NEET 2021 Question Paper with Solutions (12-9-2021)
Paper Code - O1

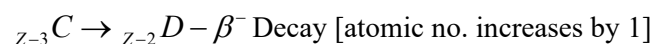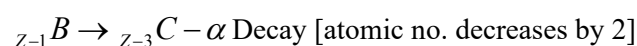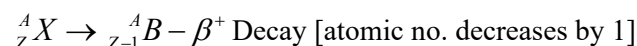# Physics

1. A radioactive nucleus $_Z^A X$ undergoes spontaneous decay in the sequence
$_Z^A X \to_{Z-1} B \to_{Z-3} C \to_{Z-2} D,$ Atomic number of element X. The possible decay particles in the sequence are:
Options:
(a) β^+, α, β^-
(b) β^-, α, β^+
(c) α, β^-, β^+
(d) α, β^+, β^-
Answer: (a)
Solution:
$_Z^A X \to \ _{Z-1}^A B - \beta^+$ Decay [atomic no. decreases by 1]
$_{Z-1} B \to \ _{Z-3} C - \alpha$ Decay [atomic no. decreases by 2]
$_{Z-3} C \to \ _{Z-2} D - \beta^-$ Decay [atomic no. increases by 1]

2. Polar molecules are the molecules:
Options:
(a) Acquire a dipole moment only when magnetic field is absent.
(b) Having a permanent electric dipole moment .
(c) Having zero dipole moment.
(d) presence of electric field due to displacement of charges.
Answer: (b)
Solution:
Definition Based

3. 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?
Options:
(a) 1 Ω
(b) 4 Ω
(c) 0.25 Ω
(d) 0.5 Ω
Answer: (b)
Solution:
Let each wire's resistance be R
When all 4 are in parallel:

$R_{eq} = R/4 = 0.25$
$R = 1\ \Omega$
When all are connected in in series:
$R_{eq} = 4R$
$= 4\Omega$

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

Column I	Column II
(A) Drift Velocity	(P) $\dfrac{m}{ne^2\rho}$
(B) Electrical Resistivity	(Q) nev_d
(c) Relaxation Period	(R) $\dfrac{eE}{n}\tau$
(D) Current Density	(S) $\dfrac{E}{J}$

Options:
(a) A-R, B-P, C-S, D-Q
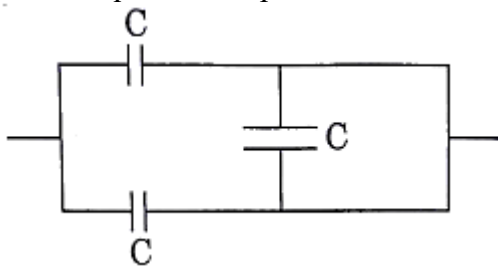(b) A-R, B-Q, C-S, D-P
(c) A-R, B-S, C-P, D-Q
(d) A-R, B-S, C-Q, D-P
Answer: (c)
Solution:
A-R, B-S, C-P, D-Q
Direct Formula

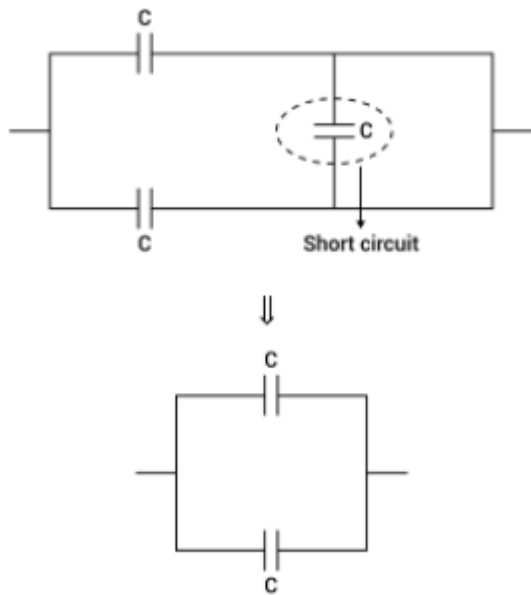**5.** The equivalent capacitance of the combination shown in the figure is:

Options:
(a) C/2
(b) 3C/2
(c) 3C
(d) 2C
Answer: (d)
Solution:

$$C_{eq} = 2C$$

6. 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?

Options:
(a) 64 cm
(b) 62 cm
(c) 60 cm
(d) 21.6 cm

Answer: (c)

Solution:

Potentiometer → Comparison of EMFs of cells

Direct formula: $\dfrac{E_1}{E_2} = \dfrac{\ell_1}{\ell_2}$

$$\frac{1.5V}{2.5V} = \frac{36cm}{\ell_2}$$

$$\ell_2 = 60cm$$

7. 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:

Options:
(a) 3v
(b) 4v
(c) v
(d) 2v

Answer: (b)

Solution:

$$v_{escape} = \sqrt{\frac{2GM}{R}}$$

$$= \sqrt{\frac{2G}{R} \times \frac{4}{3}\pi R^3 \rho} \times \sqrt{\frac{8\pi G}{3}\rho R^2}$$

$V_{escape} \propto R$ [density being same]

$V_{escape_{(other \, planet)}} = V_{escape_{(earth)}}$

8. A cup of coffee cools from 90^0C to 80^0C in t minutes, when the room temperature is 20^0C. The time taken by a similar cup of coffee to cool from 80^0C to 60^0C at a room temperature same at 20^0C is

Options:

(a) $\dfrac{10}{13}t$

(b) $\dfrac{5}{13}t$

(c) $\dfrac{13}{10}t$

(d) $\dfrac{13}{5}t$

Answer: (d)

Solution:

Newton's law of cooling:

$$-\frac{\Delta T}{\Delta t} = k\left[T_{avg} - T_0\right]$$

$$1\text{st case}: \frac{10°C}{t} = k[85 - 20]$$

$$2\text{nd case}: \frac{20°C}{t'} k\left[\frac{80+60}{2} - 20\right]$$

$$\frac{10}{t} \cdot \frac{t'}{20} = \frac{65}{50}$$

$$t' = \frac{13t}{5}$$

9. 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:

Options:

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

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

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

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

Answer: (c)

Solution:

Conduction current in case of capacitor with Ac source:

$I_c = V_0 \omega C \cos \omega t$

$\therefore$ Displacement current will be : $V_0 \omega C \cos \omega t$

10. A small block slides down on a smooth inclined plane, starting from rest at time t = 0. Let S_n be the distance travelled by the block in the interval t = n – 1 to t = n,

Then, the ratio $\dfrac{S_n}{S_n + 1}$ is:

Options:

(a) $\dfrac{2n+1}{2n-1}$

(b) $\dfrac{2n}{2n-1}$

(c) $\dfrac{2n-1}{2n}$

(d) $\dfrac{2n-1}{2n+1}$

Answer: (d)

Solution:

$S_{n^{th}} = u + \dfrac{a}{2}[2n-1]$

$u = 0$

$a = g \sin \theta$

$S_{n^{th}} = \dfrac{g \sin \theta}{2}[2n-1]$

$S_{(n+1)^{th}} = \dfrac{g \sin \theta}{2}[2n+1]$

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

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

Options:

(a) [F] [A] [T^{-1}]

(b) [F] [A^{-1}] [T]

(c) [F] [A] [T]

(d) [F] [A] [T^2]

Answer: (d)

Solution:

$E = F^a A^b T^c$

$\left[M^1 L^2 T^{-2} \right] = \left[MLT^{-2} \right]^a \left[LT^{-2} \right]^b \left[T^c \right]$

$M^1 L^2 T^{-2} = M^a L^{a+b} T^{-2-2b+c}$

$a = 1 \ b = 1 \ c \Rightarrow -2 - 2 + c = -2$

$C = +2$

$E = \left[F^1 A^1 T^2 \right]$

12. 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>

Options:

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

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

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

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

Answer: (d)

Solution:

For direction

$\vec{E} \times \vec{B} = \vec{C}$

1. $\left(\hat{j} + \hat{k} \right) \times \left(-\hat{j} - \hat{k} \right) = 0$ (*wrong*)

2. $\left(\hat{j} \times \hat{k} \right) \times \left(-\hat{j} \times \hat{k} \right) = 0$ (*wrong*)

3. $\left(\hat{j} + \hat{k} \right) \times \left(\hat{j} + \hat{k} \right) = 0$ (*wrong*)

4. $\left(-\hat{j} + \hat{k} \right) \times \left(-\hat{j} - \hat{k} \right) = \hat{i} + \hat{i} = 2\hat{i}$ (*wrong*)

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

Options:

(a) 3.14 s

(b) 0.628 s

(c) 0.0628 s

(d) 6.28 s

Answer: (b)

Solution:

$F = kx \Rightarrow 10 = k \left[5 \times 10^{-2} \right]$

$k = 200$

$T = 2\pi \sqrt{\dfrac{m}{k}} = 2\pi \sqrt{\dfrac{2}{200}} = 2\pi \sqrt{\dfrac{1}{100}}$

$= 2\pi \left[\dfrac{1}{10} \right] = \dfrac{6.28}{10}$

$= 0.628$

14. 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

Options:

(a) $\dfrac{S}{2}, \dfrac{\sqrt{3gS}}{2}$

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

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

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

Answer: (b)

Solution:

So

$\dfrac{1}{2}mu^2 = 3mgh$

$\dfrac{1}{2}mu^2 + mgh = mgS$

$3mgh + mgh = mgS$

$\boxed{h = \dfrac{S}{4}}$

and $u = 6g$

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

Options:
(a) A large aperture contributes to the quality and visibility of the images
(b) A large area of the objective ensures better light gathering power
(c) A large aperture provides a better resolution
(d) All of the above

Answer: (d)

Solution:
Fact based

16. 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 sphere (σ_1 / σ_2) is:

Options:

(a) $\sqrt{\left(\dfrac{R_1}{R_2}\right)}$

(b) $\dfrac{R_1^2}{R_2^2}$

(c) $\dfrac{R_1}{R_2}$

(d) $\dfrac{R_2}{R_1}$

Answer: (d)

Solution:

$$\frac{K(Q_1 - x)}{R_1} = \frac{K(Q_2 + x)}{R_2} = \left(\frac{Q_1 - x}{Q_2 + x}\right) = \frac{R_1}{R_2}$$

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

$$= \frac{R_1}{R_2} \times \frac{R_2^2}{R_1} = \frac{R_2}{R_1}$$

17. 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:

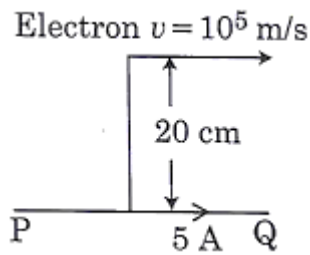**Options:**

(a) 50

(b) 30

(c) 25

(d) 15

Answer: (d)

Solution:
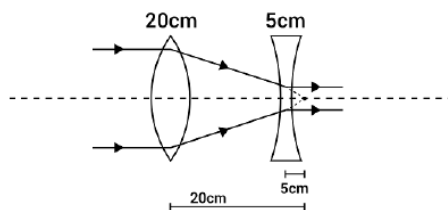
Separation between the lens: 15 cm

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

Electron $v = 10^5$ m/s

Options:
(a) $4\pi \times 10^{-20}$ N
(b) 8×10^{-20} N
(c) 4×10^{-20} N
(d) $8\pi \times 10^{-20}$ N
Answer: (b)
Solution:

$$\beta = \frac{\mu_0}{4\pi}\left(\frac{2I}{r}\right)$$

$$F = qBV$$

$$F = 1.6 \times 10^{-19} \times 10^{-7} \times \frac{2 \times 5}{0.2} \times 10^5$$

$$= \frac{16}{0.2} \times 10^{-26} \times 10^5 = 8 \times 10^{-20} N$$

19. If E and G respectively denote energy and gravitational constant, then E/G has dimensions of:
Options:
(a) $[M][L^0][T^0]$
(b) $[M^2][L^{-2}][T^{-1}]$
(c) $[M^2][L^{-1}][T^0]$
(d) $[M][L^{-1}][T^{-1}]$
Answer: (c)
Solution:

$$[G] = \frac{F.r^2}{m^2} = \left[M^{-1}L^3T^{-2}\right]$$

$$[E] = \left[M^{-1}L^2T^{-2}\right]$$

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

20. 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 :
Options:
(a) $\frac{3}{2}Mg$
(b) 2 Mg

(c) $\dfrac{Mg}{2}$

(d) Mg

Answer: (c)

Solution:

Viscous force = weight - buoyant force

$= Vd_1g - Vd_2g$

$= Vd_1g - V\dfrac{d}{2}g$

$= \dfrac{Vdg}{2} = \dfrac{mg}{2}$

21. 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.

Options:

(a) Current in n-type > current in p-type

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

(c) Current in n-type = current in p-type

(d) Current in p-type > current in n-type

Answer: (a)

Solution:

All the other factors are same, so due to mobility

option (a)

22. A thick current 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 :
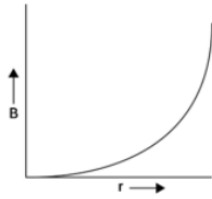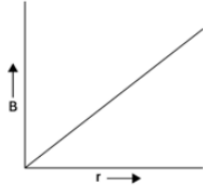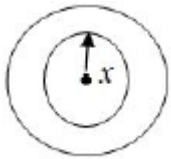
Options:

(a)

(b)

(c)

(d)
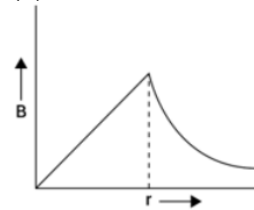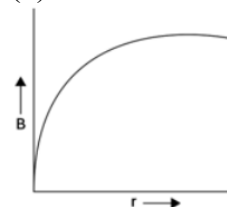
Answer: (a)

Solution:

$$J = \frac{I}{\pi R^2}$$

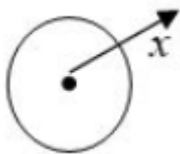$$I_{e_n} = \frac{1}{\pi R^2} \times \pi x^2 = \frac{Ix^2}{R^2}$$

$$\mu_0 I_{e_n} = \int \vec{B}.d\vec{l}$$

$$\mu_0 \frac{Ix^2}{R^2} = B \times 2\pi x$$

$$\Rightarrow B \propto x$$

- Initially it will increase linearly
- After 'R' $\Rightarrow \mu_0 I = B \times 2\pi x$

$$B \propto \frac{1}{x}$$

23. 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:

Options:
(a) 0.26 cm
(b) 0.052 cm
(c) 0.52 cm
(d) 0.026 cm

Answer: (b)
Solution:
M.S.R + L.C x C.S.R
= 1/100 x 52 = 0.52 mm = 0.052 cm

24. 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 x 10^{-3} watt will be : (h = 6.6 x 10^{-34} Js)
Options:
(a) 10^{16}
(b) 10^{15}
(c) 10^{18}
(d) 10^{17}
Answer: (a)
Solution:
$$P = 3.3 \times 10^{-3}$$

$$3.3 \times 10^{-3} = h \times \frac{hc}{\lambda}$$

$$h = 100 \times 10^{14} = 10^{16}$$

25. 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)
Options:
(a) 12 .3 kW
(b) 7.0 kW
(c) 10.2 kW
(d) 8.1 kW
Answer: (d)
Solution:
Pi = (15) (10) (60) = 9000 W
P$_{loss}$ = (10/100) x 9000 = 900 W
P = 8100 W = 8.1 kW

26. 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 :
Options:
(a) $\lambda = \left(\dfrac{2mc}{h} \right) \lambda_d^2$

(b) $\lambda = \left(\dfrac{2h}{mc} \right) \lambda_d^2$

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

(d) $\lambda_d = \left(\dfrac{2mc}{h} \right) \lambda^2$

Answer: (a)

Solution:

$$K.E = \frac{hc}{\lambda} \quad \lambda_d = \frac{h}{p} = \frac{h}{\sqrt{2mK.E.}}$$

$$\lambda_d = \frac{h}{\sqrt{2m\dfrac{hc}{\lambda}}} = \sqrt{\frac{h\lambda}{2mc}}$$

$$\Rightarrow \lambda_d^2 = \left(\frac{h}{2mC}\right)\lambda$$

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

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

Options:
(a) A-Q, B-P, C-S, D-R
(b) A-R, B-Q, C-P, D-S
(c) A-R, B-P, C-S, D-Q
(d) A-Q, B-R, C-S, D-P
Answer: (a)
Solution:
Formula Based

28. A nucleus with mass number 240 breaks into two fragments each of mass number 120, the binding energy per nucleon of unfragmented nuclei is 7.6 MeV while that of fragments is 8.5 MeV. The total gain in the Binding Energy in the process is :
Options:
(a) 804 MeV
(b) 216 MeV
(c) 0.9 MeV
(d) 9.4 MeV
Answer: (b)
Solution:

$$(240)(7.6 Mev) + \Delta Q = (120)(8.5 Mev) + (120)(8.5 Mev)$$

$$T \cdot BE_i + gain$$

$$\Rightarrow \Delta Q = 240(8.5 - 7.6) Mev$$

$$= 216 Mev$$

29. 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)

Options:

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

(b) $\dfrac{E^2 Ad}{\varepsilon_0}$
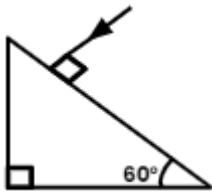
(c) $\dfrac{1}{2}\varepsilon_0 E^2$

(d) $\varepsilon_0 EAd$

Answer: (a)

Solution:

$$E = \frac{1}{2}CV^2 = \frac{1}{2}\frac{(\varepsilon_0 A)}{d}\left(E^2 d^2\right)$$

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

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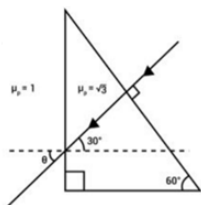

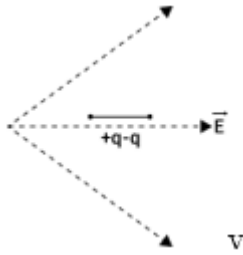**Options:**
(a) 45°
(b) 90°
(c) 60°
(d) 30°

Answer: (c)

Solution:

$$(\sin\theta) = \sqrt{3}\sin 30°$$

$$\sin\theta = \frac{\sqrt{3}}{2}$$

$$\theta = 60°$$

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

Options:
(a) Towards the left as its potential energy will decrease
(b) Towards the right as its potential energy will increase
(c) Towards the left as its potential energy will increase
(d) Towards the right as its potential energy will decrease
Answer: (d)
Solution:
Towards the right as its potential energy decreases.

32. 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.
Options:
(a) (A) is correct (B) is incorrect.
(b) (A) is incorrect but (B) is correct.
(c) (A) and (B) both are correct.
(d) (A) and (B) both are incorrect.
Answer: (c)
Solution:
Zener diode is connected in reverse bias, when used as a voltage regulator.
The potential barrier of p - n junction can be more than the given range.

33. A half-life of a radioactive nuclide is 100 hours. The fraction of original activity that will remain after 150 hours would be:
Options:
(a) $\dfrac{2}{3}$

(b) $\dfrac{2}{3\sqrt{2}}$

(c) $\dfrac{1}{2}$

(d) $\dfrac{1}{2\sqrt{2}}$

Answer: (d)
Solution:
$$N = N_0 \left(\frac{1}{2}\right)^n$$

$$= N_0 \left(\frac{1}{2}\right)^{\frac{150}{100}}$$

$$= N_0 \left(\frac{1}{2}\right)^{3/2}$$

$$\frac{N}{N_0} = \frac{1}{2\sqrt{2}}$$

34. 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 figures. Potential difference across L, C and R is 40 V, 10V and 40V, respectively. The amplitude of current flowing through LCR series circuit is $10\sqrt{2}$. The impedance of the circuit is :
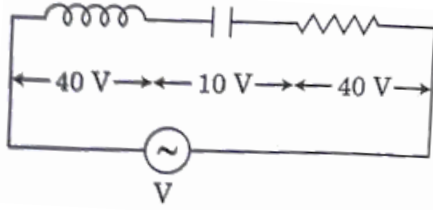
Options:
(a) 4Ω
(b) 5Ω
(c) $4\sqrt{2}\Omega$
(d) $\dfrac{5}{\sqrt{2}}\Omega$

Answer: (b)
Solution:

$$V_{rms} = \sqrt{30^2 + 40^2} = 50$$

$$I_{rms} = \frac{10\sqrt{2}}{\sqrt{2}} = 10$$

$$Z = \frac{50}{10} = 5\Omega$$

35. A body is executing simple harmonic motion with frequency 'n', the frequency of its potential energy is:
Options:
(a) 3n
(b) 4n
(c) n
(d) 2n
Answer: (d)
Solution:
2n

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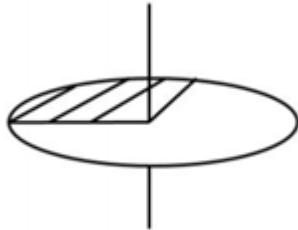**Options:**

(a) $\dfrac{1}{4}$

(b) $\dfrac{1}{8}$

(c) $\dfrac{3}{4}$

(d) $\dfrac{7}{8}$

Answer: (c)

Solution:

$$I = \dfrac{3M}{4} R^2$$
$$= KMR^2$$
$$K = \dfrac{3}{4}$$

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

Options:

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

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

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

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

Answer: (a)

Solution:

Band width at half power frequency

$$\Delta\omega = \dfrac{R}{L}$$
$$= \dfrac{40}{5} = 8 rad / s$$

38. 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:

Options:

(a) 3 Ia^2 and 4 Ia^2

(b) 4 Ia^2 and 3 Ia^2

(c) $\sqrt{3}$ Ia² and 3 Ia²
(d) 3 Ia² and I a²
Answer: (c)
Solution:
For triangle
$M = NiA$
$$= 4 \times I \frac{\sqrt{3}}{4} a^2$$
$$= \sqrt{3} Ia^2$$
For square $M = 3Ia^2$

39. A step down transformer connected to an ac mains supply of 220 V is made to operate at 11 V, 44 W lamp. Ignoring power losses in the transformer, what is the current in the primary circuit?
Options:
(a) 2A
(b) 4A
(c) 0.2A
(d) 0.4A
Answer: (c)
Solution:
$$(V_i)_{\text{Primary}} = (V_i)_{\text{Secondary}}$$
$$220i = 44$$
$$i = \frac{44}{220} = \frac{2}{10} = 0.2A$$

40. 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.
Options:
(a) 1520 V
(b) 1980 V
(c) 660 V
(d) 1320 V
Answer: (b)
Solution:
For bigger
$$V = \frac{K27q}{R}$$
$$= \frac{K27q}{3r}$$
$$= 9 \frac{Kq}{r}$$
$$= 9 \times 220$$
$$= 1980$$

41. Two conducting circular loops of radii R_1 and R_2 are placed in the same plane with their centres coinciding. If $R_1 \gg R_2$, the mutual inductance M between them will be directly proportional to:
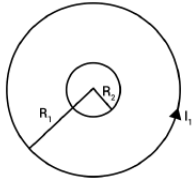
Options:

(a) $\dfrac{R_1^2}{R_2}$

(b) $\dfrac{R_2^2}{R_1}$

(c) $\dfrac{R_1}{R_2}$

(d) $\dfrac{R_2}{R_1}$

Answer: (b)

Solution:

$$B_1 = \frac{\mu_0 I_1}{2R_1}$$

$$\phi_2 = B_1\left(\pi R_2^2\right) = \frac{\mu_0 \pi R_2^2}{2R_1} I_1$$

$$\phi_2 = MI_1 \Rightarrow M = \frac{\mu_0 \pi R_2^2}{2R_1}$$

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

42. A particle of mass 'm' is projected with a velocity $u = kV_e$ ($k < 1$) from the surface of the earth.

(V_e = escape velocity)

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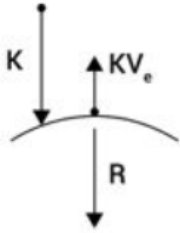
Options:

(a) $\dfrac{R^2 k}{1+k}$

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

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

(d) $R\left(\dfrac{k}{1+k}\right)^2$

Answer: (b)

Solution:

$$V_e = \sqrt{\frac{2GM}{R}}$$
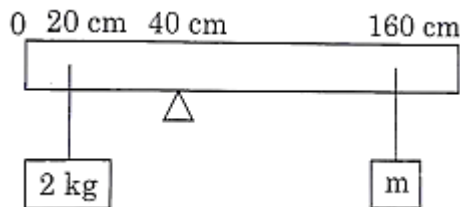
$$\frac{1}{2}m(kV_e)^2 + \left(-\frac{GMm}{R}\right)$$

$$= 0 - \left(\frac{GMm}{R+H}\right)$$

$$\frac{1}{2}mk^2\frac{2GM}{R} - \frac{GMm}{R} = -\frac{GMm}{R+H}$$

$$K^2 - 1 = -\frac{R}{R+H} \Rightarrow R+H = -\frac{R}{K^2-1}$$

$$H = \frac{R}{1-K^2} - R = R\left(\frac{K^2}{1-K^2}\right)$$

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

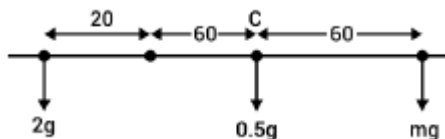**Options:**
(a) 1/6 kg
(b) 1/12 kg
(c) 1/2 kg
(d) 1/3 kg
Answer: (b)
Solution:

$$2g(20) = (0.5)60 + mg(120)$$
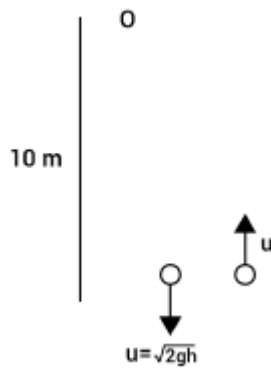
$$4 = 3 + m12 \Rightarrow m = \frac{1}{12}kg$$

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:
Options:
(a) 21 kg m/s
(b) 1.4 kg m/s
(c) 0 kg m/s
(d) 4.2 kg m/s
Answer: (d)
Solution:

Impulse
$$= 2mu = 2 \times 0.15 \times \sqrt{2gh}$$
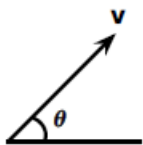$$= 0.3 \times 10 \times 1.41 = 4.23$$

45. A particle moving in a circle of radius R with a uniform speed takes a time T to complete one revolution. I 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:
Options:

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

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

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

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

Answer: (b)
Solution:

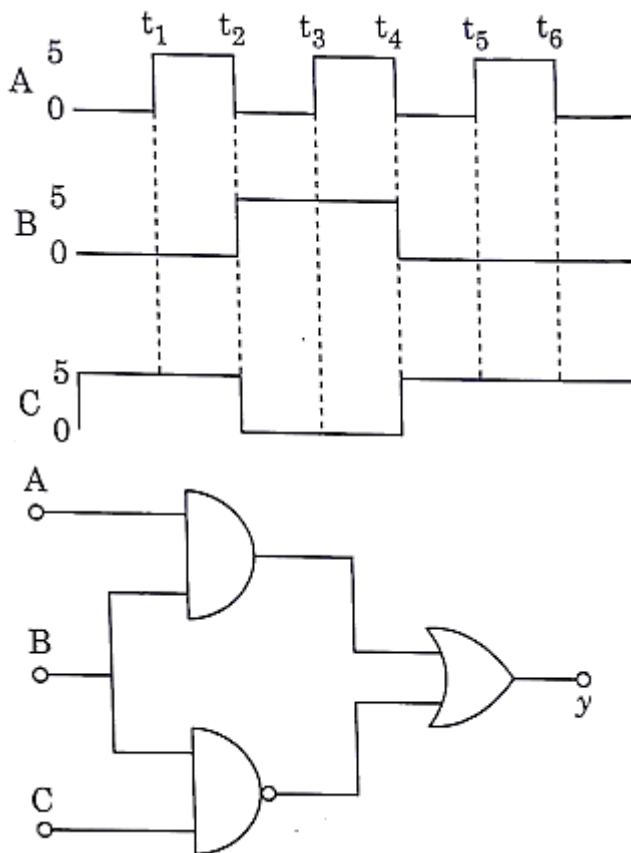$$T = \frac{2\pi R}{v} \Rightarrow v = \frac{2\pi R}{T}$$

$$H = \frac{v^2 \sin^2 \theta}{2g}$$

$$H = R$$

$$4R = \left(\frac{2\pi R}{T}\right)^2 \frac{\sin^2 \theta}{2g}$$
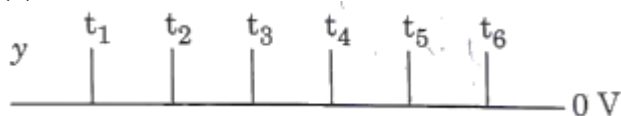
$$\sqrt{\frac{2g}{R}\left(\frac{T}{\pi}\right)^2} = \sin \theta = \sqrt{\frac{2gT^2}{\pi^2 R}}$$

46. 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?
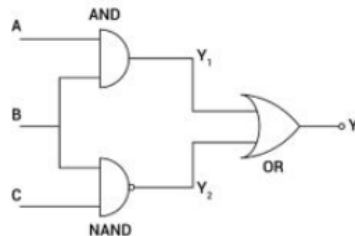

Options:

(a)

(b)

(c)

(d)

5 V
0 V

Answer: (c)
Solution:

$Y_1 = A.B$, $Y_2 \overline{B.C}$

$Y = Y_1 + Y_2 = A.B + \overline{B.C}$

A	B	C	Y_1	Y_2	Y
0	0	1	0	1	1
1	0	1	0	1	1
0	1	0	0	1	1
1	1	0	1	1	1
0	0	1	0	1	1
1	0	1	0	1	1
0	0	1	0	1	1

47. In the product $\vec{F} = q(\vec{v} \times \vec{B}) = q\vec{v} \times (B\hat{i} + B\hat{j} + B_0\hat{k})$

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

What will be the complete expression for $\vec{B}$?
Options:
(a) $8\hat{i} + 8\hat{j} - 6\hat{k}$
(b) $6\hat{i} + 6\hat{j} - 8\hat{k}$
(c) $-8\hat{i} - 8\hat{j} - 6\hat{k}$
(d) $-6\hat{i} - 6\hat{j} - 8\hat{k}$
Answer: (d)
Solution:

$\vec{v} = 2\hat{i} + 4\hat{j} + 6\hat{k}$

$\vec{F} = 4\hat{i} - 20\hat{j} + 12\hat{k}$

$\vec{B} = B\hat{i} + B\hat{j} + B_0\hat{k}$

$\vec{F} = q \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 4 & 6 \\ B & B & B_0 \end{vmatrix}$

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

$\vec{F} = 4\hat{i} - 20\hat{j} + 12\hat{k}$

$4B_0 - 6B = 4$

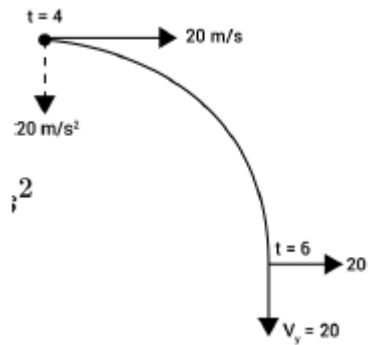$-(2B_0 - 6B) = 20 \Rightarrow 2B_0 = 20 + 6(-6)$

$-2B = 12 \Rightarrow B = -6$

48. A car starts from rest and accelerates at 5 m/s². At t = 4s, a ball is dropped out of a window by a person sitting in the car. What is the velocity and acceleration of the ball at t = 6 s? (Take g = 10 m/s²)
Options:

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

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

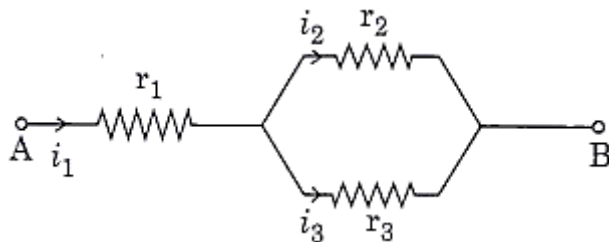(c) $20m/s, 5m/s^2$

(d) $20\ m/s, 0$

Answer: (b)

Solution:

$At\ t = 4, v = 0 + 5 \times 4 = 20\ m/s$

$v_y = 0 + 10 \times 2 = 20$

$v = \sqrt{20^2 + 20^2} = 20\sqrt{2},\ a = 10\ m/s^2$

49. Three resistors having resistance r₁, r₂, and r₃ are connected as shown in the given circuit. The ratio i₃/i₁ of currents in terms of resistances used in the circuit is:
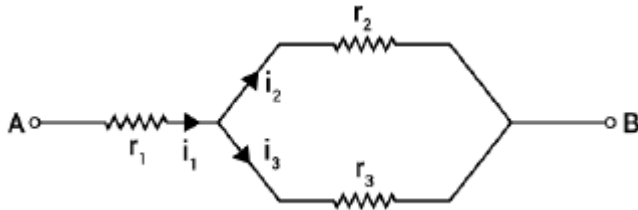

0

Options:

(a) $\dfrac{r_1}{r_1 + r_2}$

(b) $\dfrac{r_2}{r_1 + r_3}$
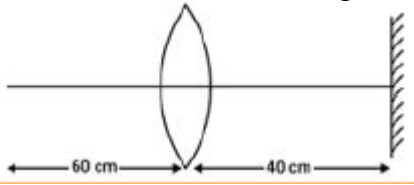
(c) $\dfrac{r_1}{r_2 + r_3}$

(d) $\dfrac{r_2}{r_2 + r_3}$

Answer: (d)

Solution:

$$i_3 = \left(\frac{r_2}{r_2 + r_3}\right) i_1 \Rightarrow \frac{i_3}{i_1} = \left(\frac{r_2}{r_2 + r_3}\right)$$

50. 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:

Options:
(a) 30cm from the plane mirror, it would be a virtual image.
(b) 20 cm from the plane mirror, it would be a virtual image.
(c) 20 cm from the lens, it would be a real image.
(d) 30 cm from the lens, it would be a real image.
Answer: (b)
Solution:
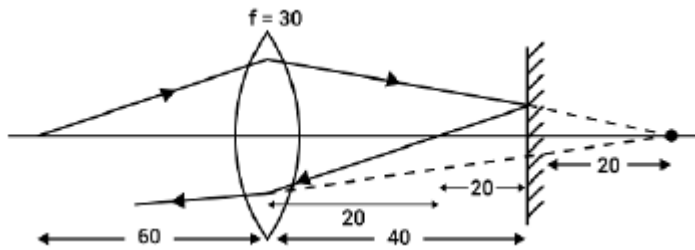
$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v_1} - \frac{1}{(-60)} = \frac{1}{30}$$

$$\frac{1}{v_1} = \frac{1}{30} - \frac{1}{60} = \frac{1}{60}$$

$$v_1 = +60$$

$$\frac{1}{v_2} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v_2} - \frac{1}{(-20)} = \frac{1}{30}$$

$$\frac{1}{v_2} = \frac{1}{30} - \frac{1}{20} = \frac{10}{30 \times 20}$$

$$v_2 = -60$$

CHEMISTRY

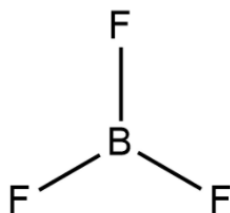**51.** BF_3 is planar and electron deficient compound. Hybridization and number of electrons around the central atom, respectively are

Options:
(a) Sp^2 and 6
(b) Sp^2 and 8
(c) Sp^3 and 4
(d) Sp^3 and 6

Answer: (a)

Solution:

- Hybridisation - sp^2
- Number of electrons around the central atom = 6

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

Options:
(a) $Fe + 2HCl \longrightarrow FeCl_2 + H_2\uparrow$
(b) $2Pb(NO_3)_2 \longrightarrow 2PbO + 4NO_2 + O_2\uparrow$
(c) $2KClO_3 \xrightarrow{\Delta} 2KCl + 3O_2$
(d) $Cr_2O_3 + 2Al \xrightarrow{\Delta} Al_2O_3 + 2Cr$

Answer: (d)

Solution: Metal displacement reactions are the ones in which more reactive metal displaces a less reactive metal from its compound. Thus, out of the given reactions, the metal displacement reaction is:

$Cr_2O_3 + 2Al \xrightarrow{\Delta} Al_2O_3 + 2Cr$
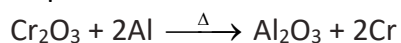
53. The compound which shows metamerism is

Options:
(a) C_3H_6O
(b) $C_4H_{10}O$
(c) C_5H_{12}
(d) C_3H_8O

Answer: (b)

Solution: Metamers are the isomers having the same molecular formula but different alkyl groups on two sides of functional groups.

$CH_3–CH_2–CH_2–O–CH_3$, $CH_3–CH_2–O–CH_2–CH_3$
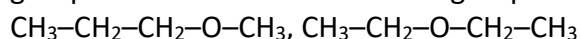
54. The pK_b of dimethylamine and pK_a of acetic acid are 3.27 and 4.77 respectively at T(K). The correct option for the pH of dimethyl ammonium acetate solution is:

Options:
(a) 7.75
(b) 6.25
(c) 8.50
(d) 5.50

Answer: (a)

Solution: The given salt is a salt of weak acid + weak base.

$pH = 0.5 [pK_w + pK_a - pK_b]$

$pH = 0.5 [14 + 4.77 - 3.27]$

$pH = 0.5 [15.5]$

$pH = 7.75$

55. The structure of beryllium chloride in solid state and vapour phase, are:

Options:
(a) Dimer and Linear, respectively
(b) Chain in both
(c) Chain and dimer, respectively
(d) Linear in both

Answer: (c)

Solution:

In solid state:
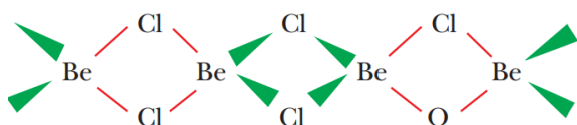
In vapour phase:
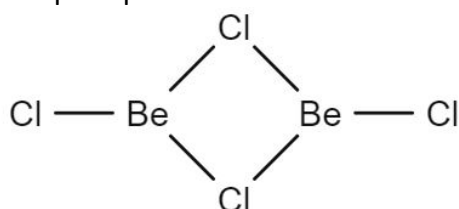
56. Zr (Z = 40) and Hf (Z = 72) have similar atomic and ionic radii because of:

Options:
(a) lanthanoid contraction
(b) having similar chemical properties
(c) Belonging to same group
(d) diagonal relationship

Answer: (a)

Solution: Due to presence of 4f electrons in Hf it's Z_{eff} increases, size remains the same. This is also known as lanthanoid contraction.

57. 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, $c = 3 \times 10^8$ ms^{-1}]

Options:
(a) 2192 m
(b) 21.92 cm
(c) 219.3 m
(d) 219.2 m
Answer: (c)
Solution: Wavelength = speed of light / Frequency
Wavelength = 3×10^8 / 1368×10^3
Wavelength = 219.298 m ≈ 219.3 m

58. 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]
Options:
(a) CH_3
(b) CH_4
(c) CH
(d) CH_2
Answer: (a)
Solution:

Element	Percentage	Moles	Relative	
C	78	6.5	1	
H	22	22	3.38	

Thus, empirical formula is CH_3.

59. Ethylenediaminetetraacetate (EDTA) ion is
Options:
(a) Bidentate ligand with two "N" donor atoms
(b) Tridentate ligand with three "N" donor atoms.
(c) Hexadentate ligand with four "O" and two "N" donor atoms
(d) Unidentate ligand
Answer: (c)
Solution: Ethylenediaminetetraacetate ion ($EDTA^{4-}$) is an important <u>hexadentate ligand</u>. It can bind through two nitrogen and four oxygen atoms to a central metal ion.
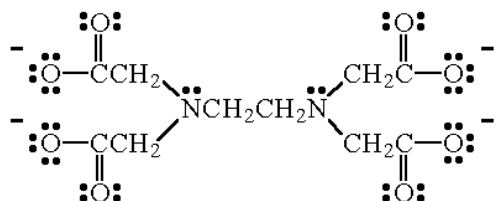
60. Among the following alkaline earth metal halides, one which is covalent and soluble in organic solvents is:
Options:
(a) Magnesium chloride
(b) Beryllium chloride

(c) Calcium chloride

(d) Strontium chloride

Answer: (b)

Solution: Beryllium halides are essentially covalent and soluble in organic solvents.

NCERT line - s block elements (Page no. 309)

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

Options:

(a) Starch solution

(b) Urea Solution

(c) NaCl solution

(d) Glucose Solution

Answer: (a)

Solution: Starch is a colloid.

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

Options:

(a) 698.28 S cm^2 mol^{-1}

(b) 540.48 S cm^2 mol^{-1}

(c) 201.28 S cm^2 mol^{-1}

(d) 390.71 S cm^2 mol^{-1}

Answer: (d)

Solution:

$\lambda^\infty(CH_3COOH) = \lambda^\infty(CH_3COONa) + \lambda^\infty(HCl) - \lambda^\infty(NaCl)$

$= (91 + 426.16 - 126.45)$ S cm^2 mol^{-1}

$= 390.71$ S cm^2 mol^-

63. The correct structure of 2,6-Dimethyl-dec-4-ene

Options:

(a)

(b)

(c)

(d)
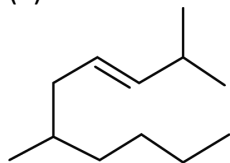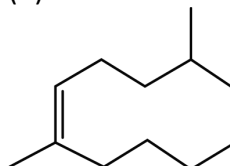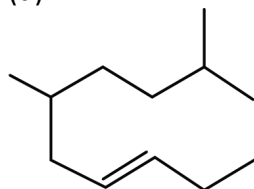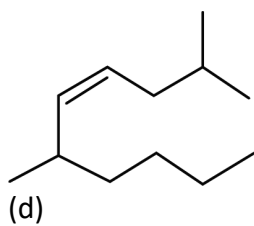
Answer: (c)

Solution: 2,6-Dimethyl-dec-4-ene
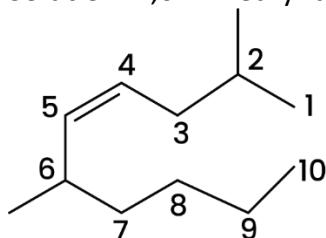
64. The correct option for the number of body centred unit cells in all 14 types of Bravais lattice unit cells is:

Options:

(a) 2

(b) 3

(c) 7

(d) 5

Answer: (b)

Solution: Body centred unit cells are possible in Cubic, Tetragonal and Orthorhombic crystal system.

65. Which one of the following polymers is Prepared by addition polymerisation?

Options:

(a) Novolac

(b) Dacron

(c) Teflon

(d) Nylon-66

Answer: (c)

Solution:

Tetra fluoroethylene
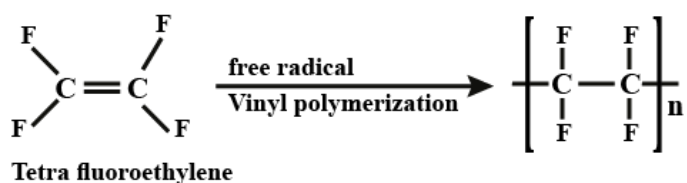
66. What is the IUPAC name of the organic compound formed in the following chemical reaction?

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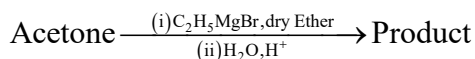
Options:

(a) pentan-3-ol

(b) 2-methyl butan-2-ol

(c) 2-methylpropan-2-ol

(d) pentan-2-ol

Answer: (b)

Solution:

2 - methyl - butan - 2 - ol
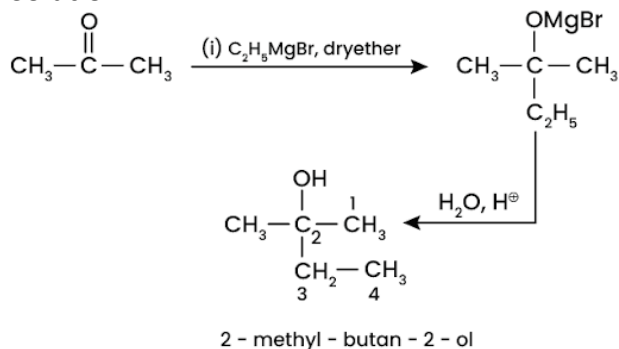
67. Match List-I with List-II

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

Options:

(a) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

(b) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

(c) (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)

(d) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)

Answer: (c)

Solution:
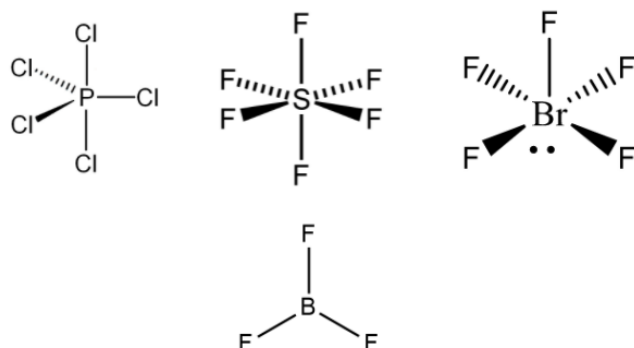
68. The incorrect statement among the following is:

Options:

(a) Lanthanoids are good conductors of heat and electricity

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

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

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

Answer: (d)

Solution:

<u>Many trivalent lanthanoid ions are coloured both in the solid state and in aqueous solutions.</u> Colour of these ions may be attributed to the presence of f-electrons.

<mark>NCERT line - d and f block elements</mark>

69. Dihedral angle of least stable conformer of ethane is

Options:

(a) 60°

(b) 0°

(c) 120°

(d) 180°

Answer: (b)

Solution: In this position, the dihedral angle (also called the angle of rotation or the angle of torsion or torsional angle) is zero degree.

70. Choose the correct option for graphical representation of Boyle's law, which shows a graph of pressure vs. Volume of a gas at different temperature.

Options:

(a)

(b)

(c)

(d)
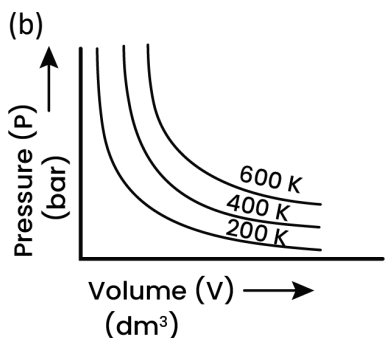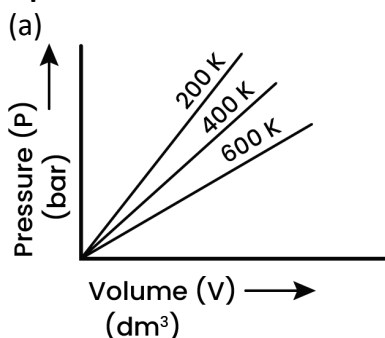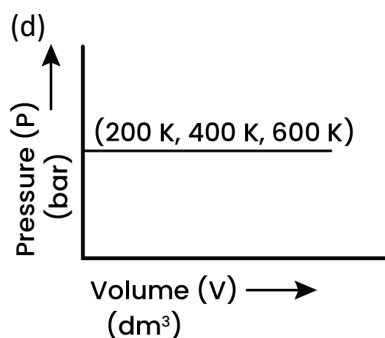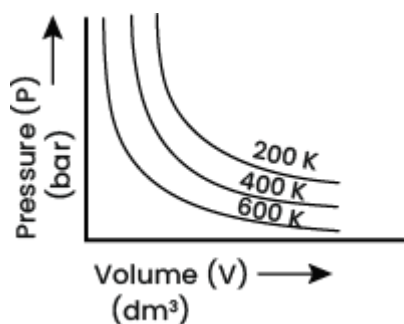
Answer: (b)

Solution: The pressure varies with volume at constant temperature as P = K/V. Thus, the graph should be hyperbolic. Also, on increasing the temperature at constant volume, the pressure should increase. Thus, the correct graph is (B).
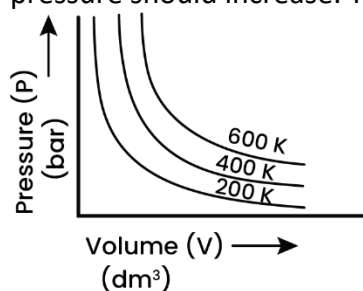
71. The correct sequence of bond enthalpy of 'C-X' bond is

Options:

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

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

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

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

Answer: (d)

Solution:

•   Due to high bond length C-I has less bond strength and has less bond dissociation enthalpy.

•   Because of short bond length C-F has high bond dissociation enthalpy so that increasing order of bond dissociation enthalpies

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

Options:

(a) Gamma (γ)

(b) Neutron (n)

(c) Beta (β^-)

(d) Alpha (α)

Answer: (c)

Solution: Tritium, a radioactive isotope of hydrogen, emits beta(β^-) particles.

$_1H^3 \rightarrow {_2}He^3 + {_{-1}}e^0 +$ antineutrino
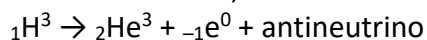
73. Statement I:

Acid strength increases in the order given as
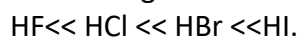
HF<< HCl << HBr <<HI.

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.

Options:

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

(b) Statement I is incorrect but Statement II is true.

(c) Both Statement I and Statement II are true

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

Answer: (c)

Solution: The acidic strength of these acids varies in the order:

HF < HCl < HBr < HI. The stability of these halides decreases down the group due to decrease in bond (H–X) dissociation enthalpy in the order: H–F > H–Cl > H–Br > H–I.

74. 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.

Options:

(a) Statement I is correct but Statement II is false

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

(c) Both Statement I and Statement II are true

(d) Both Statement I and Statement II are false

Answer: (d)

Solution: Aspirin and Paracetamol belong to the class of non narcotic analgesics.

Morphine and Heroin are narcotic analgesics.

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

Options:

(a) $C_P = RC_V$

(b) $C_V = RC_P$

(c) $C_P + C_V = R$

(d) $C_P - C_V = R$

Answer: (d)

Solution: $C_p = C_v + R$

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

Options:

(a) Upto 1900 K

(b) Upto 5000 K

(c) Upto 1200 K

(d) Upto 2200 K

Answer: (d)

Solution: In the Blast furnace, reduction of iron oxides takes place in different temperature ranges. Hot air is blown from the bottom of the furnace and coke is burnt to <u>give temperature upto about 2200K</u> in the lower portion itself

<mark>NCERT line - Metallurgy</mark>

77. For a reaction A → 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.

Options:

(a)

(b)

(c)

(d)

Reaction Progress
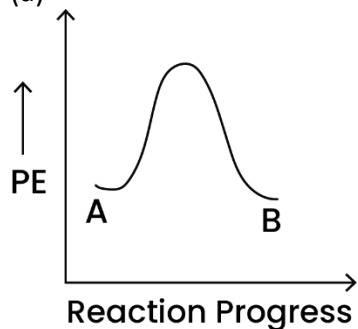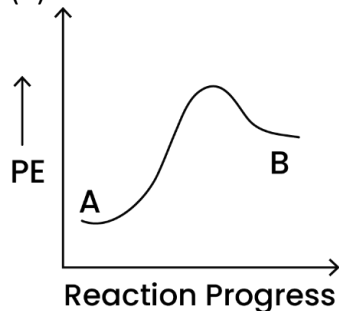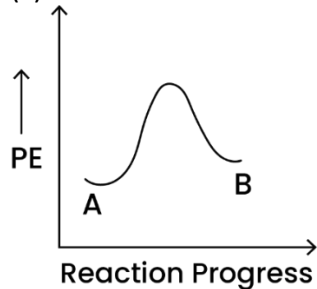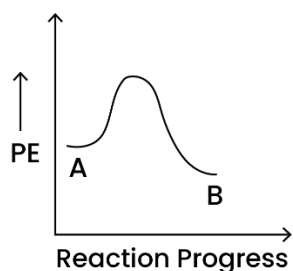
Answer: (d)

Solution: Since the enthalpy of reaction is negative, it means product has lesser potential energy than the reactant. Thus, the correct graph would be (D)

Reaction Progress
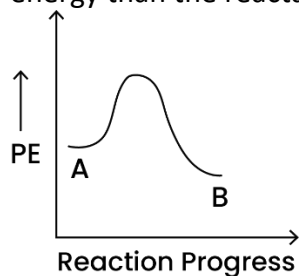
78. Which one of the following methods can be used to obtain highly pure metal which is liquid at room temperature?

Options:

(a) Distillation

(b) Zone refining

(c) Electrolysis

(d) Chromatography

Answer: (a)

Solution: Distillation:

This is very useful for low boiling metals like zinc and mercury. The impure metal is evaporated to obtain the pure metal as distillate.

NCERT line: Metallurgy

79. The RBC deficiency is deficiency disease of

Options:

(a) Vitamin B_1

(b) Vitamin B_2

(c) Vitamin B_{12}

(d) Vitamin B_6

Answer: (c)

Solution: Vitamin B_{12} : Deficiency disease - Pernicious anaemia (RBC deficient in haemoglobin)

NCERT Table 14.3 - Biomolecules

80. The major product of the following chemical reaction is:

$$\underset{CH_3}{\overset{CH_3}{\diagdown}}CH-CH=CH_2 + HBr \xrightarrow{(C_6H_5CO)_2O_2} ?$$

Options:

(a)

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

(b)

$$\underset{CH_3}{\overset{CH_3}{\diagdown}}CBr-CH_2-CH_3$$

(c)

$$\underset{CH_3}{\overset{CH_3}{\diagdown}}CH-CH_2-CH_2-Br$$

(d)

$$\underset{CH_3}{\overset{CH_3}{\diagdown}}CH-CH_2-CH_2-O-COC_6H_5$$
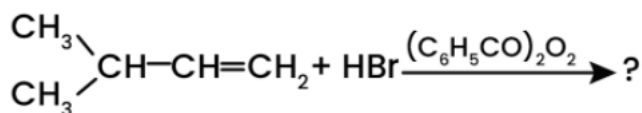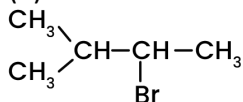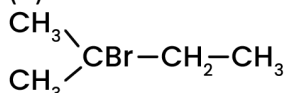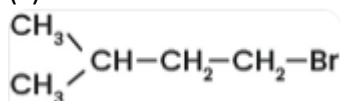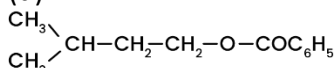
Answer: (c)

Solution: In the presence of peroxide anti markovnikov addition of HBr take place.

$$\underset{CH_3}{\overset{CH_3}{\diagdown}}CH-CH=CH_2 + HBr \xrightarrow{(C_6H_5CO)_2O_2} \underset{CH_3}{\overset{CH_3}{\diagdown}}CH-CH_2-CH_2-Br$$

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

Options:

(a) 2, 1
(b) 12, 6
(c) 8, 4
(d) 6, 12

Answer: (b)

Solution:

HCP has effectively 6 atoms per unit cell. Now,

Number of tetrahedral voids = 2n = 12

Number of octahedral voids = n = 6

82. Noble gases are named because of their inertness towards reactivity. Identify an incorrect statement about them.

Options:

(a) Noble gases have weak dispersion forces
(b) Noble gases have large positive values of electron gain enthalpy
(c) Noble gases are sparingly soluble in water
(d) Noble gases have very high melting and boiling points

Answer: (d)

Solution: They have very low melting and boiling points because the only type of interatomic interaction in these elements is weak dispersion forces.

83. The major product formed in dehydrohalogenation reaction of 2-Bromopentane is pent-2-ene. This product formation is based on?

Options:

(a) Hofmann Rule

(b) Huckel's Rule

(c) Saytzeff's Rule

(d) Hund's Rule

Answer: (c)

Solution:
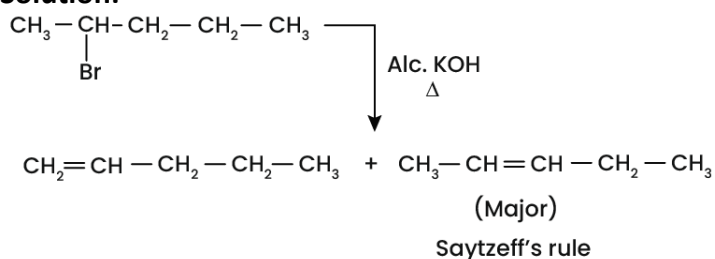
84. Identify the compound that will react with HInsberg's reagent to give a solid which dissolves in alkali.

Options:

(a)

(b)

(c)

(d)
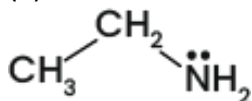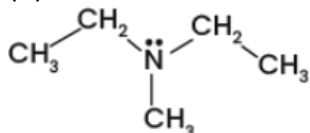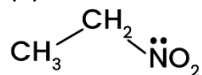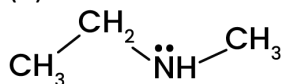
Answer: (a)

Solution: Primary amine on reaction with Hinsberg's reagent give a solid which dissolves in alkali.
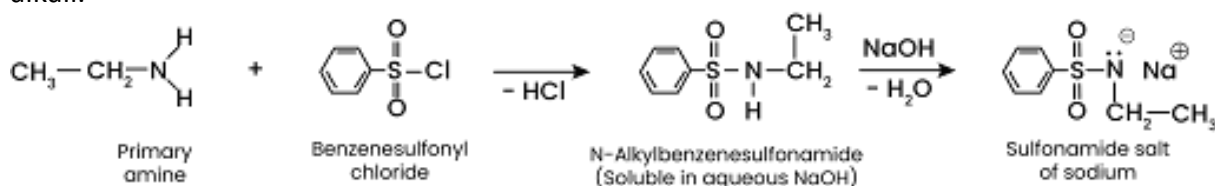
85. The following solutions were prepared by dissolving 10 g glucose ($C_6H_{12}O_6$) in 250 ml of water (P_1) 10 g of urea (CH_4N_2O) in 250 ml of water (P_2) and 10 g of sucrose ($C_{12}H_{12}O_{11}$) in 250 ml of water (P_3). The right option for the decreasing order of osmotic pressure of these solutions is.

Options:

(a) $P_2 > P_3 > P_1$

(b) $P_3 > P_1 > P_2$

(c) $P_2 > P_1 > P_3$

(d) $P_1 > P_2 > P_3$

Answer: (c)

Solution: $\Pi = wRT/MV$

Here, all the given solutions have the same volume and mass of solute. Thus, the osmotic pressure will decrease with increase in molar mass of solute.

Thus, the order should be: $P_2 > P_1 > P_3$

86. Match List - I with List – II

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

Choose the correct answer from the options given below:

Options:

(a) (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)

(b) (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)

(c) (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)

(d) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)

Answer: (a)

Solution: (c) represents effect of acid rain on marble.

87. The intermediate compound "X" in the following chemical reaction is

Options:

(a)

(b)

(c)

(d)

Answer: (c)

Solution:

Toluene   Chromium complex   Benzaldehyde
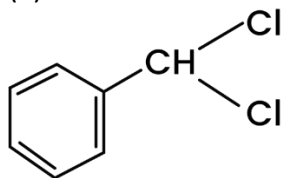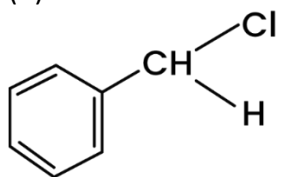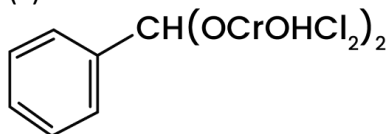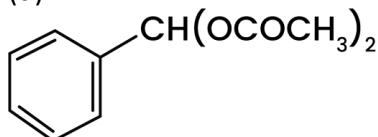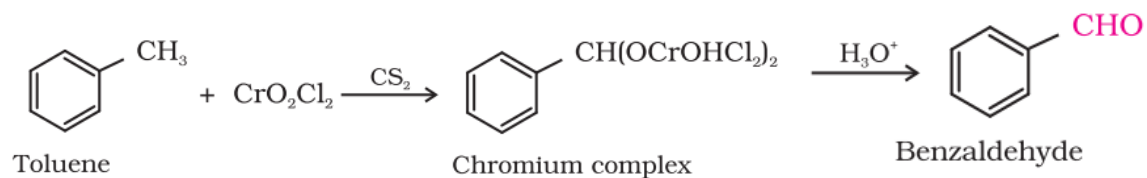
88. Match List - I with List - II

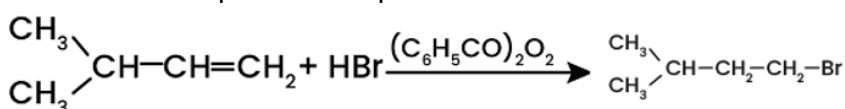| List - I	List - II
(a) CO, HCl Anhy. AlCl₃/CuCl	(i)Hell-Volhard-Zelinsky reaction
(b) $R - \overset{O}{\underset{\|}{C}} - CH_3 + NaOX \rightarrow$	(ii) Gattermann-Koch

(c) R - CH₂-OH + R'COOH $\xrightarrow{\text{Conc.H}_2\text{SO}_4}$	(iii) Haloform reaction
(d) R - CH₂COOH $\xrightarrow[\text{(ii)H}_2\text{O}]{\text{(i)X}_2/\text{Red P}}$	(iv) Esterification

Choose the correct answer form the options given below.

Options:
(a) (a)-(i), (b)-(iv), (c)-(iii), (d)-(ii)
(b) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)
(c) (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)
(d) (a)-(iii), (b)-(ii), (c)-(i), (d)-(iv)

Answer: (b)

Solution:

(ii) Gattermann-Koch reaction

(b)

(iii) Haloform reaction

(C)

(iv) Esterification

(d)

(i) Hell-Volhard–Zelinsky reaction
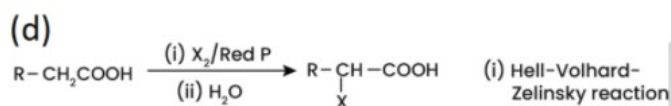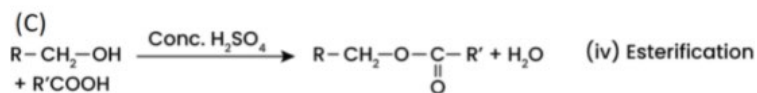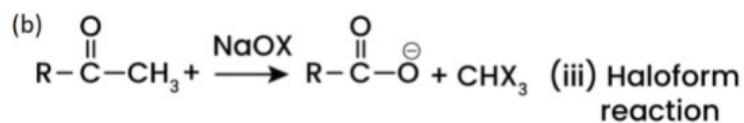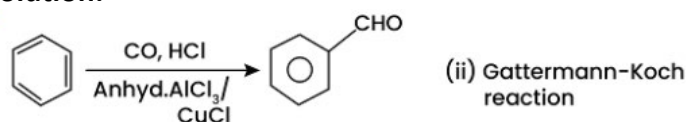
89. The product formed in the following chemical reaction is

Options:
(a)

(b)

(c)

(d)
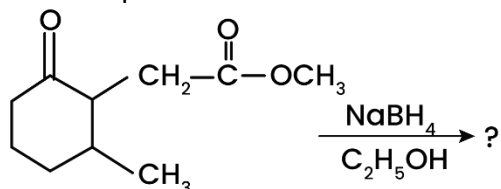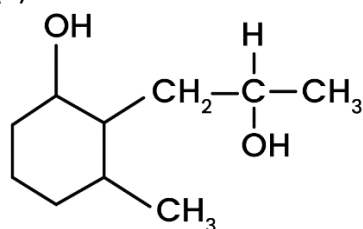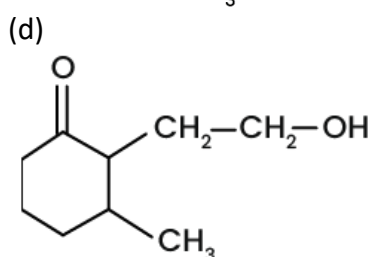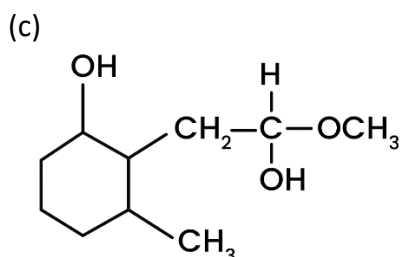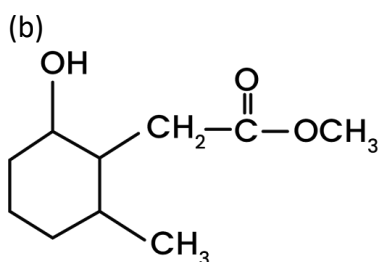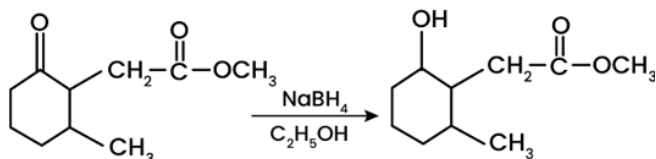
Answer: (b)

Solution:

90. Choose the correct option for the total pressure (in atm.) in a mixture of 4 g O_2 and 2 g H_2 confined in a total volume of one litre at 0° C is:

Options:

(a) 25.18

(b) 26.02

(c) 2.518

(d) 2.602

Answer: (a)

Solution: Moles of O_2 = 4/32 = 0.125

Moles of H_2 = 2/2 = 1

Total moles = 1.125

Now, PV = nRT

P = 1.125 × 0.082 × 273 = 25.18 atm

91. 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]

Options:

(a) 336 mm of Hg
(b) 350 mm of Hg
(c) 160 mm of Hg
(d) 168 mm of Hg
Answer: (a)
Solution: Let benzene is B and octane is O
X_B = 3/5 = 0.6
X_O = 2/5 = 0.4
Now, PT = $P_B^0 X_B + P_O^0 X_O$ = 0.6(280)+0.4(420) = 336 mm Hg

92. Which of the following molecules is non-polar in nature?
Options:
(a) $SbCl_5$
(b) NO_2
(c) $POCl_3$
(d) CH_2O
Answer: (a)
Solution:
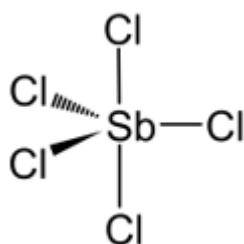
93. The reagent 'R' in the given sequence of chemical reaction is:
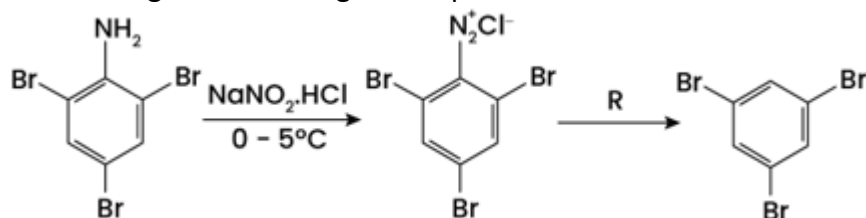
Options:
(a) HI
(b) CuCN/KCN
(c) H_2O
(d) CH_3CH_2OH
Answer: (d)
Solution:

94. Match List - I with List - II.

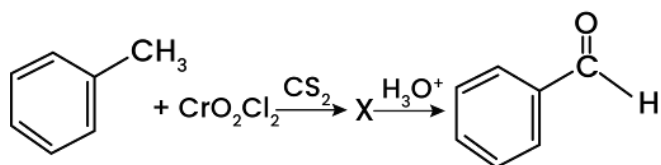| List – I	List – II
(a) $[Fe(CN)_6]^{3-}$	(i) 5.92 BM
(b) $[Fe(H_2O)_6]^{3+}$	(ii) 0 BM
(c) $[Fe(CN)_6]^{4-}$	(iii) 4.90 BM
(d) $[Fe(H_2O)_6]^{2+}$	(iv) 1.73 BM

Choose the correct answer from the options given below.

Options:
(a) (a)-(i), (b)-(iii), (c)-(iv), (d)-(ii)
(b) (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)
(c) (a)-(iv), (b)-(ii), (c)-(i), (d)-(iii)
(d) (a)-(ii), (b)-(iv), (c)-(iii), (d)-(i)

Answer: (b)

Solution: $[Fe(CN)_6]^{4-}$: Fe^{2+} = [Ar] $3d^6$

In the presence of strong field CN^- ligand, electrons will be paired and magnetic moment = 0 B.M.

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

Options:
(a) Mn^{2+}, Fe^{3+}
(b) Fe^{2+}, Mn^{2+}
(c) O^{2-}, F^-
(d) Na^+, Mg^{2+}

Answer: (b)

Solution: Isoelectronic pairs have the same number of electrons. The number of electrons in Fe^{2+} = 24

Mn^{2+} = 23

Thus, these ions are not isoelectronic.

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

Options:
(a) $\Delta U = 0$, $\Delta S_{total} \neq 0$
(b) $\Delta U \neq 0$, $\Delta S_{total} = 0$
(c) $\Delta U = 0$, $\Delta S_{total} = 0$
(d) $\Delta U \neq 0$, $\Delta S_{total} \neq 0$

Answer: (a)

Solution: For irreversible processes, the entropy of the universe increases, i.e., $\Delta S_{total} > 0$

Also, since the process is isothermal($\Delta T=0$) and gas is ideal, $\Delta U = nC_V\Delta T = 0$

97. 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.

λ^o_H = 350 S cm^2 mol^{-1}

λ^o = 50 S cm^2 mol^{-1}

Options:
(a) 1.75×10^{-5} mol L^{-1}
(b) 2.50×10^{-5} mol L^{-1}
(c) 1.75×10^{-4} mol L^{-1}

(d) 2.50×10^{-4} mol L^{-1}

Answer: (a)

Solution: Limiting molar conductivity of CH_3COOH = 350 + 50 =400

Now, α = 20/400 = 0.05

$K_a = C\alpha^2 = 0.007\,(0.05)^2 = 1.75 \times 10^{-5}$

98. The slope of Arrhenius Plot (ln k v/s 1/T) of first order reaction is -5 $\times$ 10^3 K. The value of E_a of the reaction is. Choose the correct option for your answer.

[Given R = 8.314 JK^{-1} mol^{-1}]

Options:

(a) 166 kJ mol^{-1}

(b) -83 kJ mol^{-1}

(c) 41.5 kJ mol^{-1}

(d) 83.0 kJ mol^{-1}

Answer: (c)

Solution: The logarithmic form of Arrhenius equation is

$$\ln k = -\frac{E_a}{RT} + \ln A$$

Slope = $-E_a/R \Rightarrow E_a = -$(slope)R

$E_a = 5 \times 10^3 \times 8.314 = 41.57 \times 10^3$

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

Consider the above reaction and identify the missing reagent/chemical

Options:

(a) CaO

(b) DIBAL-H

(c) B$_2$H$_6$

(d) Red Phosphorus

Answer: (a)

Solution:

$$CH_3CH_2COO^-Na^+ \xrightarrow[Heat]{NaOH+CaO} CH_3CH_3 + Na_2CO_3$$
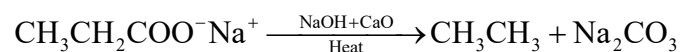
It is soda lime decarboxylation reaction.

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

Options:

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

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

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

(d) $H_2O < H_2S < H_2Se < H_2Te$: Increasing pK$_a$ values

Answer: (d)

Solution:

H$_2$O	∵ B.E ↓
H$_2$S	K$_a$↑ pK$_a$↓
H$_2$Se	
H$_2$Te	
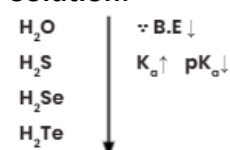
BIOLOGY

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

Options:

(a) Histones

(b) Polysaccharides

(c) RNA

(d) DNA

Answer: (d)

102. A typical angiosperm embryo sac at maturity is

Options:

(a) 7-nucleate and 7-celled

(b) 8-nucleate and 8-celled

(c) 8-nucleate and 7-celled

(d) 7-nucleate and 8-celled

Answer: (c)

103. Which of the following is an incorrect statement ?

Options:

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

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

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

(d) Microbodies are present both in plant and animal cells

Answer: (c)

104. The plant hormone used to destroy weeds in a field is

Options:

(a) 2, 4-D

(b) IBA

(c) IAA

(d) NAA

Answer: (a)

105. 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 tissues
(c)	Tissue having different type of cells	(iii)	Sclereids
(d)	Dead cells with highly thickened walls and narrow lumen	(iv)	Simple Tissue

Options:
(a) (a)- (i); (b) - (ii); (c) - (iii);(d) - (iv)
(b) (a)- (iii); (b) - (ii); (c) - (iv);(d) - (i)
(c) (a)- (ii); (b) - (iv); (c) - (i);(d) - (iii)
(d) (a)- (iv); (b) - (iii); (c) - (ii);(d) - (i)
Answer: (c)

106. Which of the following is not an application of PCR (Polymerase Chain Reaction)
Options:
(a) Purification of isolated protein
(b) Detection of gene mutation
(c) Molecular diagnosis
(d) Gene amplification
Answer: (a)

107. Which of the following is a correct sequence of steps in a PCR (Polymerase Chain Reaction) ?
Options:
(a) Extension, Denaturation, Annealing
(b) Annealing, Denaturation, Extension
(c) Denaturation, Annealing, Extension
(d) Denaturation, Extension, Annealing
Answer: (c)

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

Options:

(a) Molecular diagnosis

(b) Safety testing

(c) Biopiracy

(d) Gene therapy

Answer: (d)

109. Mutations in plant cells can be induced by:

Options:

(a) Gamma rays

(b) Zeatin

(c) Kinetin

(d) Infrared rays

Answer: (a)

110. Which of the following algae produce Carrageen?

Options:

(a) Red Algae

(b) Blue-Green Algae

(c) Green Algae

(d) Brown Algae

Answer: (a)

111. Diadelphous stamens are found in:

Options:

(a) Pea

(b) China rose and citrus

(c) China rose

(d) Citrus

Answer: (a)

112. Which of the following statements is not correct?

Options:

(a) Pyramid of energy is always upright

(b) Pyramid of numbers in a grassland ecosystem is upright

(c) Pyramid of biomass in sea is generally inverted.

(d) Pyramid of biomass in sea is generally upright

Answer: (d)

113. Which of the following are not secondary metabolites in plants?

Options:

(a) Vinblastin, curcumin

(b) Rubber, gums

(c) Morphine, codeine

(d) Amino acids, glucose

Answer: (d)

114. Gemmae are present in:

Options:

(a) Some Gymnosperms

(b) Some Liverworts

(c) Mosses

(d) Pteridophytes

Answer: (b)

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

Options:

(a) Sub-metacentric

(b) Acrocentric

(c) Metacentric

(d) Telocentric

Answer: (c)

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

Options:

(a) Mutation

(b) Genetic drift

(c) Natural selection

(d) Genetic recombination

Answer: (b)

117. Genera like *Selaginella* and *Salvinia* produce two kinds of spores. Such plants are known as:

Options:

(a) Homosporous

(b) Heterosporous

(c) Homosorus

(d) Heterosorus

Answer: (b)

118. In the equation GPP - R = NPP R represents

Options:

(a) Environment factor

(b) Respiration losses

(c) Radiant energy

(d) Retardation factor

Answer: (b)

119. Which of the following plants is monoecious?

Options:

(a) *Marchantia polymorpha*

(b) *Cycas circinalis*

(c) *Carica papaya*

(d) *Chara*

Answer: (d)

120. The amount of nutrients such as carbon, nitrogen, phosphorus and calcium

Options:

(a) Standing state

(b) Standing crop

(c) Climax

(d) Climax community

Answer: (a)

121. 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:

Options:

(a) Chasmogamy

(b) Cleistogamy

(c) Xenogamy

(d) Geitonogamy

Answer: (c)

122. 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

Options:

(a) (a)- (ii); (b) - (iii); (c) - (iv);(d) - (i)

(b) (a)- (iv); (b) - (ii); (c) - (i);(d) - (iii)

(c) (a)- (iv); (b) - (i); (c) - (iii);(d) - (ii)

(d) (a)- (iii); (b) - (i); (c) - (iv);(d) - (ii)

Answer: (d)

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

Options:

(a) Dark red bands

(b) Bright blue bands

(c) Yellow bands

(d) Bright orange bands

Answer: (d)

124. Which of the following stages of meiosis involves division of centromere?

Options:

(a) Anaphase II

(b) Telophase II

(c) Metaphase I

(d) Metaphase II

Answer: (a)

125. The production of gametes by the parents, formation of zygotes, the F_1 and F_2 plants can be understood from a diagram called

Options:

(a) Punnett square

(b) Net square

(c) Bullet square

(d) Punch square

Answer: (a)

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

Options:

(a) Plasticity

(b) Maturity

(c) Elasticity

(d) Flexibility

Answer: (a)

127. Amensalism can be represented as :

Options:

(a) Species A (-) ; Species B (-)

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

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

(d) Species A (+);Species B (+)

Answer: (c)

128. 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

Options:

(a) (a)- (iii); (b) - (iv); (c) - (i);(d) - (ii)
(b) (a)- (iv); (b) - (iii); (c) - (ii);(d) - (i)
(c) (a)- (iii); (b) - (iv); (c) - (ii);(d) - (i)
(d) (a)- (ii); (b) - (i); (c) - (iv);(d) - (iii)
Answer: (d)

129. Inspite of interspecific competition in nature, which mechanism the competing species might have evolved for their survival?
Options:
(a) Mutualism
(b) Predation
(c) Resource partitioning
(d) Competitive release
Answer: (c)

130. Which of the following algae contains mannitol as reserve food material?
Options:
(a) *Volvox*
(b) *Ulothrix*
(c) *Ectocarpus*
(d) *Gracilaria*
Answer: (c)

131. The site of perception of light in plants during photoperiodism is:
Options:
(a) Axillary bud
(b) Leaf
(c) Shoot apex
(d) Stem
Answer: (b)

132. The first stable product of CO_2 fixation in sorghum is:
Options:
(a) Succinic acid
(b) Phosphoglyceric acid
(c) Pyruvic acid
(d) Oxaloacetic acid

Answer: (d)

133. Match List -I with LIst – II

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

Options:

(a) (a)-(iii), (b)-(iv), (c)- (i), (d)-(ii)

(b) (a)-(ii), (b)-(iii), (c)- (iv), (d)-(i)

(c) (a)-(iv), (b)-(iii), (c)- (ii), (d)-(i)

(d) (a)-(i), (b)-(iv), (c)- (iii), (d)-(ii)

Answer: (a)

134. Complete the flow chart on central dogma.

$$(a) \circlearrowleft DNA \xrightarrow{(b)} mRNA \xrightarrow{(c)} (d)$$

Options:

(a) (a)-Replication; (b)-Transcription; (c) -Translation; (d)-Protein

(b) (a)-Transduction; (b)-Translation; (c) -Replication; (d)-Protein

(c) (a)-Replication; (b)-Transcription; (c) -Transduction; (d)-Protein

(d) (a)-Translation; (b)-Replication; (c) -Transcription; (d)-Transduction

Answer: (a)

135. 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.

Options:

(a) (a)-(iii), (b)-(i), (c)- (iv), (d)-(ii)

(b) (a)-(ii), (b)-(i), (c)- (iv), (d)-(iii)

(c) (a)-(ii), (b)-(iv), (c)- (i), (d)-(iii)

(d) (a)-(iv), (b)-(iii), (c)- (ii), (d)-(i)

Answer: (c)

136. Which of the following statements is incorrect?

Options:

(a) Grana lamellae have both PS I and PS II

(b) Cyclic photophosphorylation involves both PS I and PS II.

(c) Both ATP and NADPH + H+ are synthesized during non-cyclic photophosphorylation.

(d) Stroma lamellae have PS I only and lack NADP reductase

Answer: (b)

137. Select the correct pair.

Options:

(a) Cells of medullary rays that form part of cambial ring - Interfascicular cambium

(b) Loose parenchyma cells rupturing the epidermis and forming a lens-shaped opening in bark - Spongy parenchyma

(c) Large colorless empty cells in the epidermis of grass leaves – Subsidiary cells

(d) In dicot leaves, vascular bundles are surrounded by large thick-walled cells– Conjunctive tissue

Answer: (a)

138. Identify the correct statement.

Options:

(a) The coding strand in a transcription unit is copied to an mRNA

(b) Split gene arrangement is characteristic of prokaryotes

(c) In capping, methyl guanosine triphosphate is added to the 3' end of hnRNA.

(d) RNA polymerase binds with Rho factor to terminate the process of transcription in bacteria.

Answer: (d)

139. 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

Options:

(a) (a)-(iv), (b)-(i), (c)- (ii), (d)-(iii)

(b) (a)-(ii), (b)-(iv), (c)- (iii), (d)-(i)

(c) (a)-(iii), (b)-(ii), (c)- (i), (d)-(iv)

(d) (a)-(iv), (b)-(ii), (c)- (iii), (d)-(i)

Answer: (a)

140. Match list I with list II.

List I		List 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

Options:

(a) (a)- (iii); (b) - (i); (c) - (iv);(d) - (ii)

(b) (a)- (iv); (b) - (iii); (c) - (ii);(d) - (i)

(c) (a)- (ii); (b) - (iv); (c) - (i);(d) - (iii)

(d) (a)- (i); (b) - (ii); (c) - (iii);(d) - (iv)

Answer: (c)

141. Match list I with list II.

List I		List II	
(a)	$\% \lightning K_{(5)} C_{1+2+(2)} A_{(9)+1} \underline{G}_1$	(i)	Brassicaceae
(b)	$\oplus \lightning K_{(5)} \overparen{C_{(5)}} A_5 \underline{G}_2$	(ii)	Liliaceae
(c)	$\oplus \lightning \overparen{P_{(3+3)} A_{3+3}} \underline{G}_{(3)}$	(iii)	Fabaceae
(d)	$\oplus \lightning K_{2+2} C_4 A_{2-4} \underline{G}_{(2)}$	(iv)	Solanaceae

Options:

(a) (a)- (ii); (b) - (iii); (c) - (iv);(d) - (i)

(b) (a)- (iv); (b) - (ii); (c) - (i);(d) - (iii)

(c) (a)- (iii); (b) - (iv); (c) - (ii);(d) - (i)

(d) (a)- (i); (b) - (ii); (c) - (iii);(d) - (iv)

Answer: (c)

142. 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

Options:

(a) (a)- (ii); (b) - (i); (c) - (iv);(d) - (iii)

(b) (a)- (iv); (b) - (iii); (c) - (i);(d) - (ii)

(c) (a)- (iv); (b) - (i); (c) - (ii);(d) - (iii)

(d) (a)- (i); (b) - (iv); (c) - (iii);(d) - (ii)

Answer: (c)

143. Which of the following statements is incorrect?

Options:

(a) ATP is synthesized through complex V

(b) Oxidation-reduction reactions produce proton gradient in respiration.

(c) During aerobic respiration, role of oxygen is limited to the terminal stage

(d) In ETC (Electron Transport Chain), one molecule of NADH + H+ gives rise to 2 ATP molecules, and one $FADH_2$ gives rise to 3 ATP molecules

Answer: (d)

144. DNA fingerprinting involves identifying differences in some specific regions in DNA sequence, called as:

Options:

(a) Single nucleotides

(b) Polymorphic DNA

(c) Satellite DNA

(d) Repetitive DNA

Answer: (d)

145. Which of the following statements is correct?

Options:

(a) Organisms that depend on living plants are called saprophytes

(b) Some of the organisms can fix atmospheric nitrogen in specialized cells called sheath cells

(c) Fusion of two cells is called Karyogamy.

(d) Fusion of protoplasms between two motile or non-motile gametes is called plasmogamy

Answer: (d)

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

Options:

(a) mutated gene does not appear on a Photographic film as the probe has no complementarity with it

(b) mutated gene does not appear on Photographic film as the probe has complementarity with it

(c) mutated gene partially appears on a photographic film

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

Answer: (a)

147. Plasmid pBR322 has PsI 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 a *E.coli* strain

Options:

(a) it will lead to lysis of host cell.

(b) it will be able to produce a novel protein with dual ability

(c) it will not be able to confer ampicillin resistance to the host cell

(d) the transformed cells will have the ability to resist ampicillin as well as produce β-galactoside

Answer: (c)

148. In some members of which of the following pairs of families, pollen grains retain their viability for months after release ?

Options:

(a) Poaceae ; Solanaceae

(b) Rosaceae ; Leguminosae

(c) Poaceae ; Rosaceae

(d) Poaceae ; Leguminosae

Answer: (b)

149. What is the role of RNA polymerase III in the process of transcription in eukaryotes?

Options:

(a) Transcribes precursor of mRNA

(b) Transcribes only snRNAs

(c) Transcribes rRNAs (28S, 18S and 5.8S)

(d) Transcribes tRNA, 5s rRNA and snRNA

Answer: (d)

150. In the exponential growth equation $N_t = N_0 e^{rt}$, e represents:

Options:

(a) The base of natural logarithms

(b) The base of geometric logarithms

(c) The base of number logarithms

(d) The base of exponential logarithms

Answer: (a)

151. 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.

Options:

(a) (a), (d) and (e) are correct

(b) (b), (c) and (e) are correct

(c) (c), (d) and (e) are correct

(d) (a), (b) and (c) are correct

Answer: (b)

152. 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

Options:

(a) (a)- (iii); (b) - (iv); (c) - (ii); (d) - (i)

(b) (a)- (iv); (b) - (i); (c) - (ii); (d) - (iii)

(c) (a)- (iv); (b) - (iii); (c) - (i); (d) - (ii)

(d) (a)- (iii); (b) - (iv); (c) - (i); (d) - (ii)

Answer: (a)

153. Which of the following statements wrongly represents the nature of smooth muscle?

Options:

(a) Communication among the cells is performed by intercalated discs

(b) These muscles are present in the wall of blood vessels

(c) These muscle have no striations

(d) They are involuntary muscles

Answer: (a)

154. The centriole undergoes duplication during:

Options:

(a) Metaphase

(b) G_2 phase

(c) S-phase

(d) Prophase

Answer: (c)

155. 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.

Options:

(a) (a), (c) and (d) only

(b) (a) and (d) only

(c) (b) and (d) only

(d) (b) and (c) only

Answer: (a)

156. 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

Options:

(a) (a)- (ii); (b) - (iv); (c) - (iii);(d) - (i)

(b) (a)- (iii); (b) - (i); (c) - (iv);(d) - (ii)

(c) (a)- (iv); (b) - (ii); (c) - (i);(d) - (iii)

(d) (a)- (i); (b) - (iii); (c) - (ii);(d) - (iv)
Answer: (d)

157. Which of the following RNAs is not required for the synthesis of protein?
Options:
(a) rRNA
(b) siRNA
(c) mRNA
(d) tRNA
Answer: (b)

158. Identify the incorrect pair.
Options:
(a) Lectins - Concanavalin A
(b) Drugs - Ricin
(c) Alkaloids - Codeine
(d) Toxin - Abrin
Answer: (b)

159. A specific recognition sequence identified by endonucleases to make cuts at specific positions within the DNA is:
Options:
(a) Palindromic Nucleotide sequences
(b) Poly(A) tail sequences
(c) Degenerate primer sequence
(d) Okazaki sequences
Answer: (a)

160. Which of the following is not an objective of Biofortification in crops ?
Options:
(a) Improve vitamin content
(b) Improve micronutrient and mineral content
(c) Improve protein content
(d) Improve resistance to diseases
Answer: (d)

161. Chronic auto immune disorder affecting neuromuscular junction leading to fatigue, weakening and paralysis of skeletal muscle is called as:
Options:
(a) Myasthenia gravis
(b) Gout

(c) Arthritis

(d) Muscular dystrophy

Answer: (a)

162. Which one of the following belongs to the family Muscidae?

Options:

(a) Cockroach

(b) House fly

(c) Fire fly

(d) Grasshopper

Answer: (b)

163. The partial pressures (in mm Hg) of oxygen (O_2) and carbon dioxide. (CO_2) at alveoli (the site of diffusion) are:

Options:

(a) $pO_2 = 95$ and $pCO_2 = 40$

(b) $pO_2 = 159$ and $pCO_2 = 0.3$

(c) $pO_2 = 104$ and $pCO_2 = 40$

(d) $pO_2 = 40$ and $pCO_2 = 45$

Answer: (c)

164. 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?

Options:

(a) Denaturation

(b) Ligation

(c) Annealing

(d) Extension

Answer: (a)

165. Which enzyme is responsible for the conversion of inactive fibrinogens to fibrins?

Options:

(a) Epinephrine

(b) Thrombokinase

(c) Thrombin

(d) Renin

Answer: (c)

166. The organelles that are included in the endomembrane system are

Options:

(a) Golgi complex, Mitochondria; Ribosomes and Lysosomes

(b) Golgi complex, Endoplasmic reticulum, Mitochondria and Lysosomes

(c) Endoplasmic reticulum, Mitochondria, Ribosomes and Lysosomes

(d) Endoplasmic reticulum, Golgi complex, Lysosomes and Vacuoles

Answer: (d)

167. Which one of the following is an example of Hormone releasing IUD?

Options:

(a) Cu 7

(b) Multiload 375

(c) CuT

(d) LNG 20

Answer: (d)

168. Succus entericus is referred to as:

Options:

(a) Gastric juice

(b) Chyme

(c) Pancreatic juice

(d) Intestinal juice

Answer: (d)

169. Select the favourable conditions required for the formation of oxyhaemoglobin at the alveoli.

Options:

(a) High pO_2, high pCO_2, less H^+, higher temperature

(b) Low pO_2, low pCO_2, more H^+, higher temperature

(c) High pO_2, low pCO_2, less H^+, lower temperature

(d) Low pO_2, high pCO_2, more H^+, higher temperature

Answer: (c)

170. Veneral 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 below:

Options:

(a) (b) and (c) only

(b) (a) and (c) only

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

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

Answer: (a) or (d)

171. 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?

Options:

(a) 4

(b) 32

(c) 8

(d) 16

Answer: (c)

172. If Adenine makes 30% of the DNA molecule, what will be the percentage of Thymine, Guanine and Cytosine in it?

Options:

(a) T : 30; G : 20; C : 20

(b) T : 20; G : 25; C : 25

(c) T : 20; G : 30; C : 20

(d) T : 20; G : 20; C : 30

Answer: (a)

173. Which one of the following organisms bears hollow and pneumatic long bones?

Options:

(a) *Macropus*

(b) *Ornithorhynchus*

(c) *Neophron*

(d) *Hemidactylus*

Answer: (c)

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

Options:

(a) DNA Ligase

(b) DNase

(c) DNA dependent DNA polymerase

(d) DNA dependent RNA polymerase

Answer: (d)

175. 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)	Hookworm

Options:

(a) (a)- (ii); (b) - (iii); (c) - (iv);(d) - (i)

(b) (a)- (i); (b) - (iv); (c) - (iii);(d) - (ii)

(c) (a)- (ii); (b) - (iii); (c) - (i);(d) - (iv)

(d) (a)- (iv) - (i); (c) - (iii);(d) - (ii)

Answer: (a)

176. Which stage of meiotic prophase shows terminalisation of chiasmata as its distinctive feature?

Options:

(a) Diakinesis

(b) Pachytene

(c) Leptotene

(d) Zygotene

Answer: (a)

177. Dobson units are used to measure thickness of:

Options:

(a) Ozone

(b) Troposphere

(c) CFCs

(d) Stratosphere

Answer: (a)

178. Sphincter of oddi is present at:

Options:

(a) Gastro-oesophageal junction

(b) Junction of jejunum and duodenum

(c) Ileo-caecal junction

(d) Junction of hepato-pancreatic duct and duodenum

Answer: (d)

179. In a cross between a male and female, both heterozygous for sickle cell anaemia gene, what percentage of the progeny will be diseased?

Options:

(a) 25%

(b) 100%

(c) 50%

(d) 75%

Answer: (a)

180. Persons with "AB" blood group are called as "Universal recipients". This is due to:

Options:

(a) Presence of antibodies, anti-A and anti-B, on RBCs

(b) Absence of antibodies, anti-A and anti-B, in plasma

(c) Absence of antigens A and B on the surface of RBCs

(d) Absence of antigens A and B in plasma

Answer: (b)

181. Which of the following characteristics is incorrect with respect to cockroach ?

Options:

(a) In females, 7th-9th sterna together form a genital pouch

(b) 10th abdominal segment in both sexes, bears a pair of anal cerci

(c) A ring of gastric caeca is present at the junction of midgut and hind gut

(d) Hypopharynx lies within the cavity enclosed by the mouth parts.

Answer: (c)

182. Erythropoietin hormone which stimulates R.B.C. formation is produced by

Options:

(a) The cells of bone marrow

(b) Juxtaglomerular cells of the kidney

(c) Alpha cells of pancreas

(d) The cells of rostral adenohypophysis

Answer: (b)

183. 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

Options:

(a) (a)- (ii); (b) - (iii); (c) - (i);(d) - (iv)

(b) (a)- (iv); (b) - (ii); (c) - (i);(d) - (iii)

(c) (a)- (iii); (b) - (i); (c) - (iv);(d) - (ii)

(d) (a)- (i); (b) - (ii); (c) - (iii);(d) - (iv)

Answer: (c)

184. Receptors for sperm binding in mammals are present on

Options:

(a) Perivitelline space

(b) Zona pellucida

(c) Corona radiata

(d) Vitelline membrane

Answer: (b)

185. 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?

Options:

(a) ELISA Technique

(b) Hybridization Technique

(c) Western Blotting Technique

(d) Southern Blotting Technique

Answer: (a)

186. Statement I: The codon 'AUG' codes for methionine and phenylalanine.
Statement II: 'AAA' and 'AAG' both codons code for the amino acid lysine.

Options:

(a) Statement I is correct but statement II is false

(b) Statement I is incorrect but statement II is true

(c) Both Statement I and Statement II are true

(d) Both Statement I and Statement II are false

Answer: (b)

187. Match list I with list II.

	List I		List II
(a)	Scapula	(i)	Cartilaginous joints
(b)	Cranium	(ii)	Flat bones
(c)	Sternum	(iii)	Fibrous joints
(d)	Vertebral column	(iv)	Triangular flat bone

Options:

(a) (a)- (iv); (b) - (ii); (c) - (iii);(d) - (i)

(b) (a)- (iv); (b) - (iii); (c) - (ii);(d) - (i)

(c) (a)- (i); (b) - (iii); (c) - (ii);(d) - (iv)

(d) (a)- (ii); (b) - (iii); (c) - (iv);(d) - (i)

Answer: (b)

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

Options:

(a) Cow is fertilized by artificial insemination

(b) Fertilized eggs are transferred to surrogate mothers at 8-32 cell stage

(c) Cow is administered hormone having LH like activity for super ovulation

(d) Cow yields about 6-8 eggs at a time

Answer: (c)

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

Options:

(a) Foetus

(b) Uterus

(c) Graafian follicle

(d) Corpus luteum

Answer: (d)

190. Which one Of the following statements about Histones is wrong ?

Options:

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

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

(c) Histones are organized to form a unit of 8 molecules.

(d) The pH of histones is slightly acidic

Answer: (d)

191. 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

Options:

(a) Adhering junctions and Tight junctions, respectively

(b) Adhering junctions and Gap junctions, respectively

(c) Gap junctions and Adhering junctions, respectively

(d) Tight junctions and Gap junctions, respectively

Answer: (d)

192. 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

Options:

(a) (b) and (c) only

(b) (b) and (e) only

(c) (a) and (b) only

(d) (c) and (d) only

Answer: (a)

193. 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*

Options:

(a) (a)- (i); (b) - (ii); (c) - (iv);(d) - (iii)

(b) (a)- (ii); (b) - (iii); (c) - (i);(d) - (iv)

(c) (a)- (iv); (b) - (i); (c) - (iii);(d) - (ii)

(d) (a)- (iii); (b) - (iv); (c) - (i);(d) - (ii)

Answer: (d)

194. During the muscular contraction which of the following events occur?

(a) 'H' zone disappears

(b) 'A' band widens

(c) 'I' band reduces in width

(d) Myosine 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.

Options:

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

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

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

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

Answer: (c)

195. 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

Options:

(a) (A) is true but (R) is false

(b) (A) is false but (R) is true

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

(d) Both (A) and (R) are true but (R) is not the correct explanation of (A)

Answer: (c)

196. 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 birds
(d)	Evolution by anthropogenic action	(iv)	Darwin Finches

Options:

(a) (a)- (ii); (b) - (i); (c) - (iv);(d) - (iii)

(b) (a)- (i); (b) - (iv); (c) - (iii);(d) - (ii)

(c) (a)- (iv); (b) - (iii); (c) - (ii);(d) - (i)

(d) (a)- (iii); (b) - (ii); (c) - (i);(d) - (iv)

Answer: (c)

197. 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

Options:

(a) (a), (b), (c) and (d) are correct

(b) (b), (c) are correct

(c) (a), (b) and (c) are correct

(d) (a), (b) and (d) are correct

Answer: (c)

198. The Adenosine deaminase deficiency results into:

Options:

(a) Digestive disorder

(b) Addison's disease

(c) Dysfunction of Immune system

(d) Parkinson's disease

Answer: (c)

199. 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

Options:

(a) (a)- (iv); (b) - (i); (c) - (ii);(d) - (iii)

(b) (a)- (iv); (b) - (iii); (c) - (ii;(d) - (i)

(c) (a)- (iv); (b) - (ii); (c) - (iii);(d) - (i)

(d) (a)- (iv); (b) - (i); (c) - (iii);(d) - (ii)

Answer: (a)

200. Which of these is not an important component of initiation of parturition in humans?

Options:

(a) Release of Oxytocin

(b) Release of Prolactin

(c) Increase in estrogen and progesterone ratio

(d) Synthesis of prostaglandins

Answer: (b)