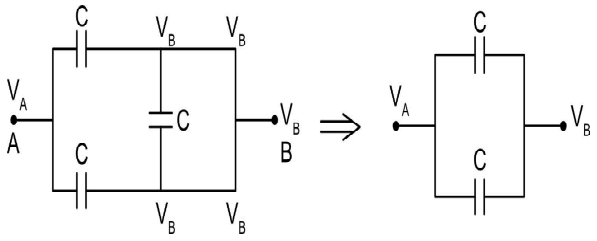
(2) 3C

(3) 2C

(4) C/2

Ans: (3)

Sol:



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

17. 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?

(1) 62 cm

(2) 60 cm

(3) 21.6 cm

(4) 64 cm

Ans: (2)

Sol: Potential gradient $=\dfrac{1.5}{36}$ [Initially]

Finally $\dfrac{2.5}{l_2}=\dfrac{1.5}{36}$

$\Rightarrow l_2=\dfrac{36\times2.5}{1.5}=60\,\text{cm}$

18. 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:

(1) $I_d=V_0\omega C\sin\omega t$

(2) $I_d=V_0\omega C\cos\omega t$

(3) $I_d=\dfrac{V_0}{\omega C}\cos\omega t$

(4) $I_d=\dfrac{V_0}{\omega C}\sin\omega t$

Ans: (2)

Sol: The displacement current is given by

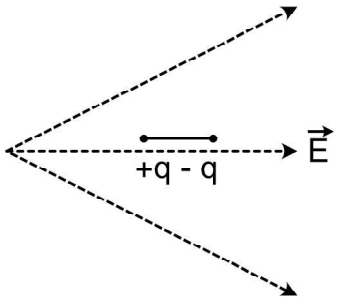
$I_d=C\dfrac{dV}{dt}$

$=C\dfrac{d}{dt}\left[V_0\sin\omega t\right]$

$=CV_0\omega\cos\omega t$

$I_d=V_0\left(\omega C\right)\cos\omega t$

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



(1) towards the right as its potential energy will increase.

(2) towards the left as its potential energy will increase.

(3) towards the right as its potential energy will decrease.

(4) towards the left as its potential energy will decrease.

Ans: (3)

Sol: As the electric field will loose its strength in the rightward direction. So, the force on (+q) will be more then the force on (-q)

$$E_1 \xrightarrow{E_1 > E_2} E_2$$

$$(+q) \longrightarrow qE_1 \qquad -qE_2 \longleftarrow (-q)$$

$$\left|\vec{F}_1\right| > \left|\vec{F}_2\right|$$

Hence the dipole will move towards right as in the direction of electric field potential reduces

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 3.3×10^{-3} watt will be : $\left(h = 6.6\times10^{-34}\,\text{Js}\right)$

(1) 10^{15}

(2) 10^{18}

(3) 10^{17}

(4) 10^{16}

Ans: (4)

Sol: The number of protons delivered per second is given by

$$\frac{n}{t} = \frac{IA\lambda}{hc} = \frac{P\lambda}{hc} \Rightarrow \frac{n}{t} = \frac{3.3\times10^{-3}\times600\times10^{-9}}{3\times10^{8}\times6.6\times10^{-34}}$$

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

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

(1) $\frac{2n}{2n-1}$

(2) $\frac{2n-1}{2n}$

(3) $\frac{2n-1}{2n+1}$

(4) $\frac{2n+1}{2n-1}$

Ans: (3)

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

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

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

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

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 100 divisions on the circular scale. The diameter of the wire from the above data is :

(1) 0.052 cm

(2) 0.52 cm

(3) 0.026 cm

(4) 0.26 cm

Ans: (1)

Sol: Least count $= \frac{1}{100} = 0.01\text{mm}$

Diameter of the wire

$$= \text{CSR} \times \text{LC}$$

$$= 52\times0.01\text{mm}$$

$$= 0.52\text{mm}$$

$$d = 0.052\text{cm}$$

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

(1) β^-, α, β^+

(2) α, β^-, β^+

(3) α, β^+, β^-

(4) β^+, α, β^-

Ans: (4)

Sol: ${}_{Z}X^{A} \to_{Z-1} B\left(\beta^+ \text{decay}\right)$

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

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

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

(1) a large aperture contributes to the quality and visibility of the images.

(2) a large area of the objective ensures better light gathering power.

(3) a large aperture provides a better resolution.

(4) all of the above.

Ans: (4)

Sol: All of the above

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

(1) 4n

(2) n

(3) 2n

(4) 3n

Ans: (3)

Sol: Potential energy of a particle executing SHM is given by

$U = \frac{1}{2}m\omega^2x^2$

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

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

(1) $\frac{2}{3\sqrt{2}}$ (2) $1/2$

(3) $\frac{1}{2\sqrt{2}}$ (4) $\frac{2}{3}$

Ans: (3)

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

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)	$\frac{1}{3}nm\bar{v}^2$
(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)	$\frac{3}{2}k_BT$

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

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

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

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

Ans: (4)

Sol: $A \to Q$

$B \to P$

$C \to S$

$D \to R$

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

(1) $[F]\,[A^{-1}]\,[T]$

(2) $[F]\,[A]\,[T]$

(3) $[F]\,[A]\,[T^2]$

(4) $[F]\,[A]\,[T^{-1}]$

Ans: (3)

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

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? ($g = 10\ m/s^2$)

(1) 7.0 kW

(2) 10.2 kW

(3) 8.1 kW

(4) 12.3 kW

Ans: (3)

Sol: 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

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 Ω. What will be the effective resistance if they are connected in series?

(1) 4Ω (2) 0.25Ω

(3) 0.5Ω (4) 1Ω

Ans: (1)

Sol: 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

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

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) $\frac{m}{ne^2\rho}$
B) Electrical Resistivity	Q) nev_d
C) Relaxation Period	R) $\frac{eE}{m}\tau$
D) Current Density	S) $\frac{E}{J}$

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

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

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

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

Ans: (2)

Sol: $j = neV_d = \sigma E$

$\sigma = j/E \Rightarrow \rho = E/j$

$(A) \rightarrow (R)$

$(B) \rightarrow (S)$

$(C) \rightarrow (P)$

$(D) \rightarrow (Q)$

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 :

(1) 216 MeV

(2) 0.9 MeV

(3) 9.4 MeV

(4) 804 MeV

Ans: (1)

Sol: 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

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 :

(1) 30

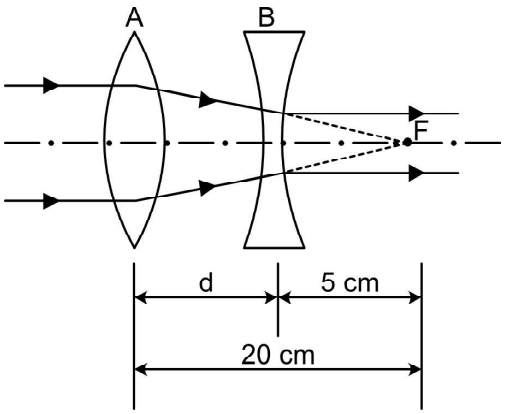
(2) 25

(3) 15

(4) 50

Ans: (3)

Sol:



Point F is the second focal length of A and first focal length of B.

$\therefore d = (20-5)\text{cm} = 15\text{ cm}$

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 :

(1) 0.628 s

(2) 0.0628 s

(3) 6.28 s

(4) 3.14 s

Ans: (1)

Sol: $K = \frac{10}{5\times10^{-2}}\text{N/m}$ = 200 N/m

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

T = 0.628 s

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

(1) $\left[M^2\right]\left[L^{-2}\right]\left[T^{-1}\right]$

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

(3) $[M]\left[L^{-1}\right]\left[T^{-1}\right]$

(4) $[M]\left[L^0\right]\left[T^0\right]$

Ans: (2)

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

$$[G]=\frac{\left[Fr^2\right]}{\left[m_1m_2\right]}=\left[\frac{MLT^{-2}L^2}{M^2}\right]=M^{-1}L^3T^{-2}$$

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

SECTION - B

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.

(1) 1980 V

(2) 660 V

(3) 1320 V

(4) 1520 V

Ans: (1)

Sol: 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 $\frac{4}{3}\pi r^3n=\frac{4}{3}\pi R^3$

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

Now potential of the small drop $V=\frac{q}{4\pi\in_0 r}=220\,V$

Potential of the big drop,

$$V=\frac{nq}{4\pi\in_0 R}=\frac{nq}{4\pi\in_0 n^{1/3}r}=n^{2/3}\frac{q}{4\pi\in_0 r}$$

$V=(27)^{2/3}\times220\,V$

= 9 × 220 = 1980 V

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 :

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

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

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

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

Ans: (1)

Sol: Velocity of the particle $v=\frac{2\pi R}{T}$

When projected at angle θ

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

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

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

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

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

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

38. From a circular ring of mass 'M' and radius 'R' an arc correspoonding 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 'MR^2'. Then the value of 'K' is :

(1) $\frac{1}{8}$

(2) $\frac{3}{4}$

(3) $\frac{7}{8}$

(4) $\frac{1}{4}$

Ans: (2)

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

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

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

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 :

(1) $4\ Ia^2$ and $3\ Ia^2$

(2) $\sqrt{3}Ia^2$ and $3Ia^2$

(3) $3Ia^2$ and Ia^2

(4) $3\ Ia^2$ and $4Ia^2$

Ans: (2)

Sol: (i) If it is an equilateral triangle of side 'a' no. of triangular loops formed $\frac{12a}{3a}=4$

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

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

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

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

40. Two condcuting circular loops of radii R_1 and R_2 are placed in the same plane with their centres coinciding. If $R_1 >> R_2$, the mutual indcutance M between them will be directly proportional to :

(1) $\frac{R_2^2}{R_1}$

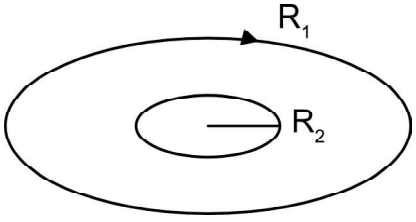
(2) $\frac{R_1}{R_2}$

(3) $\frac{R_2}{R_1}$

(4) $\frac{R_1^2}{R_2}$

Ans: (1)

Sol:



Magnetic field due to R_1 at the center

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

Flux linked with R_2

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

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

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

41. A partile of mass 'm' is projected with a velocity $v=kV_e\ (k<1)$ from the surface of the earth.

(V_e= escape velocity)

The maximum height above the surface reached by the particle is :

(1) $\frac{Rk^2}{1-k^2}$

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

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

(4) $\frac{R^2k}{1+k}$

Ans: (1)

Sol: 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

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

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

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

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

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

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

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

42. A step down tranformer 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 ?

(1) 4 A

(2) 0.2 A

(3) 0.4 A

(4) 2 A

Ans: (2)

Sol: $V_P = 220\,V$ $V_S = 11\,V$ P = 44 W

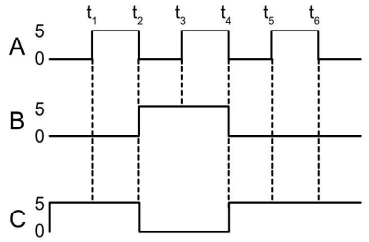
As it is an ideal transformer

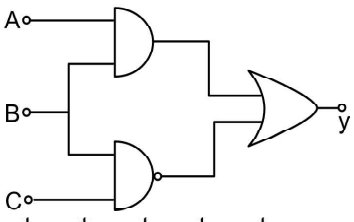
$V_P i_P = V_S i_S = 44\,W$

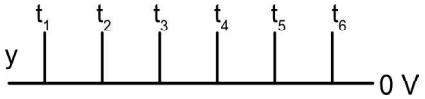
$220 \times i_P = 44$

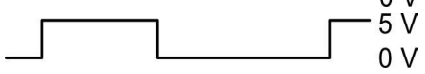
$i_P = \frac{44}{220} = \frac{1}{5} = 0.2\,A$

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 ?

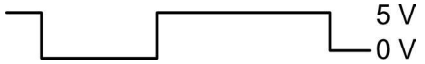




(1) 

(2) 

(3) 

(4) 

Ans: (3)

Sol: 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

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/s^2) nearly :

(1) 1.4 kg m/s

(2) 0 kg m/s

(3) 4.2 kg m/s

(4) 2.1 kg m/s

Ans: (3)

Sol: 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

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

45. A car starts from rest and accelerates at 5 m/s^2. 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/s^2)

(1) $20\sqrt{2}\ m/s, 10\ m/s^2$

(2) 20 m/s, 5 m/s^2

(3) 20 m/s, 0

(4) $20\sqrt{2}\ m/s, 0$

Ans: (1)

Sol: Velocity of the car at t = 4 sec is

V_x = at = 4 × 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

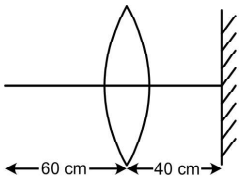
V_y = gt = 20 m/s

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

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 :



(1) 20 cm from the plane mirror, it would be a virtual image.

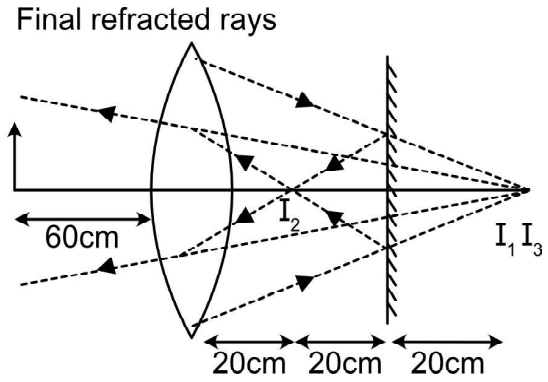
(2) 20 cm from the lens, it would be a real image.

(3) 30 cm from the lens, it would be a real image.

(4) 30 cm from the plane mirror, it would be a virtual image.

Ans: (1)

Sol:



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

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

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

$v=-60\,cm$ from lens

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

47. In the product

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

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 $\vec{B}$?

(1) $6\hat{i}+6\hat{j}-8\hat{k}$

(2) $-8\hat{i}-8\hat{j}-6\hat{k}$

(3) $-6\hat{i}-6\hat{j}-8\hat{k}$

(4) $8\hat{i}+8\hat{j}-6\hat{k}$

Ans: (3)

Sol: $\vec{F}=q\left(\vec{V}\times\vec{B}\right)$

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

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

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

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

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

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

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

$B=-6$ and $B_0=-8$

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

(1) 42 rad/s and 58 rad/s

(2) 25 rad/s and 75 rad/s

(3) 50 rad/s and 25 rad/s

(4) 46 rad/s and 54 rad/s

Ans: (4)

Sol: $\omega_0=\frac{1}{\sqrt{LC}}=\frac{1}{\sqrt{5\times80\times10^{-6}}}$

$=\frac{1}{\sqrt{4\times10^{-4}}}=\frac{10^2}{2}=50$

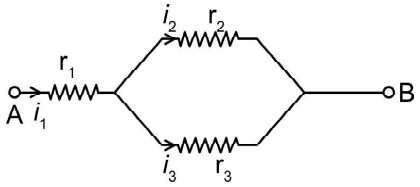
Half power frequency band width is $\frac{R}{L}$

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

Half power frequencies

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

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



(1) $\frac{r_2}{r_1+r_3}$

(2) $\frac{r_1}{r_2+r_3}$

(3) $\frac{r_2}{r_2+r_3}$

(4) $\frac{r_1}{r_1+r_2}$

Ans: (3)

Sol: $\frac{i_2}{i_3}=\frac{r_3}{r_2}$ and $i_2+i_3=i_1$

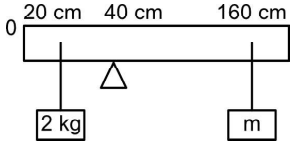
$\frac{i_2}{i_3}+1=\frac{r_3+r_2}{r_2}$

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

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

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

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. ($g = 10\ m/s^2$)



(1) $\frac{1}{12}$kg

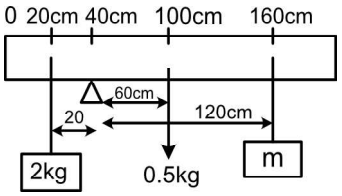
(2) $\frac{1}{2}$kg

(3) $\frac{1}{3}$kg

(4) $\frac{1}{6}$kg

Ans: (1)

Sol:



From principle of moments

$2\times20=0.5\times60+m\times120$

$2=1.5+6m$

$0.5=6m$

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

CHEMISTRY

SECTION - A

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

(1) 0°

(2) 120°

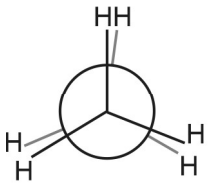
(3) 180°

(4) 60°

Ans: (1)

Sol: Eclipsed conformer is highly unstable

Dihedral angle is zero



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

(1) Chain in both

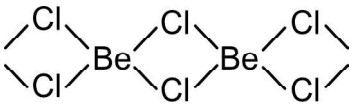
(2) Chain and dimer, respectively

(3) Linear in both

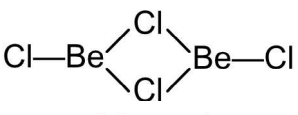
(4) Dimer and Linear, respectively

Ans: (2)

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

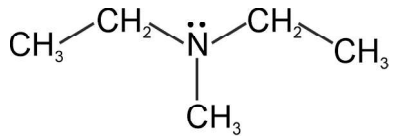


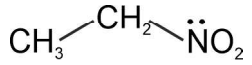
(Solid)

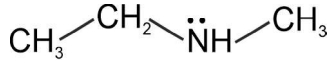


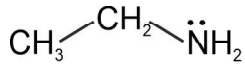
(Vapour)

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

(1) 

(2) 

(3) 

(4) 

Ans: (4)

Sol: $\underset{1^{\circ}-\text{amine}}{R-NH-H}+\underset{\text{Hinsberg reagent}}{Cl-SO_2C_6H_5}\rightarrow \underset{\substack{\text{N-alkyl benzene Sulphonamide}\\ \text{alkali soluble}}}{R-NHSO_2C_6H_5}+HCl$

H - atom attached to nitrogen is highly acidic because it is attached to strong electron withdrawing $-SO_2C_6H_5$ group

54. The molar conductance of NaCl, HCl and CH_3COONa at infinite dilution are 126.45, 426.16 and $91.0\,S\,cm^2mol^{-1}$ respectively. The molar conductance of CH_3COOH at infinite dilution is. Choose the right option for your answer

(1) $540.48\,S\,cm^2mol^{-1}$

(2) $201.28\,S\,cm^2mol^{-1}$

(3) $390.71\,S\,cm^2mol^{-1}$

(4) $698.28\,S\,cm^2mol^{-1}$

Ans: (3)

Sol: $\lambda_M^{CH_3COOH}=\lambda^M_{CH_3COO^-}+\lambda^M_{Na^+}+\lambda^M_{H^+}+\lambda^M_{Cl^-}-\lambda^M_{Na^+}-\lambda^M_{Cl^-}$

$=\lambda^M_{CH_3COONa}+\lambda^M_{HCl}-\lambda^M_{NaCl}$

= 91 + 426.16 - 126.45

$=390.71\,S\,cm^2\,mole^{-1}$

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

(1) 12, 6

(2) 8, 4

(3) 6, 12

(4) 2, 1

Ans: (1)

Sol: Number of tetrahedral voids = 2N

Number of octahedral voids = N

N = effective atoms

for Hexagonal effective atoms = 6

Tetrahedral voids = $2\times6=12$

Octahedral voids = 6

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

(1) Neutron (n)

(2) Beta (β^-)

(3) Alpha (α)

(4) Gamma (γ)

Ans: (2)

Sol: $_1H^3\rightarrow{}_2He^3+{}_{-1}e^o\,(\beta-ray)$

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]

(1) CH_4

(2) CH

(3) CH_2

(4) CH_3

Ans: (4)

Sol: % C = 78

% H = 22

$C:H=\frac{78}{12}:\frac{22}{1}$

= 6.5 : 22

$\frac{6.5}{6.5}:\frac{22}{6.5}=1:3.3$

$C:H=CH_3$

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

Acetone $\xrightarrow[(ii)\ H_2O,H^+]{(i)C_2H_5MgBr,\text{dry Ether}}$ Product

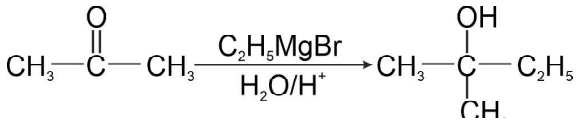
(1) 2-methyl butan-2-ol

(2) 2-methyl propan-2-ol

(3) pentan-2-ol

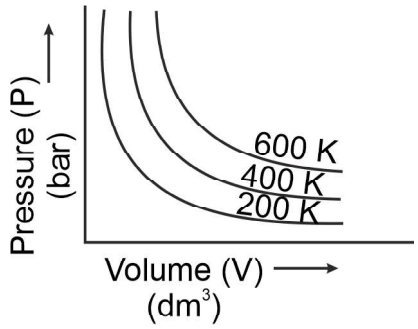
(4) pentan-3-ol

Ans: (1)

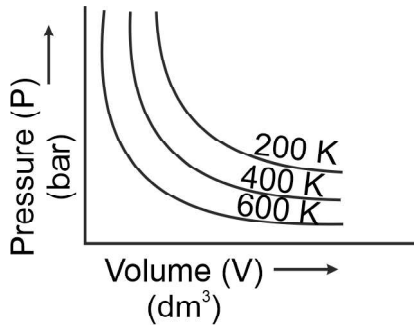
Sol: 

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

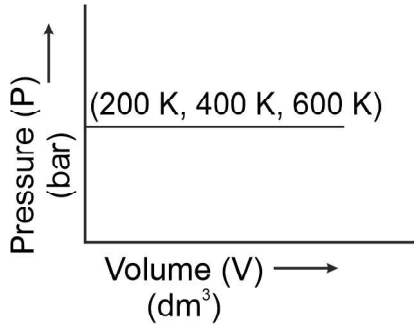
(1)



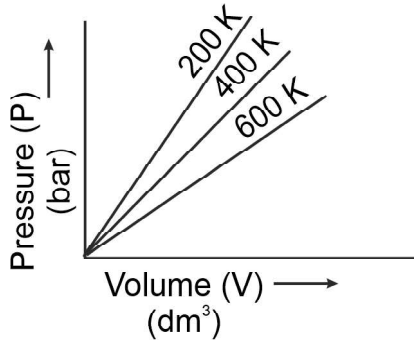
(2)



(3)



(4)



Ans: **(1)**

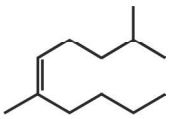
Sol: $P \propto \frac{1}{V}$

at constant temperature PV = K

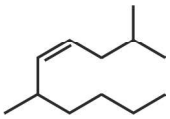
Greater the temperature greater the magnitude of PV

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

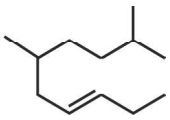
(1)



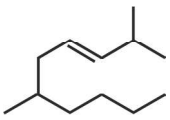
(2)



(3)

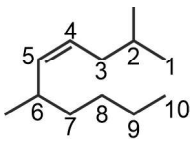


(4)



Ans: **(2)**

Sol:



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**
(1)	iv	iii	ii	i
(2)	iv	iii	i	ii
(3)	ii	iii	iv	i
(4)	iii	i	iv	ii

Ans: **(2)**

Sol: 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)

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

(1) upto 5000 K

(2) upto 1200 K

(3) upto 2200 K

(4) upto 1900 K

Ans: **(3)**

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

63. Which one among the following is the correct option for right relationship between C_p and C_V for one mole of ideal gas?

(1) $C_V = RC_P$

(2) $C_P + C_V = R$

(3) $C_P - C_V = R$

(4) $C_P = RC_V$

Ans: (3)

Sol: For an ideal gas, $C_P - C_V = R$

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.

(1) Statement I is incorrect but Statement II is true

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

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

(4) Statement I is correct but Statement II is false.

Ans: (2)

Sol: 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

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

(1) Urea solution

(2) NaCl solution

(3) Glucose solution

(4) Starch solution

Ans: (4)

Sol: Colloidal sol shows Tyndall effect. Starch is a colloid

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

(1) 3

(2) 7

(3) 5

(4) 2

Ans: (1)

Sol: Cubic, Tetragonal, Orthorhombic

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

(1) $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2\uparrow$

(2) $2KClO_3 \xrightarrow{\Delta} 2KCl + 3O_2$

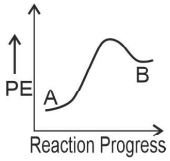
(3) $Cr_2O_3 + 2Al \xrightarrow{\Delta} Al_2O_3 + 2Cr$

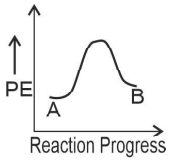
(4) $Fe + 2HCl \rightarrow FeCl_2 + H_2\uparrow$

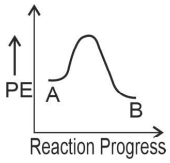
Ans: (3)

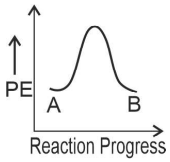
Sol: More electropositive element displaces less electropositive metal

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.

(1) 

(2) 

(3) 

(4) 

Ans: (3)

Sol: It is an exothermic reaction

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

69. The p^{K_b} of dimethylamine and p^{K_a} of acetic acid are 3.27 and 4.77 respectively at T (K). The correct option for the p^H of dimethylammonium acetate solution is:

(1) 6.25 (2) 8.50

(3) 5.50 (4) 7.75

Ans: (4)

Sol: For a salt of weak acid and weak base P^H does not depend on concentration of salt.

$$P^H = 7 + \frac{1}{2}\left[P^{K_a} - P^{K_b}\right]$$

$$= 7 + \frac{1}{2}[4.77 - 3.27] = \mathbf{7.75}$$

70. The major product formed in dehydrohalogenation reaction of 2-Bromo pentane is Pent-2-ene. This product formation is based on?
(1) Huckel's Rule
(2) Saytzeff's Rule
(3) Hund's Rule
(4) Hofmann Rule

Ans: (2)

Sol: $CH_3-CH(Br)-CH_2-CH_2-CH_3 \xrightarrow{\text{alc.KOH}}$

$CH_2=\underset{\text{1-pentene(minor)}}{CH-CH_2-CH_2-CH_3}+CH_3-\underset{\text{2-pentene(major)}}{CH=CH-CH_2-CH_3}$

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

71. Which one of the following polymers is prepared by addition polymerisation?
(1) Dacron
(2) Teflon
(3) Nylon-66
(4) Novolac

Ans: (2)

Sol: Teflon is formed by addition polymerisation of Tetrafluoro ethylene

$$nCF_2=CF_2 \xrightarrow[\text{Under pres}]{\text{Peroxide}} \left(-CF_2-CF_2-\right)_n$$

72. The RBC deficiency is deficiency disease of :
(1) Vitamin B_2
(2) Vitamin B_{12}
(3) Vitamin B_6
(4) Vitamin B_1

Ans: (2)

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

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 surcrose ($C_{12}H_{22}O_{11}$) in 250 ml of water (P_3). The right option for the decreasing order of osmotic pressure of these solutions is:
(1) $P_3 > P_1 > P_2$ (2) $P_2 > P_1 > P_3$
(3) $P_1 > P_2 > P_3$ (4) $P_2 > P_3 > P_1$

Ans: (2)

Sol: $\pi = \frac{W}{M}ST$

$\pi \propto \frac{1}{\text{Mol.wt}}$

Glucose (180), Urea (60), Sucrose (342)

$\pi_{urea} > \pi_{glucose} > \pi_{sucrose}$

$P_2 > P_1 > P_3$

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 × 10^8 ms^{-1}]
(1) 21.92 cm
(2) 219.3 m
(3) 219.2 m
(4) 2192 m

Ans: (2)

Sol: $\lambda = \frac{C}{V} = \frac{3\times10^8\ ms^{-1}}{1368\times10^3\ S^{-1}} = 219.3m$

75. Noble gases are named because of their inertness towards reactivity. Identify an **incorrect** statement about them.
(1) Noble gases have large positive values of electorn gain enthalpy.
(2) Noble gases are sparingly soluble in water.
(3) Noble gases have very high melting and boiling points.
(4) Noble gases have weak dispersion forces.

Ans: (3)

Sol: Noble gases have low melting point and boiling point due to weak London dispersion forces

76. Given below 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.

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

Ans: (3)

Sol: Aspirin and Paracetamol are non - narcotic where as Morphine and Heroin are narcotic analgesics

77. Which one of the following methods can be used to obtain highly pure metal which is liquid at room temperature ?
(1) Zone refining
(2) Electrolysis
(3) Chromatography
(4) Distillation

Ans: (4)

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

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

(1) $CH_3-Cl > CH_3-F > CH_3-Br > CH_3-I$

(2) $CH_3-F < CH_3-Cl < CH_3-Br < CH_3-I$

(3) $CH_3-F > CH_3-Cl > CH_3-Br > CH_3-I$

(4) $CH_3-F < CH_3-Cl > CH_3-Br > CH_3-I$

Ans: (3)

Sol: Atomic size of F < Cl < Br < I

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

79. The compound which shows metamerism is

(1) $C_4H_{10}O$

(2) C_5H_{12}

(3) C_3H_8O

(4) C_3H_6O

Ans: (1)

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

(1) diethyl ether

(2) methyl n - propyl ether

(3) iso propyl methyl ether

(1) and (2), (1) and (3) are metamers

80. Ethylene diaminetetraacetate (EDTA) ion is

(1) Tridentate ligand with three "N" donor atoms

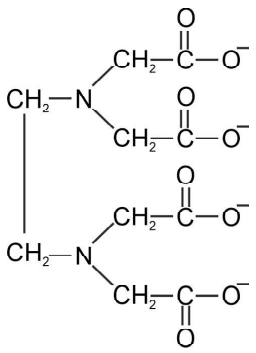
(2) Hexadentate ligand with four "O" and two "N" donor atoms

(3) Unidentate ligand

(4) Bidentate ligand with two "N" donor atoms

Ans: (2)

Sol:



four O - atoms and two N - atoms

81. Zr (Z = 40) and Hf (Z = 72) have similar atomic and ionic radii because of

(1) having similar chemical properties

(2) belonging to same group

(3) diagonal relationship

(4) lanthanoid contraction

Ans: (4)

Sol: Zr and Hf have same size due to Lanthanoid contraction

82. BF_3 is planar and electron deficient compound. Hybridization and number of electrons around the central atom, respectively are

(1) sp^2 and 8

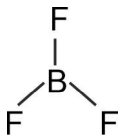
(2) sp^3 and 4

(3) sp^3 and 6

(4) sp^2 and 6

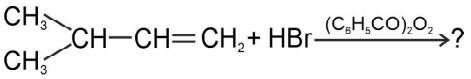
Ans: (4)

Sol:

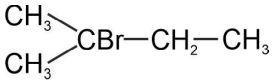


sp^2 and 6

83. The major product of the following chemical reaction is



(1)



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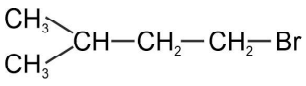

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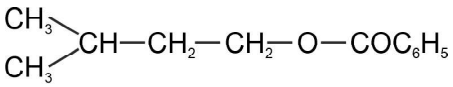

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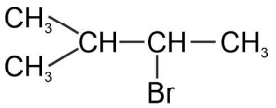
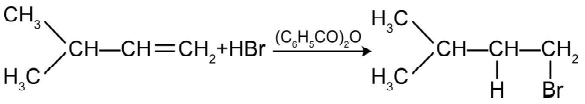


Ans: (2)

Sol:



84. The incorrect statement among the following is :

(1) Actinoids are highly reactive metals, especially when finely divided

(2) Actinoid contraction is greater for element to element than Lanthanoid contraction

(3) Most of the trivalent Lanthanoid ions are colorless in the solid state

(4) Lanthanoids are good conductors of heat and electricity

Ans: (3)

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

85. Among the following alkaline earth metal halides, one which is covalent and soluble in organic solvents is

(1) Beryllium chloride

(2) Calcium chloride

(3) Strontium chloride

(4) Magnesium chloride

Ans: (1)

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

SECTION - B

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 280 mm Hg and that of octane is 420 mm Hg. Assume Ideal gas]

(1) 350 mm of Hg

(2) 160 mm of Hg

(3) 168 mm of Hg

(4) 336 mm of Hg

Ans: (4)

Sol: Applying Raoult's law, $P_{total} = P_A^o . X_A + P_B^o . X_B$

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

$$P_{total} = 280 \times \left(\frac{3}{5}\right) + 420 \times \left(\frac{2}{5}\right) = 336 \text{ mm of Hg}$$

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

(1) $\Delta U \neq 0,\ \Delta S_{total} = 0$

(2) $\Delta U = 0,\ \Delta S_{total} = 0$

(3) $\Delta U \neq 0,\ \Delta S_{total} \neq 0$

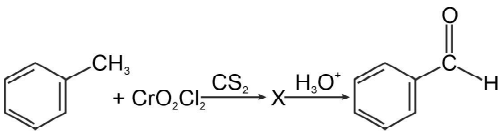
(4) $\Delta U = 0,\ \Delta S_{total} \neq 0$

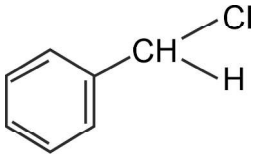
Ans: (4)

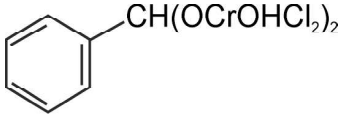
Sol: For an isothermal process, $\Delta T = 0 \ \ \therefore \Delta U = 0$

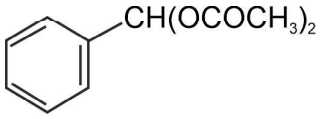
For an irreversible expansion, $\Delta S_{total} \neq 0$

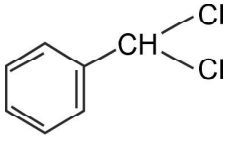
88. The intermediate compound 'X' in the following chemical reaction is



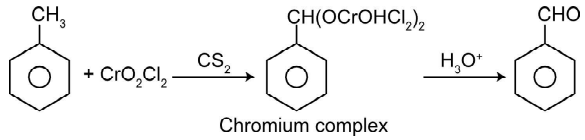
(1) 

(2) 

(3) 

(4) 

Ans: (2)

Sol: 

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 :

$\left[\text{Given } R = 0.082 \text{ L atm mol}^{-1}\text{K}^{-1},\ T = 273\text{K}\right]$

(1) 26.02

(2) 2.518

(3) 2.602

(4) 25.18

Ans: (4)

Sol: $n = n_{O_2} + n_{H_2}$

$$n = \frac{4}{32} + \frac{2}{2}$$

$$n = \frac{9}{8}$$

$$P = \frac{nRT}{V}$$

$$P = \frac{9}{8} \times \frac{0.0821 \times 273}{1} = 25.18 \text{ atm}$$

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

(1) Fe^{2+}, Mn^{2+}

(2) O^{2-}, F^-

(3) Na^+, Mg^{2+}

(4) Mn^{2+}, Fe^{3+}

Ans: (1)

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

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

91. $CH_3CH_2COO^-Na^+ \xrightarrow[\text{Heat}]{\text{NaOH, + ?}} CH_3CH_3 + Na_2CO_3$

Consider the above reaction and identify the missing reagent/chemical

(1) DIBAL - H

(2) B_2H_6

(3) Red Phosphorus

(4) CaO

Ans: (4)

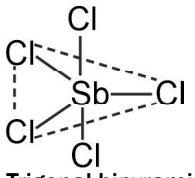
Sol: $CH_3CH_2COONa + NaOH \xrightarrow[\Delta]{CaO} CH_3 - CH_3 + Na_2CO_3$

This is a decarboxylation reaction

92. Which of the following molecules is non - polar in nature?
(1) NO_2
(2) $POCl_3$
(3) CH_2O
(4) $SbCl_5$

Ans: (4)

Sol:



Trigonal bipyramidal

dipole moment $(\mu) = 0$

93. The slope of Arrhenius Plot $\left(\ln k \text{ v/s } \frac{1}{T}\right)$ of first oder reaction is $-5\times10^3 K$. The value of E_a of the reaction is. Choose the correct option for your answer

$\left[\text{Given } R = 8.314\, JK^{-1}mol^{-1}\right]$

(1) $-83\ kJ\ mol^{-1}$
(2) $41.5\ kJ\ mol^{-1}$
(3) $83.0\ kJ\ mol^{-1}$
(4) $166\ kJ\ mol^{-1}$

Ans: (2)

Sol: $K = Ae^{-\frac{E_a}{RT}}$

$$\underset{y}{\ln K} = \underset{C}{\ln A} - \frac{E_a}{R}\cdot\frac{1}{T}$$
$$\quad\ m \quad x$$

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

$$-\frac{E_a}{R} = -5\times10^3 K$$

$$E_a = 5\times8.314\ J\,K^{-1}\,mole^{-1}\times10^3 K$$

94. Match List - I with List - II

	List - I		List – II
a)	$2SO_2(g)+O_2(g)\rightarrow 2SO_3(g)$	i)	Acid rain
b)	$HOCl(g)\xrightarrow{h\nu}\dot{O}H+\dot{C}l$	ii)	Smog
c)	$CaCO_3+H_2SO_4\rightarrow CaSO_4+H_2O+CO_2$	iii)	Ozone depletion
d)	$NO_2(g)\xrightarrow{h\nu}NO(g)+O(g)$	iv)	Tropospheric pollution

Choose the correct answer from the options given below.

	a	b	c	d
(1)	iii	ii	iv	i
(2)	i	ii	iii	iv
(3)	ii	iii	iv	i
(4)	iv	iii	i	ii

Ans: (4)

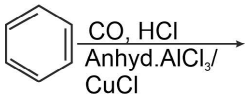
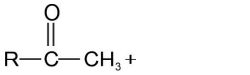
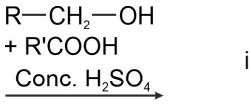
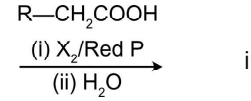
Sol: (a) $2SO_2(g)+O_2(g)\rightarrow 2SO_3(g)$ .... Tropospheric pollution

(b) $HOCl(g)\xrightarrow{h\nu}\dot{O}H+\dot{C}l$ .... Ozone depletion

(c) $CaCO_3+H_2SO_4\longrightarrow CaSO_4+H_2O+CO_2$ .... Acid rain

(d) $NO_2(g)\xrightarrow{h\nu}NO(g)+O(g)$ .... Photo chemical smog

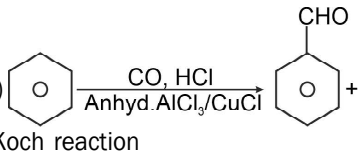
95. Match List - I with List - II

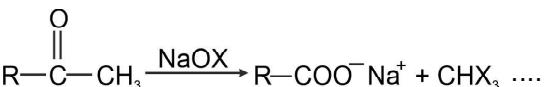
	List - I		List – II
a)		i)	Hell -Volhard Zelinsky reaction
b)		ii)	Gattermann - Koch reaction
c)		iii)	Haloform reaction
d)		iv)	Esterification

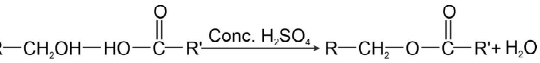
Choose the correct answer from the options given below.

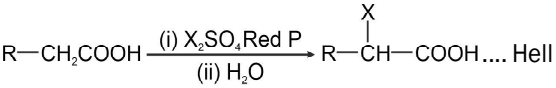
	a	b	c	d
(1)	ii	iii	iv	i
(2)	iv	i	ii	iii
(3)	iii	ii	i	iv
(4)	i	iv	iii	ii

Ans: (1)

Sol: (a)  + HCl.... Gattermann - Koch reaction

(b)  Haloform test

(c)  .... Esterification

(d)  .... Hell - Volhard Zelinsky reaction

96. Match List - I with List - II

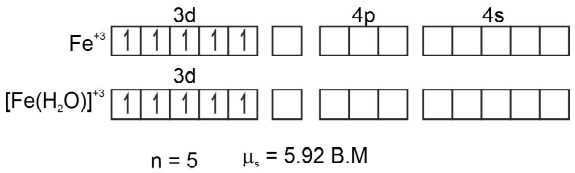
	List - I		List – II
a)	$[Fe(CN)_6]^{3-}$	i)	5.92 BM
b)	$[Fe(H_2O)_6]^{3+}$	ii)	0 BM
c)	$[Fe(CN)_6]^{4-}$	iii)	4.90 BM
d)	$[Fe(H_2O)_6]^{2+}$	iv)	1.73 BM

Choose the correct answer from the options given below.

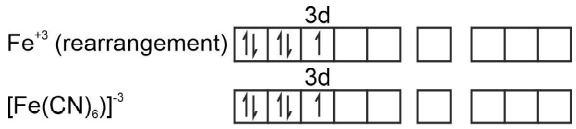
	a	b	c	d
(1)	iv	i	ii	iii
(2)	iv	ii	i	iii
(3)	ii	iv	iii	i
(4)	i	iii	iv	ii

Ans: (1)

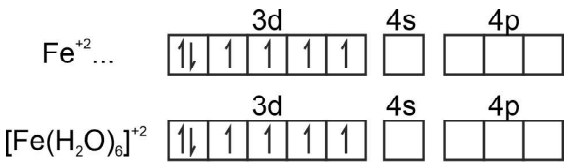
Sol:



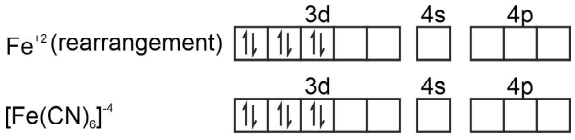
n = 5 μ_s = 5.92 B.M



n = 1 μ_s = 1.732 B.M

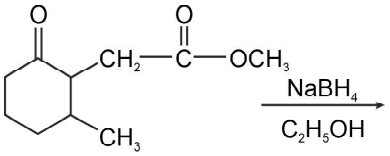


n = 4 μ_s = 4.9 B.M

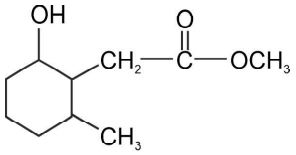


n = 4 μ_s = O

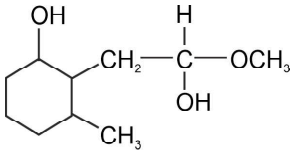
97. The product formed in the following chemical reaction is :



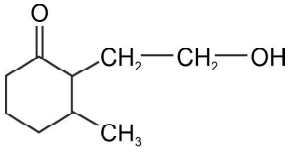
(1)



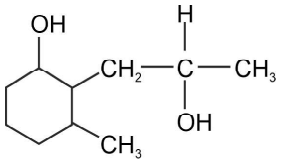
(2)



(3)



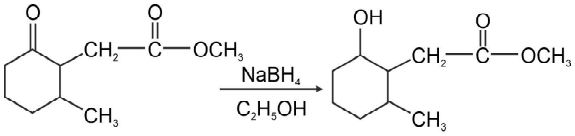
(4)



Ans: (1)

Sol: $NaBH_4/C_2H_5OH$ is a weak reducing agent. It cannot reduce - COOR group

It reduces $-\overset{O}{\overset{\|}{C}}-$ **to - CHOH - group**



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

(1) $CO_2 < SiO_2 < SnO_2 < PbO_2$: Increasing oxidizing power

(2) HF < HCl < HBr < HI : Increasing acidic strength

(3) $H_2O < H_2S$ $H_2Se < H_2Te$: Increasing pK_a values

(4) $NH_3 < PH_3 < AsH_3 < SbH_3$: Increasing acidic character

Ans: (3)

Sol: From H_2O to H_2Te as X - H bond enthalpy decreases, acidic strength increases (K_a increases)

$\therefore H_2O < H_2S < H_2Se < H_2Te....K_a$

$H_2O > H_2S > H_2Se > H_2Te....P^{K_a}$

99. The molar conductivity of 0.007 M acetic acid is 20 S cm^2 mol^{-1}. What is the dissociation constant of acetic acid? Choose the correct option.

$$\left[\begin{array}{l}\Lambda^{0}_{H^+} = 350\ S\ cm^2\ mol^{-1} \\ \Lambda^{0}_{CH_3COO^-} = 50\ S\ cm^2\ mol^{-1}\end{array}\right]$$

(1) $2.50\times10^{-5}\ mol\,L^{-1}$

(2) $1.75\times10^{-4}\ mol\,L^{-1}$

(3) $2.50\times10^{-4}\ mol\,L^{-1}$

(4) $1.75\times10^{-5}\ mol\,L^{-1}$

Ans: (4)

Sol: Degree of dissociation (α) of CH_3COOH

$$= \frac{\Lambda_c}{\Lambda_0} = \frac{20}{350+50} = \frac{1}{20}$$

$$K_a = \frac{C\alpha^2}{1-\alpha}$$

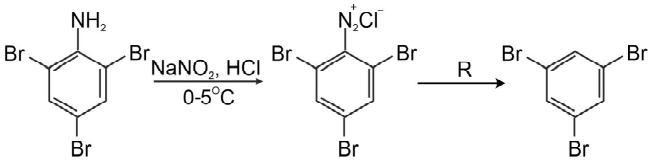
$$1-\alpha \approx 1$$

$$K_a = C\alpha^2$$

$$K_a = 0.007\times\frac{1}{20}\times\frac{1}{20}$$

$$K_a = 1.75\times10^{-5}$$

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



(1) CuCN/KCN

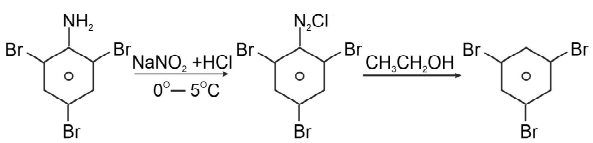
(2) H_2O

(3) CH_3CH_2OH

(4) HI

Ans: (3)

Sol:



BOTANY

SECTION - A

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
(1)	iii	ii	iv	i
(2)	ii	iv	i	iii
(3)	iv	iii	ii	i
(4)	i	ii	iii	iv

Ans: (2)

Sol: 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

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

(1) Nuclear pores act as passages for proteins and RNA molecules in both directions between nucleus and cytoplasm.

(2) Mature sieve tube elements possess a conspicuous nucleus and usual cytoplasmic organelles.

(3) Microbodies are present both in plant and animal cells.

(4) The perinuclear space forms a barrier between the materials present inside the nucleus and that of the cytoplasm.

Ans: (2)

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

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

(1) Safety testing

(2) Biopiracy

(3) Gene therapy

(4) Molecular diagnosis

Ans: (3)

Sol. 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 sed to increase the expression of desired gene.

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

(1) Polysaccharides

(2) RNA

(3) DNA

(4) Histones

Ans: (3)

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

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**
(1)	iv	iii	ii	i
(2)	iii	iv	ii	i
(3)	ii	i	iv	iii
(4)	iii	iv	i	ii

Ans: (3)

Sol: Protoplast fusion – Pomato

Plant tissue culture – Totipotency

Meristem culture – Virus free plants

Micropropagation – Somaclones

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

(1) Acrocentric

(2) Metacentric

(3) Telocentric

(4) Sub-metacentric

Ans: (2)

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

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

(1) Genetic drift

(2) Natural selection

(3) Genetic recombination

(4) Mutation

Ans: (1)

Sol. 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.

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

(1) Annealing, Denaturation, Extension

(2) Denaturation, Annealing, Extension

(3) Denaturation, Extension, Annealing

(4) Extension, Denaturation, Annealing

Ans: (2)

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

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

(1) Predation

(2) Resource partitioning

(3) Competitive release

(4) Mutualism

Ans: (2)

Sol. Species facing competition might evolve mechanisms that promote co-existence rather than exclusion. One such mechanism is 'resource partitioning'. MacArthur 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.

110. A typical angiosperm embryo sac at maturity is :

(1) 8-nucleate and 8-celled

(2) 8-nucleate and 7-celled

(3) 7-nucleate and 8-celled

(4) 7-nucleate and 7-called

Ans: (2)

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

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

(1) Leaf

(2) Shoot apex

(3) Stem

(4) Axillary bud

Ans: (1)

Sol: The site of perception of light in plants during photoperiodism is leaf.

112. Which of the following plants is monoecious ?
(1) *Cycas circinalis*
(2) *Carica papaya*
(3) Chara
(4) *Marchantia polymorpha*

Ans: (3)

Sol: 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.

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

	a	**b**	**c**	**d**
(1)	ii	iii	iv	i
(2)	iv	iii	ii	i
(3)	i	iv	iii	ii
(4)	iii	iv	i	ii

Ans: (4)

Sol: 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

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**
(1)	ii	i	iv	iii
(2)	ii	iv	i	iii
(3)	iv	iii	ii	i
(4)	iii	i	iv	ii

Ans: (2)

Sol: Cohesion – Mutual attraction among water

Adhesion – Attraction towards polar surfaces

Surface tension – More attraction in liquid phase

Guttation – Water loss in liquid phase

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**
(1)	iv	ii	i	iii
(2)	iv	i	iii	ii
(3)	iii	i	iv	ii
(4)	ii	iii	iv	i

Ans: (3)

Sol: Lenticels – Exchange of gases

Cork cambium – Phellogen

Secondary cortex – Phelloderm

Cork – Suberin deposition

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 :
(1) Cleistogamy
(2) Xenogamy
(3) Geitonogamy
(4) Chasmogamy

Ans: (2)

Sol: 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.

117. Which of the following is **not** an application of PCR (Polymerase Chain Reaction)?
(1) Detection of gene mutation
(2) Molecular diagnosis
(3) Gene amplification
(4) Purification of isolated protein

Ans: (4)

Sol: Purification of isolated protein is not an application of PCR (Polymerase Chain Reaction)

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 :
(1) Net square
(2) Bullet square
(3) Punch square
(4) Punnett square

Ans: (4)

Sol: Punnet square : It is a diagram which shows the production of gametes by parents, formation of zygotes, the F_1 and F_2 plants.

119. Which of the following algae produce Carrageen?
(1) Blue-green algae
(2) Green algae
(3) Brown algae
(4) Red algae

Ans: (4)

Sol: Carrageen is produced by Red algae.

120. Amensalism can be represented as :
(1) Species A (+) ; Species B (0)
(2) Species A (-) ; Species B (0)
(3) Species A (+) ; Species B (+)
(4) Species A (-) ; Species B (-)

Ans: (2)

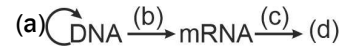
Sol. In Amensalism one species is harmed (-) whereas the other is unaffected (0).

121. Which of the following stages of meiosis involves division of centromere?
(1) Telephase II
(2) Metaphase I
(3) Metaphase II
(4) Anaphase II

Ans: (4)

Sol: During meiosis centromere division is seen in Anaphase II

122. Complete the flow chart on central dogma.



(1) (a)-Transduction; (b)-Translation; (c)-Replication; (d)-protein
(2) (a)-Replication; (b)-Transcription; (c)-Transduction; (d)-protein
(3) (a)-Translation; (b)-Replication; (c)-Transcription; (d)-Transduction
(4) (a)-Replication; (b)-Transcription; (c)-Translation; (d)-protein

Ans: (4)

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

123. Mutations in plant cells can be induced by :
(1) Zeatin
(2) Kinetin
(3) Infrared rays
(4) Gamma rays

Ans: (4)

Sol: Gamma rays induce mutations.

124. In the equation GPP-R=NPP
R represents :
(1) Respiration losses
(2) Radiant energy
(3) Retardation factor
(4) Environment factor

Ans: (1)

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

125. Plants follow different pathways in response to environment or phases of life to form different kinds of structures. This ability is called :
(1) Maturity
(2) Elasticity
(3) Flexibility
(4) Plasticity

Ans: (4)

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

126. The plant hormone used to destroy weeds in a field is:
(1) IBA
(2) IAA
(3) NAA
(4) 2, 4-D

Ans: (4)

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

127. Which of the following statements is **not** correct?
(1) Pyramid of numbers in a grassland ecosystem is upright.
(2) Pyramid of biomass in sea is generally inverted.
(3) Pyramid of biomass in sea is generally upright.
(4) Pyramid of energy is always upright.

Ans: (3)

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

128. Gemmae are present in :
(1) Some Liverworts
(2) Mosses
(3) Pteridophytes
(4) Some Gymnosperms

Ans: (1)

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

129. The first stable product of CO_2 fixation in sorghum is :
(1) Phosphoglyceric acid
(2) Pyruvic acid
(3) Oxaloacetic acid
(4) Succinic acid

Ans: (3)

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

130. Which of the following algae contains mannitol as reserve food material?
(1) *Ulothrix*
(2) *Ectocarpus*
(3) *Gracilaria*
(4) *Volvox*

Ans: (2)

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

131. DNA strands on a gel stained with ethidium bromide when viewed under UV raidation,appear as :
(1) Bright blue bands
(2) Yellow bands
(3) Bright orange bands
(4) Dark red bands

Ans: (3)

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

132. Diadelphous stamens are found in :
(1) China rose and citrus
(2) China rose
(3) Citrus
(4) Pea

Ans: (4)

Sol: Diadelphous stamens are seen in pea (Fabaceae)

133. Which of the following are **not** secondary metabolites in plants ?
(1) Rubber,gums
(2) Morphine,codeine
(3) Amino acids,glucose
(4) Vinblastin,curcumin

Ans: (3)

Sol: Amino acids and Glucose are primary metabolites but not secondary metabolites as they have some known functions.

134. The amount of nutrients, such as carbon,nitrogen, phosphorus and calcium present in the soil at any given time,is reffered as :
(1) Standing crop(2) Climax
(3) Climax community
(4) Standing state

Ans: (4)

Sol: The amount of nutrients, such as carbon, nitrogen, phosphorus and calcium present in the soil at any given time is called standing state .

135. Genera like *Selaginella* and *Salvinia* produce two kinds of spores. Such plants are known as :
(1) Heterosporous
(2) Homosorus
(3) Heterosorus
(4) Homosporous

Ans: (1)

Sol: Genera like *Selaginella* and *Salvinia* (Pteridophytes) form two types of spores microspores and megaspores and they are described as heterosporous.

SECTION - B (BIOLOGY : BOTONY)

136. Plasmid pBR322 has PstI restriction enzyme site within gene *amp*^{R} that confers ampicillin resistance. If this enzyme is used for inserting a gene for β -galactoside production and the recombinant plasmid is inserted in an *E.coli* strain
(1) it will be able to produce a novel protien with dual ability.
(2) it will not be able to confer ampicillin resistance to the host cell.
(3) the transformed cells will have the ability to resist ampicilin as well as produce β -galactoside.
(4) it will lead to lysis of host cell.

Ans: (2)

Sol: Since the gene is inserted at Pst I of *amp*^{R} region of pBR322, the *amp*^{R} gene is inactivated which is called as insertional inactivation. Hence the genetically modified *E.coli* strain will not be able to confer ampicillin resistance.

137. In some member of which of the following pairs of families, pollen grains retain their viability for months after release ?
(1) Rosaceae;Leguminosae
(2) Poaceae;Rosaceae
(3) Poaceae;Leguminosae
(4) Poaceae;Solanaceae

Ans: (1)

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

138. Identify the **correct** statement.
(1) Split gene arrangement is characteristic of prokaryotes.
(2) In capping,methyl guanosine triphosphate is added to the 3' end of hnRNA.
(3) RNA polymerase binds with Rho factor to terminate the process of transcription in bacteria.
(4) The coding strand in a transcription unit is copied to an mRNA.

Ans: (3)

Sol: Transcription is terminated when Rho factor binds to RNA polymerase in bacteria.

139. Which of the following statements is **correct** ?
(1) Some of the organisms can fix atmospheric nitrogen in specialized cells called sheath cells.
(2) Fusion of two cells is called Karyogamy.
(3) Fusion of protoplasms between two motile on non-motile gametes is called plasmogamy.
(4) Organisms that depend on living plants are called saprophytes.

Ans: (3)

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

140. DNA fingerprinting involves identifying differences is some specific regions in DNA sequence, called as :
(1) Polymorphic DNA
(2) Satellite DNA
(3) Repetitive DNA
(4) Single nucleotides

Ans: (3)

Sol. 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.

141. Select the **correct** pair.
(1) Loose parenchyma cells rupturing the epidermis and forming a lens-shaped opening in bark - Spongy parenchyma
(2) Large colorless empty cells in the epidermis of grass leaves - Subsidiary cells
(3) In dicot leaves, vascular bundles are surrounded by large thick-walled cells - Conjunctive tissue
(4) Cells of medullary rays that form part of cambial ring - Interfascicular cambium

Ans: (4)

Sol: Inter fascicular cambium is formed from medullary ray cells which is a part of vascular cambium in dicot stems.

142. Which of the following statements is **incorrect** ?
(1) Oxidation -reduction reactions produce proton gradient in respiration.
(2) During aerobic respiration, role of oxygen is limited to the terminal stage.
(3) In ETC (Electron Transport Chain), one molecule of $NADH+H^+$ gives rise to 2ATP molecules, and one $FADH_2$ gives rise to 3ATP molecules.
(4) ATP is synthesized through complex V.

Ans: (3)

Sol: In ETC of respiration, oxidation of one molecule of $NADH + H^+$ gives rise 3 ATP and $FADH_2$ produces 2 ATP.

143. Which of the following statements is **incorrect**?
(1) Cyclic photophosphorylation involves both PS I and PS II
(2) Both ATP and NADPH + H^+ are synthesized during non-cyclic photophosphorylation.
(3) Stroma lamellae have PS I only and lack NADP reductase.
(4) Grana lamelllae have both PS I and PS II.

Ans: (1)

Sol: In Cyclic photophosphorylation only PSI is involved but not PSII.

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**
(1)	iv	iii	ii	i
(2)	ii	iv	i	iii
(3)	i	ii	iii	iv
(4)	iii	i	iv	ii

Ans: (2)

Sol: *Nitrococcus* – Conversion of ammonia to nitrite

Rhizobium – Conversion of atmospheric nitrogen to ammonia

Thiobacillus – Denitrification

Nitrobacter – Conversion of Nitrite to Nitrate

145. What is the role of RNA polymerase III in the process of transcription in eukaryotes?
(1) Transcribes only snRNAs
(2) Transcribes rRNAs (28S, 18S and 5.85S)
(3) Transcribes tRNA, 5s rRNA and snRNA
(4) Transcribes precursor of mRNA

Ans: (3)

Sol: RNA polymerase III is involved in transcribing tRNA, 5s rRNA and snRNA.

146. In the exponential growth equation
$N_t = N_o e^{rt}.e$ represents :
(1) The base of geometric logarithms
(2) The base of number logarithms
(3) The base of exponential logarithms
(4) The base of natural logarithms

Ans: (4)

Sol. The integral form of the exponential growth equation as $Nt = N_0\ e^{rt}$

Where,

Nt = 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)

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:

(1) mutated gene does not appear on photographic film as the probe has complimentarity with it.

(2) mutated gene partially appears on a photographic film

(3) mutated gene completely and clearly appears on a photographic film.

(4) mutated gene does not appear on a photographic film as the probe has no complimentarity with it.

Ans: (4)

Sol. 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.

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**
(1)	iv	iii	i	ii
(2)	iv	i	ii	iii
(3)	i	iv	iii	ii
(4)	ii	i	iv	iii

Ans: (2)

Sol: Protein – Peptide bonds

Unsaturated fatty acid – has C = C double bonds

Nucleic acid – Phosphodiester bonds

Polysaccharide – Glycosidic bonds

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**
(1)	ii	iv	iii	i
(2)	iii	ii	i	iv
(3)	iv	ii	iii	i
(4)	iv	i	ii	iii

Ans: (4)

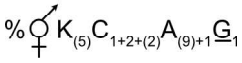
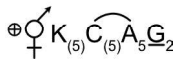
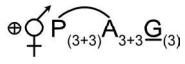
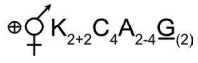
Sol: S phase – DNA replication

G_2 phase – Proteins are synthesized

Quiescent stage – Inactive phase

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

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

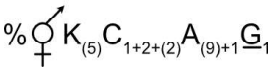
	Column- I		**Column– II**
(a)		(i)	Brassicaceae
(b)		(ii)	Liliaceae
(c)		(iii)	Fabaceae
(d)		(iv)	Solanaceae

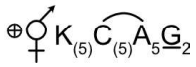
Select the **correct** answer from the option given below.

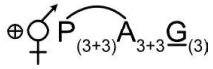
	a	**b**	**c**	**d**
(1)	(iv)	(ii)	(i)	(iii)
(2)	(iii)	(iv)	(ii)	(i)
(3)	(i)	(ii)	(iii)	(iv)
(4)	(ii)	(iii)	(iv)	(i)

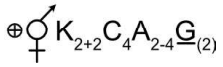
Ans: (2)

Sol:

 - Fabaceae

 - Solanaceae

 - Liliaceae

 - Brassicaceae

ZOOLOGY

SECTION - A

151. Receptors for sperm binding in mammals are present on :
(1) Zona pellucida
(2) Corona radiata
(3) Vitelline membrane
(4) Perivitelline space

Ans: (1)

Sol. One of the glycoproteins in the zona pellucida, called ZP3, acts as a sperm receptor.

152. Which stage of meiotic prophase shows terminalisation of chiasmata as its distinctive feature ?
(1) Pachytene
(2) Leptotene
(3) Zygotene
(4) Diakinesis

Ans: (4)

Sol: During Diakinesis of meiotic Prophase I, the distinctive feature of this stage, terminalisation of chiasmata is seen.

153. The organelles that are included in the endomembrane system are :
(1) Golgi complex, Endoplasmic reticulum, Mitochondria and Lysosomes
(2) Endoplasmic reticulum, Mitochondria, Ribosomes and Lysosomes
(3) Endoplasmic reticulum, Golgi complex, Lysosomes and Vacuoles
(4) Golgi complex, Mitochondria, Ribosomes and Lysosomes

Ans: (3)

Sol: Endomembrane system includes Endoplasmic Reticulum, Golgi complex, Lysosomes and Vacuoles.

154. A specific recognition sequence identified by endonucleases to make cuts at specific positions within the DNA is :
(1) Poly(A) tail sequences
(2) Degenerate primer sequence
(3) Okazaki sequences
(4) Palindromic Nucleotide sequences

Ans: (4)

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

155. Select the favourable conditions required for the formation of oxyhaemoglobin at the alveoli.
(1) Low pO_2, low pCO_2, more H^+, higher temperature
(2) High pO_2, low pCO_2, Less H^+, lower temperature
(3) Low pO_2, high pCO_2, more H^+, higher temperature
(4) High pO_2, lhigh pCO_2, Less H^+, lower temperature

Ans: (2)

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

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**
(1)	(i)	(iv)	(iii)	(ii)
(2)	(ii)	(iii)	(i)	(iv)
(3)	(iv)	(i)	(iii)	(ii)
(4)	(ii)	(iii)	(iv)	(i)

Ans: (4)

Sol. *Physalia* - Portuguese man-of-war

Limulus (King crab). - Living fossil

Ancylostoma - (Hookworm)

Pinctada - Pearl oyster

157. Dobson units are used to measure thickness of :
(1) Troposphere
(2) CFCs
(3) Stratosphere
(4) Ozone

Ans: (4)

Sol. 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).

158. Which one of the following belongs to the family Muscidae ?
(1) House fly
(2) Fire fly
(3) Grasshopper
(4) Cockroach

Ans: (1)

Sol: House fly belongs to family Muscidae

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.
(1) (a) and (c) only
(2) (a), (b) and (c) only
(3) (b), (c) and (d) only
(4) (b) and (c) only

Ans: (4)

Sol. 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.

160. Which is the "Only enzyme" that has "Capability to catalyse Initiation, Elongation and Termination in the process of transcription in prokaryotes
(1) DNase
(2) DNA dependent DNA polymerase
(3) DNA dependent RNA polymerase
(4) DNA Ligase

Ans: (3)

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

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

	a	**b**	**c**	**d**
(1)	(iii)	(i)	(iv)	(ii)
(2)	(iv)	(ii)	(i)	(iii)
(3)	(i)	(iii)	(ii)	(iv)
(4)	(ii)	(iv)	(iii)	(i)

Ans: (3)

Sol. Vaults – Entry of sperms through cervix is blocked
IUD's – Phagocytosis of sperms within the uterus
Vasectomy – Removal of vas deferens
Tubectomy – Removal of fallopian tube

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**
(1)	(iv)	(ii)	(i)	(iii)
(2)	(iii)	(i)	(iv)	(ii)
(3)	(i)	(ii)	(iii)	(iv)
(4)	(ii)	(iii)	(i)	(iv)

Ans: (2)

Sol: *Aspergillus niger* – Citric acid
Acetobacter aceti – Acetic acid
Clostridium butylicum – Butyric acid
Lactobacillus – Lactic acid

163. Identify the **incorrect** pair.
(1) Drugs - Ricin
(2) Alkaloids - Codeine
(3) Toxin - Abrin
(4) Lectins - Concanavalin A

Ans: (1)

Sol: Ricin is toxin but not drug

164. The partial pressures (in mm Hg) of oxygen (O_2) and carbon dioxide (CO_2) at alveoli (the site of diffusion) are:
(1) $pO_2 = 159$ and $pCO_2 = 0.3$
(2) $pO_2 = 104$ and $pCO_2 = 40$
(3) $pO_2 = 40$ and $pCO_2 = 45$
(4) $pO_2 = 95$ and $pCO_2 = 40$

Ans: (2)

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

165. Sphincter of Oddi is present at :
(1) Junction of jejunum and duodenum
(2) Ileo-caecal junction
(3) Junction of hepato-pancreatic duct and duodenum
(4) Gastro-oesophageal junction

Ans: (3)

Sol. Sphincter of Oddi guards the opening of hepatopancreatic duct into duodenum.

166. Which of the following RNAs is not required for the synthesis of protein?
(1) siRNA
(2) mRNA
(3) tRNA
(4) rRNA

Ans: (1)

Sol: 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.

167. Succus entericus is referred to as :
(1) Chyme
(2) Pancreatic juice
(3) Intestinal juice
(4) Gastric juice

Ans: (3)

Sol. 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.

168. Persons with 'AB' blood group are called as "Universal recipients". This is due to :
(1) Absence of antibodies, anti-A and anti-B, in plasma
(2) Absence of antigens A and B on the surface of RBCs
(3) Absence of antigens A and B in plasma
(4) Presence of antibodies, anti-A and anti-B, on RBCs

Ans: (1)

Sol. 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.

169. Which of the following characteristics is **incorrect** with respect to cockroach?
(1) 10^{th} abdominal segment in both sexes, bears a pair of anal cerci.
(2) A ring of gastric caeca is present at the junction of midgut and hind gut.
(3) Hypopharynx lies within the cavity enclosed by the mouth parts.
(4) In females, 7^{th}-9^{th} sterna together form a genital pouch.

Ans: (2)

Sol. 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.

170. Which of the following statements wrongly represents the nature of smooth muscle?
(1) These muscles are present in the wall of blood vessels
(2) These muscle have no striations
(3) They are involuntary muscles
(4) Communication among the cells is performed by intercalated discs

Ans: (4)

Sol. Communication among the cells is performed by intercalated discs in cardiac muscle. Intercalated discs are absent in smooth muscle.

171. Which of the following organisms bears hollow and pneumatic long bones?
(1) *Ornithorhynchus*
(2) *Neophron*
(3) *Hemidactylus*
(4) *Macropus*

Ans: (2)

Sol. In Aves (e.g., Neophron), endoskeleton is fully ossified (bony) and the long bones are hollow with air cavities (pneumatic).

172. If Adenine makes 30% of the DNA molecule, what will be the percentage of Thymine, Guanine and Cytosine in it?
(1) T : 20 ; G : 25 ; C : 25
(2) T : 20 ; G : 30 ; C : 20
(3) T : 20 ; G : 20 ; C : 30
(4) T : 30 ; G : 20 ; C : 20

Ans: (4)

Sol: 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.

173. Which enzyme is responsible for the conversion of inactive fibrinogens to fibrins ?
(1) Thrombokinase
(2) Thrombin
(3) Renin
(4) Epinephrine

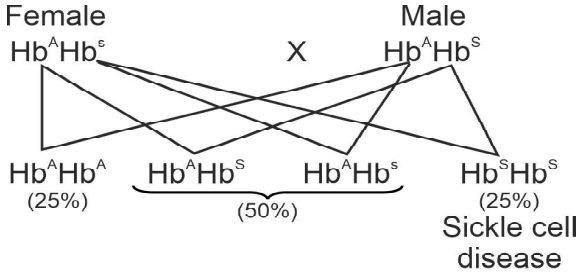
Ans: (2)

Sol. The enzyme thrombin converts inactive fibrinogens in the plasma into fibrins.

174. In a cross between a male and female, both heterozygous for sickle cell anaemia gene, what percentage of the progeny will be diseased ?
(1) 100%
(2) 50%
(3) 75%
(4) 25%

Ans: (4)

Sol.



175. Which one of the following is an example of Hormone releasing IUD ?
(1) Multiload 375
(2) Cu T
(3) LNG 20
(4) Cu 7

Ans: (3)

Sol. 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 hormone-releasing IUDs.

176. The centriole undergoes duplication during :
(1) G_2 phase
(2) S-phase
(3) Prophase
(4) Metaphase

Ans: (2)

Sol: Centrioles duplicate in S phase of cell cycle.

177. Chronic autoimmune disorder affecting neuro muscular junction leading to fatigue, weakening and paralysis of skeletal muscle is called as
(1) Gout
(2) Arthritis
(3) Muscular dystrophy
(4) Myasthenia gravis

Ans: (4)

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

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 ?
(1) Hybridization Technique
(2) Western Blotting Technique
(3) Southern Blotting Technique
(4) ELISA Technique

Ans: (4)

Sol. 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.

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.
(1) (b), (c) and (e) are correct
(2) (c), (d) and (e) are correct
(3) (a), (b) and (c) are correct
(4) (a), (d) and (e) are correct

Ans: (1)

Sol. Metagenesis is exhibited by cnidarians (not helminths). Comb plates of ctenophores help in locomotion (not digestion).

180. Erythropoietin hormone which stimulates R.B.C. formation is produced by :
(1) Juxtaglomerular cells of the kidney
(2) Alpha cells of pancreas
(3) The cells of rostral adenohypophysis
(4) The cells of bone marrow

Ans: (1)

Sol. The juxtaglomerular cells of kidney produce a peptide hormone called erythropoietin which stimulates erythropoiesis (formation of RBC).

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.
(1) (a) and (d) only
(2) (b) and (d) only
(3) (b) and (c) only
(4) (a), (c) and (d) only

Ans: (4)

Sol. C peptide present in proinsulin is removed during its maturation. The insulin produced by rDNA technology has only A peptide and B peptide.

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)**
(1)	(iv)	(i)	(ii)	(iii)
(2)	(iv)	(iii)	(i)	(ii)
(3)	(iii)	(iv)	(i)	(ii)
(4)	(iii)	(iv)	(ii)	(i)

Ans: (4)

Sol. Metamerism – Annelida
Canal system – Porifera
Comb plates – Ctenophora
Cnidoblasts - Coelenterata

183. Which of the following is **not** an objective of Biofortification in crops ?
(1) Improve micronutrient and mineral content
(2) Improve protein content
(3) Improve resistance to diseases
(4) Improve vitamin content

Ans: (3)

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

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 ?
(1) Ligation
(2) Annealing
(3) Extension
(4) Denaturation

Ans: (4)

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

185. The fruit fly has 8 chromosomes (2n) in each cell. During interphase of Mitosis if the number of chromosomes at G_1 phase is 8, what would be the number of chromosomes after S phase ?
(1) 32
(2) 8
(3) 16
(4) 4

Ans: (2)

Sol: During mitotic cell cycle if the chromosome number in G_1 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.

SECTION - B (BIOLOGY : ZOOLOGY)

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.
(1) **(A)** is false but **(R)** is true
(2) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**
(3) Both **(A)** and **(R)** are true and **(R)** is not the correct explanation of **(A)**
(4) **(A)** is true but **(R)** is false

Ans: (2)

Sol. 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.

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

Ans: (1)

Sol: 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.

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.
(1) (b) and (c) are correct
(2) (a), (b) and (c) are correct
(3) (a), (b) and (d) are correct
(4) (a), (b), (c) and (d) are correct.

Ans: (2)

Sol. 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.

189. Which of the following is **not** a step in Multiple Ovulation Embryo Transfer Technology (MOET) ?
(1) Fertilized eggs are transferred to surrogate mothers at 8-32 cell stage
(2) Cow is administered hormone having LH like activity for super ovulation
(3) Cow yields about 6-8 eggs at a time
(4) Cow is fertilized by artificial insemination

Ans: (2)

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

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.

(1) Adhering junctions and Gap junctions, respectively.

(2) Gap junctions and Adhering junctions, respectively.

(3) Tight junctions and Gap junctions, respectively.

(4) Adhering junctions and Tight junctions, respectively.

Ans: (3)

Sol. 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.

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

(1) Uterus

(2) Graafian follicle

(3) Corpus luteum

(4) Foetus

Ans: (3)

Sol. 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.

192. 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.

(1) (b), (d), (e), (a) only

(2) (a), (c), (d), (e) only

(3) (a), (b), (c), (d) only

(4) (b), (c), (d), (e) only

Ans: (2)

Sol. 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 :

(1) Addison's disease

(2) Dysfunction of Immune system

(3) Parkinson's disease

(4) Digestive disorder

Ans: (2)

Sol. 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 excessive use of herbicides and pesticides
(b)	Convergent evolution	(ii)	Bones of forelimbs in Man and Whale
(c)	Divergent evolution	(iii)	Wings of Butterfly and Bird
(d)	Evolution by anthropogenic action	(iv)	Darwin Finches

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

	a	**b**	**c**	**d**
(1)	(i)	(iv)	(iii)	(ii)
(2)	(iv)	(iii)	(ii)	(i)
(3)	(iii)	(ii)	(i)	(iv)
(4)	(ii)	(i)	(iv)	(iii)

Ans: (2)

Sol.

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 ?

(1) Release of Prolactin

(2) Increase in estrogen and progesterone ratio

(3) Synthesis of prostaglandins

(4) Release of Oxytocin

Ans: (1)

Sol. 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.

(1) (b) and (e) only

(2) (a) and (b) only

(3) (c) and (d) only

(4) (b) and (c) only

Ans:(4)

Sol: 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**
(1)	(iv)	(iii)	(ii)	(i)
(2)	(iv)	(ii)	(iii)	(i)
(3)	(iv)	(i)	(iii)	(ii)
(4)	(iv)	(i)	(ii)	(iii)

Ans: (4)

Sol. 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**
(1)	(ii)	(iii)	(i)	(iv)
(2)	(iv)	(i)	(iii)	(ii)
(3)	(iii)	(iv)	(i)	(ii)
(4)	(i)	(ii)	(iv)	(iii)

Ans: (3)

Sol. Filariasis – *Wuchereria bancrofti*

Amoebiasis – *Entamoeba histolytica*

Pneumonia – *Haemophilus influenzae*

Ringworm - *Trichophyton*

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

(1) Histones carry positive charge in the side chain.

(2) Histones are organised to form a unit of 8 molecules.

(3) The pH of histones is slightly acidic.

(4) Histones are rich in amino acids- Lysine and Arginine.

Ans: (3)

Sol: 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**
(1)	(iv)	(iii)	(ii)	(i)
(2)	(i)	(iii)	(ii)	(iv)
(3)	(ii)	(iii)	(iv)	(i)
(4)	(iv)	(ii)	(iii)	(i)

Ans: (1)

Sol. Scapula – Triangular flat bone

Cranium – Fibrous joint

Sternum – Flat bone

Vertebral column – Cartilaginous joint