Jupiter Academy

Subjects : Physics , Chemistry , Biology

Full mock test 03

(Solutions)

Total Marks : 720

Physics

1. A cooling curve is plotted between the temperature of a hot body and time. Which of the following is not true for the cooling curve?

A) Cooling is faster from a calorimeter having a larger surface area than a smaller one.

B) Cooling is faster from a calorimeter painted black from outside than that from a polished surfaced calorimeter.

C) Cooling is faster from a copper calorimeter than from a steel calorimeter.

D) The rate of cooling remains same throughout the experiment. Hence the graph is a straight line.

Solution : (Correct Answer: D)

The rate of cooling is faster at the beginning and then decreases and becomes constant.

2. A T.V. tower has a height of $100\ \mathrm{m}$. How much population is covered by T.V. broadcast, if the average population density around the tower is $1000\ \mathrm{km}^{-2}$

A) 2×10^{6} **B)** 4×10^{6} **C)** 3×10^{8} **D)** 9×10^{4}

Solution : (Correct Answer: B)

Let N is population covered

We know that

$$\mathrm{d}=\sqrt{2\mathrm{Rh}}$$

$$\mathrm{N}=\pi\mathrm{d}^{2}\sigma=2\pi\mathrm{Rh}\sigma$$

$$=2\times3.14\times6400\times0.1\times1000$$

$$=2\times3.14\times6.4\times10^{5}=4\times10^{6}$$

3. If $A=1$ and $B=0$, then in terms of Boolean algebra, $A+\overline{B}=$

A) B **B)** $\overline{B}\cdot B$ **C)** A **D)** $\overline{A}$

Solution : (Correct Answer: C)

$A=1,\ B=0\ \Rightarrow\ \overline{B}=1$

$$\therefore\quad A+\overline{B}=1+1=1=A$$

4. At some instant the ratio of the amount of two radioactive elements is $2:1$. If their half-lives respectively are 12 hours and 16 hours, then after two days, the ratio of the amount of two substances is

A) $1:1$ **B)** $1:2$ **C)** $3:1$ **D)** $4:1$

Solution : (Correct Answer: A)

$\mathrm{N}_1=\frac{1}{(2)^4}\ \mathrm{N}_0=\frac{\mathrm{N}_0}{16}$

and for the second element

$\mathrm{N}_2=\frac{1}{(2)^3}\ \mathrm{N}_0^{'}=\frac{\mathrm{N}_0^{'}}{8}$

$\frac{\mathrm{N}_1}{\mathrm{N}_2}=\frac{\mathrm{N}_0}{\mathrm{N}_0^{'}}\frac{8}{16}=\frac{\mathrm{N}_0}{2\mathrm{N}_0^{'}}$

Now given that $\mathrm{N}_0\ :\mathrm{N}_0^{'}=2\ :1$

$\frac{\mathrm{N}_1}{\mathrm{N}_2}=\frac{2}{2}=1\ :1$

5. An electron in a hydrogen atom is in an orbit from which there can be a maximum of six transitions. Another electron in a different hydrogen atom is in an orbit from which there can be a maximum of three transitions. The ratio of the velocities of the electrons in these two orbits is

A) $\frac{1}{2}$ **B)** $\frac{2}{3}$ **C)** $\frac{5}{4}$ **D)** $\frac{3}{4}$

Solution : (Correct Answer: D)

Number of spectral lines obtained due to transition of electrons from n^{th} orbit to lower orbit is,

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

For case - 1, $N=6\ =\frac{n_1(n_1-1)}{2}$

$\Rightarrow\qquad n_1=4$

For case - 2, $N=3\ =\frac{n_2(n_2-1)}{2}$

$\Rightarrow\qquad n_2=3$

The velocity of electron in a hydrogen atom in nth orbit

$$v_n\propto\frac{1}{n}$$

$$\frac{v_n}{v_n^{'}}=\frac{n_2}{n_1}$$

$\Rightarrow\qquad \frac{n_6}{n_3}=\frac{3}{4}$

6. The correctness of velocity of an electron moving with velocity $50\ \text{m s}^{-1}$ is 0.005%. The accuracy with which its position can be measured will be

A) $4634 \times 10^{-3}\ \text{m}$ **B)** $4634 \times 10^{-5}\ \text{m}$
C) $4634 \times 10^{-6}\ \text{m}$ **D)** $4634 \times 10^{-8}\ \text{m}$

Solution : (Correct Answer: B)

Here, $\Delta v = \frac{0.005 \times 50}{100} = 0.0025\ \text{m s}^{-1}$

$\Delta x = \frac{h}{m\Delta v}$

$= \frac{1.034 \times 10^{-34}}{9.1 \times 10^{-31} \times 0.0025} = 4634 \times 10^{-5}\ \text{m}$

7. In a Young's double slit experiment, I_0 is the maximum intensity and β is the fringe width. Intensity at point P which is distance x from central maxima is

A) $\text{I}_0 \cos \frac{\pi x}{\beta}$ **B)** $4\text{I}_0 \cos^2 \frac{\pi x}{\beta}$
C) $\text{I}_0 \cos^2 \frac{\pi x}{\beta}$ **D)** $\frac{I_0}{4} \cos^2 \frac{\pi x}{\beta}$

Solution : (Correct Answer: C)

Path difference at point $P = \frac{xd}{D}$

$\therefore$ phase deff at. $P = \frac{2\pi}{\lambda}\frac{xd}{D} = \frac{2\pi x}{\beta}$

$\therefore$ Intensity at $\text{P} = \text{I} + \text{I} + 2\text{I}\ \cos \frac{2\pi x}{\beta}$

$= 2\text{I}\left[1 + \cos \frac{2\pi x}{\beta}\right]\ \ [\because \text{I}_0 = 4\text{I}]$

$= 4\text{I}\ \cos^2 \frac{\pi x}{\beta} = \text{I}_0\ \cos^2 \frac{\pi x}{\beta}$

8. A ray of light is incident normally on one of the faces of a prism of apex angle $30°$ and refractive index $\sqrt{2}$. The angle of deviation of the ray is

A) $30°$ **B)** $45°$
C) $15°$ **D)** none of these

Solution : (Correct Answer: C)

Using Snell's law for the refraction at AC, we get

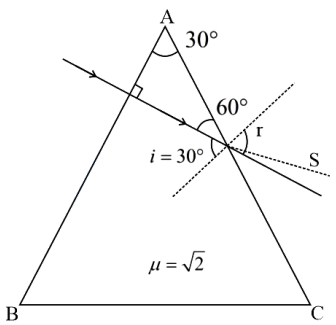
$\mu\ \text{sini} = (1)\ \ \text{sinr}$

$\sqrt{2} \sin 30° = \text{sinr}$

$\text{sinr} = \frac{1}{\sqrt{2}}$

$\Rightarrow \quad \text{r} = 45°$

$\therefore$ Angle of deviation $= 45° - 30° = 15°$



9. The magnetic field in a travelling electromagnetic wave has a peak value of $20\ \text{nT}$. The peak value of electric field strength is

A) $3\ \text{V m}^{-1}$ **B)** $6\ \text{V m}^{-1}$
C) $9\ \text{V m}^{-1}$ **D)** $12\ \text{V m}^{-1}$

Solution : (Correct Answer: B)

From question, $B_0 = 20\ \text{nT} = 20 \times 10^{-9}\ \text{T}$

$E_0 = B_0 C$

$E_0 = 20 \times 10^{-9} \times 3 \times 10^8 = 6\ \text{V m}^{-1}.$

($\because$ velocity of light in vacuum $C = 3 \times 10^8\ \text{m s}^{-1}$)

10. An $L.C.R$ circuit contains $R = 50\ \Omega$, $L = 1\ \text{mH}$ and $C = 0.1\ \mu\text{F}$. The impedance of the circuit will be minimum for a frequency of

A) $\frac{10^5}{2\pi}$ Hz
B) $\frac{10^6}{2\pi}$ Hz
C) $2\pi \times 10^5$ Hz
D) $2\pi \times 10^6$ Hz

Solution : (Correct Answer: A)

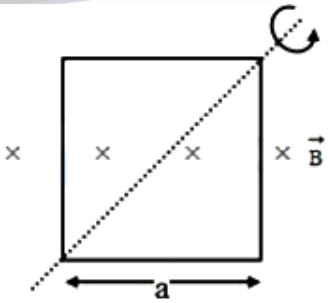
The impedance of L-C-R circuit will be minimum for a resonant frequency so,

$v_0 = \frac{1}{2\pi\sqrt{LC}}$

$= \frac{1}{2\pi\sqrt{1 \times 10^{-3} \times 0.1 \times 10^{-6}}}$

$= \frac{10^5}{2\pi}$ Hz

11. A square loop of side a is rotating about its diagonal with angular velocity ω in a perpendicular magnetic field $\vec{B}$. It has 10 turns. The emf induced is



A) $Ba^2 \sin \omega t$ **B)** $Ba^2 \cos \omega t$
C) $5\sqrt{2}Ba^2$ **D)** $10Ba^2\omega \sin \omega t$

Solution : (Correct Answer: D)

Magnetic flux linked with loop at any instant,

$\phi = BAcos\theta$

$\phi = Ba^2 cos\omega t$

Emf induced

$\therefore \varepsilon = -N\frac{d\phi}{dt} = NBa^2\omega sin\omega t$

$\varepsilon = 10Ba^2\omega sin\omega t$

12. A compass needle free to turn in a horizontal plane is placed at the centre of a circular coil of 30 turns and radius $12\ \text{cm}$. The coil is in a vertical plane making an angle of 45° with the magnetic meridian. The needle points west to east when the current in the coil is $0.35\ \text{A}$. The horizontal component of the earth's magnetic field (in T) at that location is

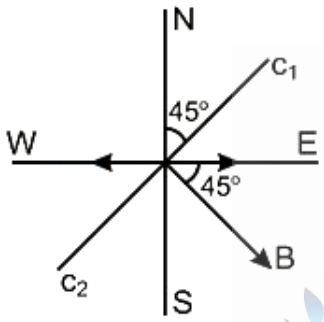
A) 3.9×10^{-5} **B)** 3.9×10^{-6}
C) 5×10^{-5} **D)** 2.6×10^{-5}

Solution : (Correct Answer: A)

Given, number of turns in the coil n = 30

Current in the coil I = 0.35 A

Radius of circular coil = 12 cm = 0.12 m



Let N - S be the line of magnetic of 45° with the magnetic meridian. C_1 and C_2 be the plane of coil. The needle points west to east. The magnetic field produced due to the coil is B. The direction of B is along the axis of coil i.e., it makes an angle of 45° with east. The needle points west to east only if the direction of magnetic field B is at 45° from east.

Use the formula, magnetic field produced by a current carrying coil

$$\text{B} = \frac{\mu_0}{4\pi} \cdot \frac{2\pi \text{I}}{\text{r}} = \frac{10 \times 2 \times 3.14 \times 0.35 \times 30}{0.12}$$

$$= 1.83 \times 10^{-6} \times 30 = 5.49 \times 10^{-5}\ \text{T}$$

The horizontal component of magnetic field

$$\text{H} = \text{B} \sin 45^\circ = 5.49 \times 10^{-5} \times \frac{1}{\sqrt{2}}$$

$$= 3.9 \times 10^{-5}\ \text{T}.$$

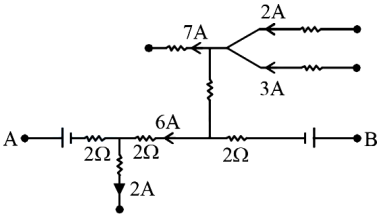
13. Which of the following is represented by the area enclosed by a hysteresis loop (B - H curve)?

A) Retentivity
B) Susceptibility
C) Permeability
D) Heat energy lost per unit volume in the sample

Solution : (Correct Answer: D)

Heat energy lost per unit volume in the sample is given by the area enclosed by a hysteresis loop (B - H curve).

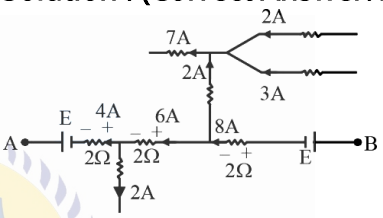
14.



In the above circuit diagram emf of two batteries are equal, then the potential difference $V_\text{A} - V_\text{B}$ between terminals A and B will be

A) $-36\ \text{V}$ **B)** $+\ 36\ \text{V}$
C) $+\ 24\ \text{V}$ **D)** $-\ 24\ \text{V}$

Solution : (Correct Answer: A)



According to Kirchhoff's Voltage and current law

$\text{V}_\text{A} - \text{E} + 8 + 12 + 16 + \text{E} = \text{V}_\text{B}$

$\text{V}_\text{A} - \text{V}_\text{B} = -36\ \text{V}$

15. The potential at a point x (measured in μm) due to some charges situated on the x-axis is given by $V(x) = \frac{20}{(x^2-4)}$ volt. The electric field E at $x = 4\ \mu\text{m}$ is given by

A) $\frac{5}{3}\frac{\text{V}}{\mu\text{m}}$ and in positive x -direction
B) $\frac{10}{9}\frac{\text{V}}{\mu\text{m}}$ and in negative x -direction
C) $\frac{10}{9}\frac{\text{V}}{\mu\text{m}}$ and in positive x -direction
D) $\frac{5}{3}\frac{\text{V}}{\mu\text{m}}$ and in negative x -direction

Solution : (Correct Answer: C)

Here, $V(x) = \frac{20}{x^2-4}\ \text{V}$

As, $E = -\frac{dV}{dx}$

$= -\frac{d}{dx}\left(\frac{20}{x^2-4}\right)$

$= +20\left\{\frac{1}{(x^2-4)^2}\right\} \cdot 2x$

$E = \frac{40x}{(x^2-4)^2}$

at $x = 4\ \text{m}$,

$E = \frac{40 \times 4}{(4^2-4)^2}$

$= \frac{160}{144}$

$= \frac{10}{9}\ \text{V}/\mu\text{m}$ in positive x -direction

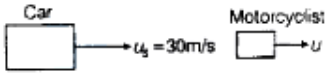
16. A police car moving at $30\ \text{m s}^{-1}$, chases a motorcyclist. The policeman sounds his horn at $180\ \text{Hz}$, while both of them move towards a stationary siren of frequency $160\ \text{Hz}$. Calculate the speed of the motorcyclist, if it is given that he does not observes any beats (take, the speed of sound $= 330\ \text{m s}^{-1}$).

A) $25\ \text{m s}^{-1}$ **B)** $30\ \text{m s}^{-1}$

C) $35.02\ \text{m s}^{-1}$ D) $40\ \text{m s}^{-1}$

Solution : (Correct Answer: C)

Speed of sound $v_S = 330\ \text{m s}^{-1}$



Case (i),

$f_1 = f_0\left(\frac{Vs-u_0}{Vs-u_s}\right)$

$= f_0\left(\frac{330-u}{330-30}\right) = 180\ \frac{(330-u)}{300}$

$f_1 = 180\ \left(\frac{330-u}{300}\right)$ ... (i)

Case (ii), $f_2 = 160\ \left(\frac{330+u}{330}\right)$ ... (ii)

$\because$ There is no beats

$\therefore f_1 = f_2$

$180 = \left(\frac{330-u}{300}\right) = 160\left(\frac{330+u}{330}\right)$

$\Rightarrow \quad 9\left(\frac{330-u}{30}\right) = 8\left(\frac{330-u}{33}\right)$

$\Longrightarrow \ \frac{9}{10}(330-u) = \frac{8}{11}(330+u)$

$\Longrightarrow 32670 - 99u = 26400 + 80u$

$\therefore u = \frac{6270}{179} = 35.02\ \text{m s}^{-1}$

17. For Simple Harmonic Oscillator, the potential energy is equal to kinetic energy

A) twice during each cycle
B) four times during each cycle
C) when $\text{x} = 0$
D) when $\text{x} = \text{a}$

Solution : (Correct Answer: B)

Total energy = $\text{P E} + \text{K E}$.

When a particle executes SHM, there is one position between maximum amplitude and mean position where PE is equal to KE, and particle have to cross that point four times to complete one oscillation.

18. An ideal diatomic gas occupies a volume V_1 at a pressure P_1 . The gas undergoes a process in which the pressure is proportional to the volume. At the end of process the root mean square speed of the gas molecules has doubled from its initial value then the heat supplied to the gas in the given process is

A) $7P_1V_1$ B) $8P_1V_1$ C) $9P_1V_1$ D) $10P_1V_1$

Solution : (Correct Answer: C)

As $P \propto V$

$\therefore PV^{-1} = \text{constant}$

Also, $C = C_v - \frac{R}{x-1}$

$C = \frac{5}{2}R - \frac{R}{-1-1}$

$C = 3R$

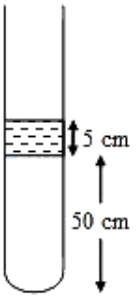
root mean square speed is, $v = \sqrt{\frac{3RT}{M}}$

But as root mean square speed is doubled therefore temperature becomes four times.

Hence, $\Delta Q = nC\Delta T = n \times 3R \times (4T_1 - T_1) = 9nRT_1$

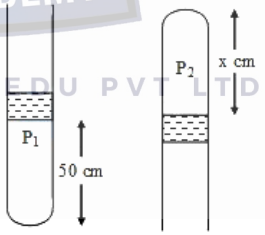
$\Delta Q = 9P_1V_1$

19. A vertical tube of length $100\ \text{cm}$ contains a mercury pallet of length $5\ \text{cm}$ as shown in the figure. The length of the tube above mercury pallet if the tube is inverted is nearly: (atmospheric pressure = $75\ \text{cm Hg}$of Hg)



A) $56\ \text{cm}$ B) $57\ \text{cm}$ C) $60\ \text{cm}$ D) $50\ \text{cm}$

Solution : (Correct Answer: B)



$\text{P}_1 \times 50 = \text{P}_2 \times \text{x}$
$\Rightarrow \text{x} = \frac{50\text{P}_1}{\text{P}_2}$
$\text{P}_1 = 80\ \text{cm}$ of Hg
$\text{P}_2 = 70\ \text{cm}$ of Hg
$\therefore \text{x} = \frac{50\times80}{70}$
$= 57.12\ \text{cm} \approx 57\ \text{cm}$

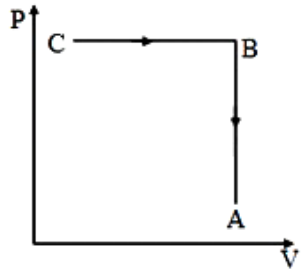
20. The pressure and density of a diatomic gas change from $(p,\ \rho)$ to (p' ,ρ ') during an adiabatic change. If $\frac{\rho'}{\rho} = 32$, value of $\frac{p'}{p}$ is

A) 32 B) 1/32 C) 128 D) 1/128

Solution : (Correct Answer: C)

From $p_1V_1^{\gamma} = p_1V_2^{\gamma}$
$\frac{p_2}{p_1} = \left(\frac{V_1}{V_2}\right)^{\gamma} = \left(\frac{\rho_2}{\rho_1}\right)^{\gamma}$
$\therefore \ \frac{P_2}{P_1} = \frac{P'}{P} = 128$

21. Ideal gas is taken through a process as shown in figure



A) in process AB, work done by system is positive
B) in process AB, heat is rejected out of the system
C) in process AB, internal energy increases
D) all of the above

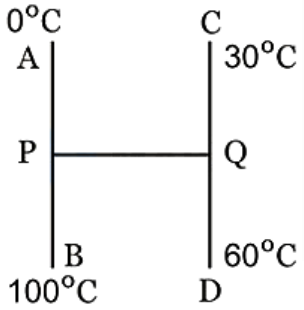
Solution : (Correct Answer: B)

In process AB volume is constant therefore work done is zero.

For constant volume, $P \propto T$

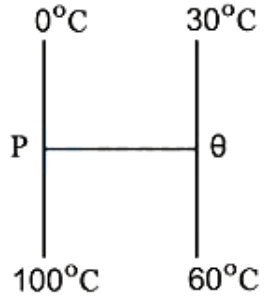
Therefore from B to A pressure and temperature decreases, therefore internal energy decreases and hence heat rejected out of the system.

22. Three identical rods AB,CD and PQ are joined as shown P and Q are mid points of AB and CD respectively. Ends A, B, C and D are maintained at $0°\mathrm{C}$,$100°\mathrm{C}$, $30°\mathrm{C}$ and $60°\mathrm{C}$ respectively. The direction of heat flow in PQ is



A) From P to Q
B) From Q to P
C) Heat does not flow in PQ
D) Data not sufficient

Solution : (Correct Answer: A)



assume that there is no 'PQ' Rod

Then $T_{\mathrm{P}} = \frac{100}{2} = 50\ ^{\circ}\mathrm{C}$

$T_{\mathrm{Q}} = 45\ ^{\circ}\mathrm{C}$

$T_{\mathrm{P}} > T_{\mathrm{Q}} \Rightarrow$ Heat flow from P to Q

23. An iron bar $10\ \mathrm{cm}$ in length is kept at $20\ ^{\circ}\mathrm{C}$. If the coefficient of linear expansion of iron is $\alpha = 11 \times 10^{-6}\ ^{\circ}\mathrm{C}^{-1}$, then at $19\ ^{\circ}\mathrm{C}$ it will be

A) $11 \times 10^{-6}\ \mathrm{cm}$ longer **B)** $11 \times 10^{-6}\ \mathrm{cm}$ shorter
C) $11 \times 10^{-5}\ \mathrm{cm}$ shorter **D)** $11 \times 10^{-5}\ \mathrm{cm}$ longer

Solution : (Correct Answer: C)

$\mathrm{L} = \mathrm{L}_0\,(1 + \alpha\Delta\theta)$

$\Rightarrow \frac{\mathrm{L}_1}{\mathrm{L}_2} = \frac{1+\alpha(\Delta\theta)_1}{1+\alpha(\Delta\theta)_2}$

$\Rightarrow \frac{10}{\mathrm{L}_2} = \frac{1+11\times10^{-6}\times20}{1+11\times10^{-6}\times19}$

$\Rightarrow \mathrm{L}_2 = 9.99989$

$\Rightarrow$ Length is shorten by

$10 - 9.99989 = 0.00011 = 11 \times 10^{-5}\ \mathrm{cm}$

24. Two raindrops reach the earth with their terminal velocities in the ratio $4 : 9$. The ratio of their radii is

A) $4 : 9$ **B)** $2 : 3$ **C)** $3 : 2$ **D)** $9 : 4$

Solution : (Correct Answer: B)

Terminal speed is $\mathrm{v} = \frac{2\mathrm{r}^2\mathrm{g}}{9\eta}(\sigma - \rho)$

therefore $\mathrm{v} \propto \mathrm{r}^2$

$\frac{\mathrm{r}_1}{\mathrm{r}_2} = \sqrt{\frac{\mathrm{v}_1}{\mathrm{v}_2}}$

$\frac{\mathrm{r}_1}{\mathrm{r}_2} = \sqrt{\frac{4}{9}}$

$\frac{\mathrm{r}_1}{\mathrm{r}_2} = \frac{2}{3}$

25. When one end of the capillary is dipped in water, the height of the water column is h. The upward force of $105\ \mathrm{dyne}$ due to surface tension is balanced by the force due to the weight of the water column. The inner circumference of the capillary is
(Surface tension of water $= 7 \times 10^{-2}\ \mathrm{N\ m^{-1}}$)

A) $1.5\ \mathrm{cm}$ **B)** $2\ \mathrm{cm}$ **C)** $2.5\ \mathrm{cm}$ **D)** $3\ \mathrm{cm}$

Solution : (Correct Answer: A)

$F = 105\ \mathrm{dyne} = 105 \times 10^{-5}\ \mathrm{N}, T = 7 \times 10^{-2}\ \mathrm{Nm^{-1}}$

$2\pi r T = F$

$2\pi r = \frac{F}{T} = \frac{105\times10^{-5}}{7\times10^{-2}}$

$= 15 \times 10^{-3}$ m

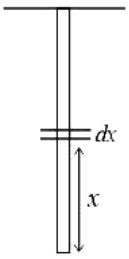
$= 1.5 \times 10^{-2}$ m

$= 1.5$ cm

26. A rubber cord of density d, Young's modulus Y and length L is suspended vertically. If the cord extends by a length $0.5L$ under its own weight, then L is

A) $\frac{Y}{2dg}$ **B)** $\frac{Y}{dg}$ **C)** $\frac{2Y}{dg}$ **D)** $\frac{dg}{2Y}$

Solution : (Correct Answer: B)



$\because$ Young's modulus $Y = \frac{\text{Stress}}{\text{Strain}}$

$Y = \frac{(\frac{F}{A})}{(\frac{\Delta L}{L})}$

$\Rightarrow \Delta l = \frac{FL}{AY}$

extennsion in dx at 'x'

$de = \frac{x\ d\ A\ g(dx)}{AY}$

total extension $e = \int_0^L \frac{x\ d\ Ag\ (dx)}{AY}$

$= \frac{dg}{Y}\frac{L^2}{2}$

$0.5\ L = \frac{dgL^2}{\text{msub}} \Rightarrow L = \frac{Y}{dg}$

27. The pressure of a medium is changed from 1.01×10^5 Pa to 1.165×10^5 Pa and change in volume is 10% keeping temperature constant.The bulk modulus of the medium is

A) 204.8×10^5 Pa **B)** 102.4×10^5 Pa
C) 51.2×10^5 Pa **D)** 1.55×10^5Pa

Solution : (Correct Answer: D)

From the definition of bulk modulus,

$\beta = -\frac{\Delta P}{\Delta V/V} = -V \cdot \frac{\Delta P}{\Delta V}$

Substituting the values, we have

$\beta = \frac{-(1.165-1.01)\times 10^5}{-10} \times 100 = 1.55 \times 10^5$ Pa

28. If the value of g acceleration due to gravity at the earth surface is 10 m s^{-2}. Its value in m s^{-2} at the centre of the earth, which is assumed to be a sphere of radius R metre and uniform mass density is

A) 5 **B)** Zero **C)** 10 **D)** 1

Solution : (Correct Answer: B)

The value of g decreases gradually towards the center of the earth and becomes zero at the center.

The value of g at center of earth = 0 m/s^2

29. The time period of a satellite of earth is 5 h. If the separation between the earth and the satellite is increased to 4 times the previous value, the new time period will become

A) 40 h **B)** 20 h
C) 10 h **D)** 80 h

Solution : (Correct Answer: A)

Using Kepler's IIIrd law

$T^2 \propto r^3$

$\frac{T'^2}{T^2} = \frac{(r')^3}{r^3}$

$\Rightarrow \frac{T'^2}{T^2} = \frac{(4R)^3}{(R)^3}$

$T'^2 = 64\,T^2$

$\Rightarrow T'^2 = 8T \Rightarrow T' = 8 \times 5 = 40$ h

30. Four similar point masses (m each) are symmetrically placed on the circumference of a disc of mass M and radius R. Moment of inertia of the system about an axis passing through centre O and perpendicular to the plane of the disc will be

A) $MR^2 + 4mR^2$ **B)** $MR^2 + \frac{8}{5}mR^2$
C) $mR^2 + 4MR^2$ **D)** $\frac{MR^2}{2} + 4mR^2$

Solution : (Correct Answer: D)

Total moment of inertia of the system $= \frac{1}{2}MR^2 + 4mR^2$

31. A thin uniform rod of length l and mass m is swinging freely, about a horizontal axis passing through its end. Its maximum angular speed is ω. The maximum height, to which its centre of mass rises, is

A) $\frac{1}{3}\frac{l^2\omega^2}{g}$ **B)** $\frac{1}{6}\frac{l\omega}{g}$
C) $\frac{1}{2}\frac{l^2\omega^2}{g}$ **D)** $\frac{1}{6}\frac{l^2\omega^2}{g}$

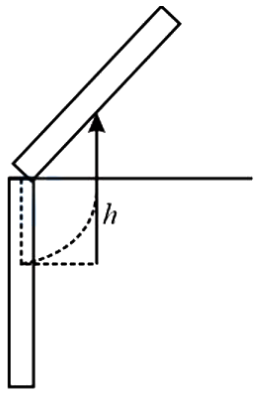
Solution : (Correct Answer: D)

$\text{TE}_i = \text{TE}_r$

$\frac{1}{2}I\omega^2 = mgh$

$\frac{1}{2} \times \frac{1}{3} ml^2\omega^2 = mgh$

$\Rightarrow h = \frac{1}{6} \frac{l^2\omega^2}{g}$



32. A $70\ \text{kg}$ man standing on ice throws a $3\ \text{kg}$ body horizontally at $8\ \text{m s}^{-1}$. The friction coefficient between the ice and his feet is 0.02. The distance, through which the man slip is

A) $0.3\ \text{m}$ **B)** $2\ \text{m}$ **C)** $1\ \text{m}$ **D)** ∞

Solution : (Correct Answer: A)

At the time of throwing body, velocity gained by man is

$v_0 = \frac{3\times 8}{70} = \frac{24}{70}$ m/s

$\therefore$ Stopping distance $s = \frac{v_0^2}{2\mu g}$

Or $s = \frac{24\times 24}{70\times 70\times 2\times 0.02\times 10}$

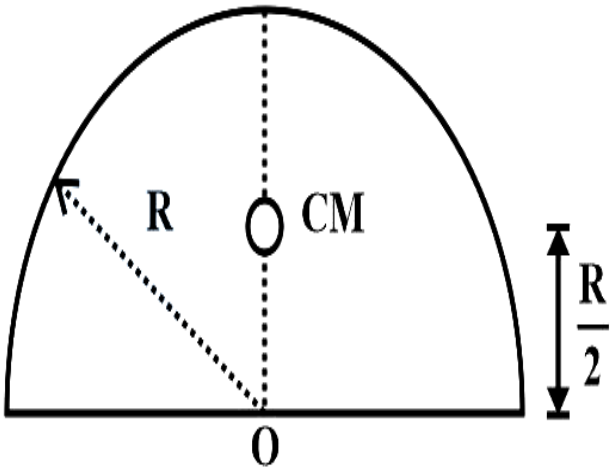
$= \frac{576}{49\times 40} = \frac{144}{490} = 0.3\ \text{m}$

33. The distance of the centre of mass of a hemispherical shell of radius R from its centre is

A) $\frac{R}{2}$ **B)** $\frac{R}{3}$ **C)** $\frac{2R}{2}$ **D)** $\frac{2R}{3}$

Solution : (Correct Answer: A)

Centre of mass of a hemispherical shell of radius R lies at a distance of $h = \frac{R}{2}$ from its centre on the axis of symmetry as shown in figure.



34. An object of mass $10\ \text{kg}$ falls from rest through a vertical distance of $10\ \text{m}$ and acquires a velocity of $10\ \text{m s}^{-1}$. The work done by the push of air on the object is $(g = 10\ \text{m s}^{-2})$

A) $500\ \text{J}$ **B)** $-500\ \text{J}$ **C)** $250\ \text{J}$ **D)** $-250\ \text{J}$

Solution : (Correct Answer: B)

Given, the mass of the object $= 10\ \text{kg}$

Initial velocity (rest), $u = 0$

Final velocity, $v = 10\ \text{m s}^{-1}$

$g = 10\ \text{m s}^{-2}$

From work-energy theorem

$mgh + W_{\text{air}} = \frac{1}{2}mV^2 - \frac{1}{2}mu^2$

$10 \times 10 \times 10 + W_{\text{air}} = \frac{1}{2}10 \times 10^2 - 0$

$W_{\text{air}} = -500\ \text{J}$

35. A $1.0\ \text{kg}$ ball drops vertically into a floor from a height of $25\ \text{cm}$. It rebounds to a height of $4\ \text{cm}$. The coefficient of restitution for the collision is

A) 0.16 **B)** 0.32 **C)** 0.40 **D)** 0.56

Solution : (Correct Answer: C)

Initial velocity before colliding floor $u = \sqrt{2gh}$

$u = \sqrt{5}$

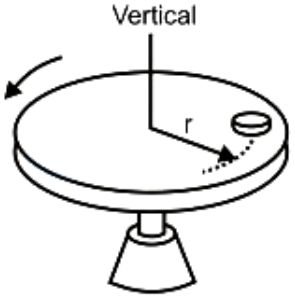
final velocity after colliding floor $v = \sqrt{2gh'}$

$v = \sqrt{0.8}$

We know that coefficient of restitution $e = \frac{v}{u}$

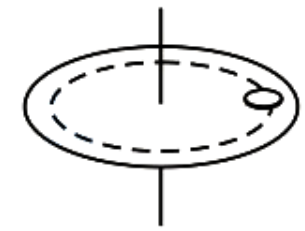
$e = \frac{\sqrt{0.8}}{\sqrt{5}} = 0.4$

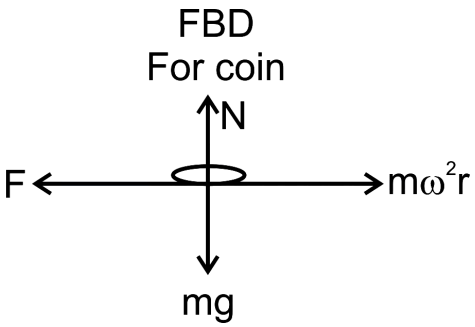
36. A small coin of mass $40\ \text{g}$ is placed on the horizontal surface of a rotating disc. The disc starts from rest and is given a constant angular acceleration $\alpha = 2\ \text{rad s}^{-2}$. The coefficient of static friction between the coin and the disc is $\mu_s = 3/4$ and the coefficient of kinetic friction is $\mu_k = 0.5$. The coin is placed at a distance $r = 1\ \text{m}$ from the centre of the disc. The magnitude of the resultant force on the coin exerted by the disc just before it starts slipping on the disc is :



A) $0.2\ \text{N}$ **B)** $0.3\ \text{N}$
C) $0.4\ \text{N}$ **D)** $0.5\ \text{N}$

Solution : (Correct Answer: D)





The friction force on coin just before coin is to slip will be : $f = \mu_s mg$

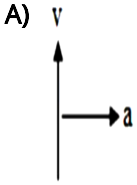
Normal reaction on the coin ; N = mg

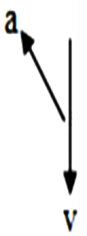
The resultant reaction by disk to the coin is

$$= \sqrt{N^2 + f^2} = \sqrt{(mg)^2 + (\mu_s mg)^2} = mg\sqrt{1+\mu_s^2}$$

$$= 40 \times 10^{-3} \times 10 \times \sqrt{1 + \tfrac{9}{16}} = 0.5 \text{ N}$$

37. Shown here are the velocity and acceleration vectors for an object in several different types of motion. In which case is the object slowing down and turning to the right

A) 

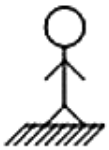
B) 

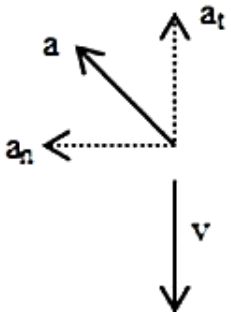
C) 

D)

Solution : (Correct Answer: B)

From observer point of view tangential acceleration a_t decreases speed v and radial aceleration a_n makes the path of object curved turning to the right.





38. A car of mass $1000\ \text{kg}$ moves on a circular path with a constant speed of $16\ \text{m s}^{-1}$. It is turned by $90\ °$after travelling $628\ \text{m}$ on the road. The centripetal force acting on the car is

A) $160\ \text{N}$ **B)** $320\ \text{N}$ **C)** $640\ \text{N}$ **D)** $1280\ \text{N}$

Solution : (Correct Answer: C)

$\frac{2\pi r}{4} = 628$

$r = \frac{628(2)}{3.14} = 400\ \text{m}$

Centripetal Force, $F = \frac{mv^2}{r}$

$F = \frac{1000(16)^2}{400}$

$F = 640\ \text{N}$

39. A room (cubical) is made of mirrors. An insect is moving along the diagonal on the floor such that the component of velocity of direct image of insect on two adjacent wall mirrors along those mirrors is $10\ \text{cm s}^{-1}$. The velocity of image of the insect in the ceiling mirror is

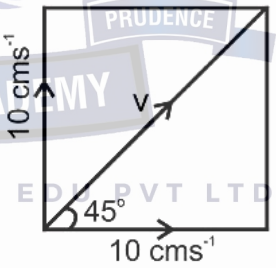
A) $10\ \text{cm s}^{-1}$ **B)** $20\ \text{cm s}^{-1}$
C) $\frac{10}{\sqrt{2}}\ \text{cm s}^{-1}$ **D)** $10\sqrt{2}\ \text{cm s}^{-1}$

Solution : (Correct Answer: D)

$v \cos 45° = 10$

$\therefore v = 10\sqrt{2}\ \text{cm s}^{-1}$

In the ceiling mirror the original velocity will be seen.



40. Speeds of two identical cars are u and $4u$, respectively, at a specific instant. If the same retardation is applied to both the cars, the ratio of the respective distances in which the two cars are stopped, from that instant, is

A) $1 : 1$ **B)** $1 : 4$
C) $1 : 8$ **D)** $1 : 16$

Solution : (Correct Answer: D)

Both the cars are given the same deceleration simultaneously and both finally stop.

Formula relevant to motion : $u^2 = 2as$

$\therefore$ For the first car, $s_1 = \frac{u^2}{2a}$

For the second car, $s_2 = \frac{(4u)^2}{2a} = \frac{16u^2}{2a}$

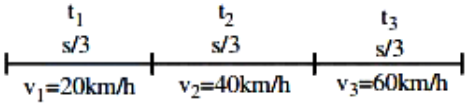
$\therefore \quad \frac{s_1}{s_2} = \frac{1}{16}$

41. If the first one-third of a journey is travelled at $20\ \text{km h}^{-1}$, next one-third at $40\ \text{km h}^{-1}$ and the last one-third at $60\ \text{km h}^{-1}$, then the average speed for the whole journey will be

A) $32.7\ \text{km h}^{-1}$ **B)** $35\ \text{km h}^{-1}$
C) $40\ \text{km h}^{-1}$ **D)** $45\ \text{km h}^{-1}$

Solution : (Correct Answer: A)

Let t_1, t_2, t_3 be the time taken in travelling distances $\frac{s}{3}, \frac{s}{3}, \frac{s}{3}$. Then



$t_1 = \frac{s/3}{v_1} = \frac{s/3}{20}$, $t_2 = \frac{s/3}{v_2} = \frac{s/3}{40}$, $t_3 = \frac{s/3}{v_3} = \frac{s/3}{60}$

$\therefore$ Average speed $= \frac{s}{\frac{s/3}{20}+\frac{s/3}{40}+\frac{s/3}{60}} = \frac{3}{\frac{1}{20}+\frac{1}{40}+\frac{1}{60}}$

$= \frac{3}{\frac{6+3+2}{120}} = \frac{3\times120}{11} = 32.7\ \text{km/h}$

42. The dimensional formula of magnetic permeability is

A) $[M^0L^{-1}T]$ **B)** $[M^0L^2T^{-1}]$
C) $[M^0L^2T^{-1}A^2]$ **D)** $[MLT^{-2}A^{-2}]$

Solution : (Correct Answer: D)

$\frac{F}{l} = \frac{\mu_0 I_1 I_2}{2\pi r}$

Or $[\mu_0] = \frac{[F]}{[I_1 I_2]} = \frac{[MLT^{-2}]}{[A^2]} = [MLT^{-2}A^{-2}]$.

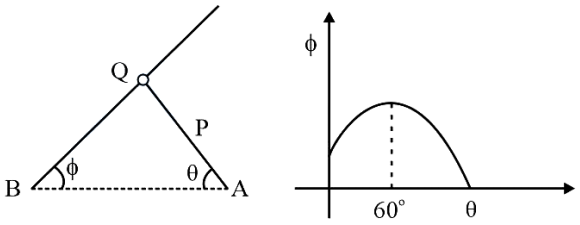
43. Dimensional formula of the physical quantity, resistance is

A) $[ML^2T^{-3}A^{-2}]$ **B)** $[ML^{-1}T^3A^{-1}]$
C) $[ML^2T^{-2}K^{-1}]$ **D)** $[ML^{-2}T^{-3}A^2]$

Solution : (Correct Answer: A)

According to Ohm's law,
$V = IR$
$\therefore\ R = \frac{V}{I}$
But $V = \frac{W}{q}$
$= \frac{W}{It}\ [\because q = It]$
$\therefore R = \frac{W/It}{I}$
$= \frac{W}{I^2t}$
Hence, $[R] = \frac{[W]}{[I^2][t]} = \frac{[ML^2T^{-2}]}{[A^2T]}$
$= [ML^2T^{-3}A^{-2}]$

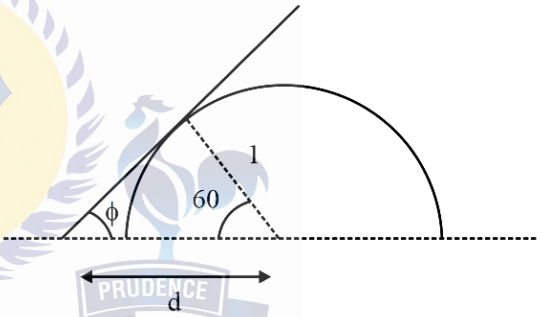
44. A rod P of length $1\ \text{m}$, is hinged at one end A and there is a ring attached to the other end. Another long rod Q is hinged at B and it passes through the ring. The rod P is rotated about an axis which is perpendicular to the plane in which both rods are present and the variations between the angles θ and ϕ are plotted as shown.The distance between the hinges A and B is



A) $3\ \text{m}$ **B)** $1\ \text{m}$ **C)** $2\ \text{m}$ **D)** $2\sqrt{2}\ \text{m}$

Solution : (Correct Answer: C)

From the graph it can be seen that the max. value ϕ is at $\theta = 60°$. ϕ is max. when the rod Q is tangent on the circle on which the ring attached to P moves.



from the fig. $\text{d} = 1\ \sec\ 60$

$= 2\ \text{m}$

45. The magnitude of x and y components of $\vec{A}$ are 7 and 6 respectively. Also, the magnitudes of x and y components of $\vec{A} + \vec{B}$ are 11 and 9 respectively. Calculate the magnitude of vector $\vec{B}$.

A) 10 **B)** 5 **C)** 6 **D)** 3

Solution : (Correct Answer: B)

Given, $\vec{A} = 7\hat{i} + 6\hat{j}$

Let $\vec{B} = b_1\hat{i} + b_2\hat{j}$ .....(i)

Given that, $\vec{A} + \vec{B} = 11\hat{i} + 9\hat{j}$

Or $(7 + b_1)\hat{i} + (6 + b_2)\hat{j} = 11\hat{i} + 9\hat{j}$

Comparing the scalar component of $\hat{i}$ and $\hat{j}$

$7 + b_1 = 11$ and $6 + b_2 = 9$

$\Rightarrow b_1 = 4$ and $b_2 = 3$

$\therefore$ From Equation. (i),

$\vec{B} = 4\hat{i} + 3\hat{j}$

$\left|\vec{B}\right| = \sqrt{4^2 + 3^2} = \sqrt{25} = 5$

Chemistry

46. Metal chloride A is soluble in hot water but insoluble in cold water. Select correct statement about A. Thus

A) A can give yellow ppt. with K_2CrO_4
B) A can give white ppt with K_2SO_4
C) A can give yellow ppt with KI
D) All of the above are correct statements.

Solution : (Correct Answer: D)

$PbCl_2$ is soluble in hot water but forms white needle like crystals on cooling.

$$PbCl_2 \xrightarrow{K_2CrO_4} \underset{\text{Yellow ppt}}{PbCrO_4 \downarrow}$$

$$PbCl_2 \xrightarrow{K_2SO_4} \underset{\text{White ppt}}{PbSO_4 \downarrow}$$

$$PbCl_2 \xrightarrow{KI} \underset{\text{Yellow ppt}}{PbI_2 \downarrow}$$

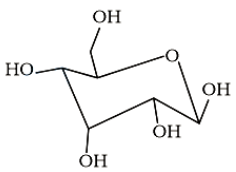
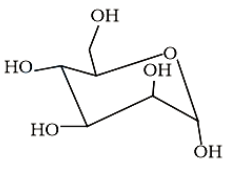
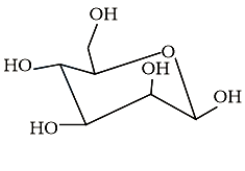
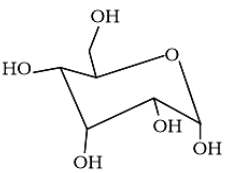
47. Which of the given polymres is a natural polymer

A) Polyester
B) Glyptal
C) Starch
D) $Nylon-2-Nylon-6$

Solution : (Correct Answer: C)

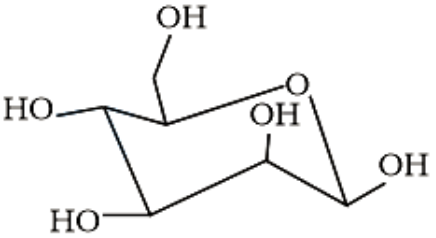
Starch is a natural polymer and other are synthetic.

48. D-mannose is epimeric with D-glucose at C_2 . Which of the following structure represents β -D-mannopyranose?

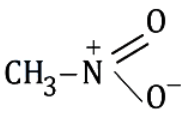
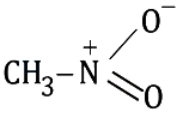
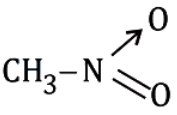
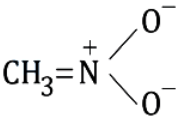
A) 
B) 
C) 
D) 

Solution : (Correct Answer: C)

In D-mannose $-OH$ at C-2 and C-3 are cis position to each other so the structure of β -D-mannopyranose can be given as

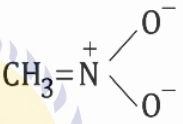


49. Which of the following is not a structure of nitromethane molecule?

A) 
B) 
C) 
D) 

Solution : (Correct Answer: D)

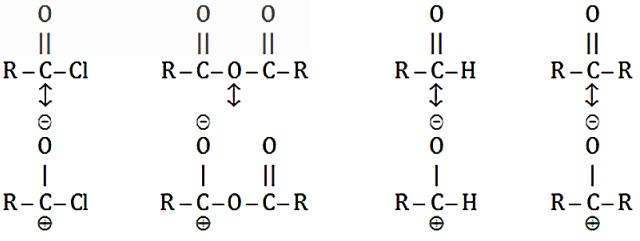
This structure is not a valid structure of nitromethane, as carbon valency exceeding 4.



50. Arrange these compounds in decreasing order of reactivity for the nucleophilic addition reactions
(1) Acid chloride
(2) Aldehyde
(3) Ketone
(4) Anhydride
Select the correct answer from the codes given below

A) $1 > 2 > 3 > 4$ **B)** $4 > 3 > 2 > 1$
C) $3 > 2 > 1 > 4$ **D)** $1 > 4 > 2 > 3$

Solution : (Correct Answer: D)



(i) Stability in increasing order
(ii) Reactivity for nucleophile is in decreasing order.

51. Which reagent is used to differenciate between aldehyde and ketone?

A) Fehling's solution **B)** Tollen's reagent
C) Schiff's reagent **D)** All of these

Solution : (Correct Answer: D)

Fehling solution is Alkaline $CuSO_4 + Na - K$ tartarate
Tollen's reagent is $NH_4OH + AgNO_3$
Schiff's reagent is $p-$rosaniline hydrochloride or magneta

All these reagents are used to distinguish between aldehydes and ketones. Aldehydes reacts with all these reagents while ketones do not react.

52. The compound formed when Ethyl bromide is heated with dry Silver oxide is

A) dimethylether **B)** diethylether
C) methylalcohol **D)** ethylalcohol

Solution : (Correct Answer: B)

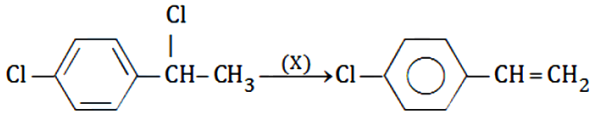
$$2C_2H_5Br + \underset{\text{Dry}}{Ag_2O} \rightarrow C_2H_5 - O - C_2H_5 + 2AgBr$$

If we take moist Ag_2O then alcohol is formed

$$Ag_2O + H_2O \rightarrow 2AgOH$$

$$C_2H_5Br + AgOH \rightarrow C_2H_5OH + AgBr$$

53. In the given reaction sequence

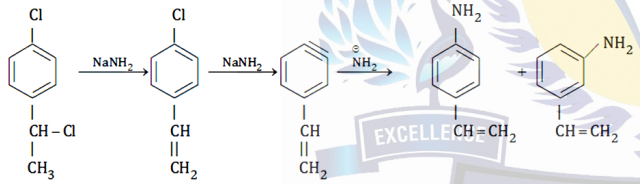


X will not be

A) alc. KOH/ Δ **B)** $C_2H_5\bar{O}/\Delta$
C) alc. NaOH/ Δ **D)** $NaNH_2/\Delta$

Solution : (Correct Answer: D)

Here X can not be $NaNH_2$ as in presence of $NaNH_2$, chlorobenzene gives nucleophilic substitution reaction by benzyne mechanism as follows



54. For which of the following d^n configuration octahedral complex, cannot exist in both high spin and low spin forms

(I) d^3
(II) d^5
(III) d^6
(IV) d^8

A) I, II and III **B)** II, III and IV
C) I and IV **D)** None of these

Solution : (Correct Answer: C)

Octahedral complexes having metal cation with d^3 and d^8 configuration cannot be defined in terms of high and low spin complex.

55. $KMnO_4$ can be prepared from K_2MnO_4 as per the reaction,

$$3MnO_4^{2-} + 2H_2O \rightleftharpoons 2MnO_4^- + MnO_2 + 4OH^-$$

The reaction can go to completion by removing OH^- ions by adding

A) CO_2 **B)** SO_2 **C)** HCl **D)** KOH

Solution : (Correct Answer: A)

To remove OH- ion a weak acid (H_2CO_3) is required because a strong acid can reverse the reaction. So here HCl is a strong acid so it reverse the reaction.

KOH is strong base which will increase OH- concentration.

SO_2 will react with water to form a strong acid H_2SO_4 .

CO_2 combines with OH^- ion to give carbonate which is easily removed.

56. The one which is tetrabasic is :

A) Ortho phosphorus acid
B) Ortho phosphoric acid
C) Meta phosphoric acid
D) Pyro phosphoric acid

Solution : (Correct Answer: D)

$H_4P_2O_7$ is tetrabasic because it gives four H^+ ions when dissolved in water.

$$HO - \underset{\underset{OH}{|}}{\overset{\overset{O}{||}}{P}} - O - \underset{\underset{OH}{|}}{\overset{\overset{O}{||}}{P}} - OH$$

57. Which of the following is an example of heterogeneous catalysis reaction?

A) $2SO_2(g) + O_2(g) \xrightarrow{NO(g)} 2SO_3(g)$
B) Hydrolysis of aqueous sucrose solution in the presence of aqueous mineral acid
C) $CH_3COOCH_3(l) + H_2O(l) \xrightarrow{HCl(l)} CH_3COOH(l) + CH_3OH$
D) $CO(g) + 2H_2(g) \xrightarrow{Cu,\ ZnO-Cr_2O_3(s)} CH_3OH(l)$

Solution : (Correct Answer: D)

$$CO(g) + 2H_2(g) \xrightarrow{Cu,\ ZnO-Cr_2O_3(s)} CH_3OH(l)$$

In this reaction, reactants and catalysts are in different physical states, hence, it is an example of heterogeneous catalysis.

58. The rate constant of the reaction $2H_2O_2\ (aq) \longrightarrow 2H_2O\ (\ell) + O_2\ (g)$ is $3 \times 10^{-3} min^{-1}$

At what concentration of H_2O_2 , the rate of the reaction will be $2 \times 10^{-4}\ Ms^{-1}$?

A) $6.67 \times 10^{-3}\ M$ **B)** 2 M
C) 4 M **D)** 0.08 M

Solution : (Correct Answer: C)

$-\frac{d[H_2O_2]}{dt} = k[H_2O_2]^1$

$\therefore \quad 2 \times 10^{-4} = \frac{3 \times 10^{-3}}{60} \times [H_2O_2]$

or $\quad [H_2O_2] = 4\ M$

59. When equal number of coulomb of electricity is passed through aqueous solution of AX and BX_2 and if number of moles of A and B deposited respectively are Y and Z then -

A) $Y = Z$ **B)** $Y < Z$
C) $Z = 2Y$ **D)** $Y = 2Z$

Solution : (Correct Answer: D)

$A^+ + e^- \rightarrow A$

$B^{2+} + 2e^- \rightarrow B$

Let n coulombs of electricity is passed through the aqueous solution

$\therefore$ no of moles of A deposited $= Y$ mole $= n$

no of moles of B deposited $= n/2 = Z$ mole

$\therefore \frac{Y}{2} = Z$

$Y = 2Z$

60. Which one of the following statements regarding Henry's law is not correct?

A) The value of K_H changes with function of the nature of the gas.
B) Higher the value of K_H at a given pressure, higher is the solubility of the gas in the liquids
C) The partial pressure of the gas in vapour phase is proportional to the mole fraction of of the gas in the solution.
D) Different gases have different K_H (Henry's law constant) value at a same temperature.

Solution : (Correct Answer: B)

Liquid solution $P_{gas} = K_H \times X_{gas}$ as $K_H \propto \frac{1}{X_{gas}}$

So, more is K_H less is solubility. Solubility of gases is less at higher temperature. So more is the temperature more is the K_H as $K_H \propto \frac{1}{\text{solubility}} \propto$ temperature

61. The void space in a primitive unit cell is:

A) 48% void space
B) 24% void space
C) 96% void space
D) 50% void space

Solution : (Correct Answer: A)

a = 2r

Volume of the cube $= a^3 = (2r)^3 = 8r^3$

Packing fraction $= \frac{\text{Volume of one atom}}{\text{Volume of the cube}}$

$= \frac{(\frac{4}{3}\pi r^3)}{8r^3} = \frac{\pi}{6} = 0.52$

Void fraction $= 1 - 0.52 = 0.48$

Void space $= 48\ \%$

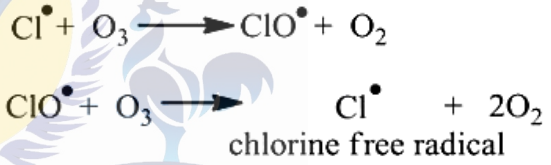
62. Which of the following is responsible for the depletion of the ozone layer in the upper strata of the atmosphere?

A) Chlorine **B)** Ferrocenes
C) Fullerenes **D)** Freons

Solution : (Correct Answer: D)

Freons or chlorofluoro carbons are responsible for depletion of the ozone layer in the upper strata of the atmosphere. They are used as propellants, aerosol spray caps, refrigerants, fire fighting reagents etc. They are stable and chemically inert compounds. They absorb UV-radiation and break down liberating free atomic chlorine which causes decomposition of ozone through free radical reaction. This results in the depletion of the ozone layer.

Freons are mainly freon-1
($CFCL_3$) and freon − 12 (CF_2Cl_2). They form free radical of chlorine in the presence of UV- radiation. Such free radical decomposes O_3 as follows

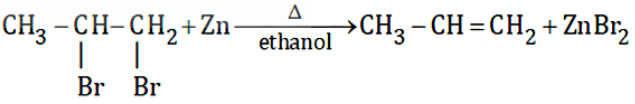


63. 1, 2-dibromopropane, when heated with Zn dust in ethanol, gives

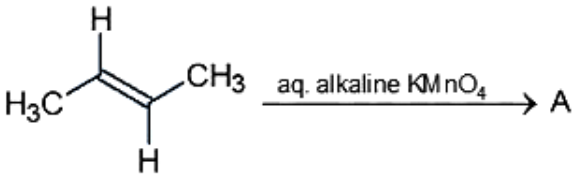
A) propane **B)** propene **C)** propyne **D)** ethyne

Solution : (Correct Answer: B)

1, 2-dibromopropane, when heated with Zn dust in ethanol, gives propene



64.



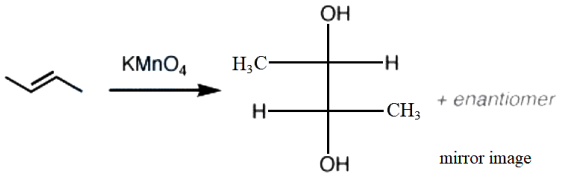
Which one of the following is true about this reaction?

A) A is meso-2, 3-butanediol formed by syn addition
B) A is meso-2, 3-butanediol formed by anti-addition
C) A is a racemic mixture of d and l-2, 3-butanediol formed by anti-addition

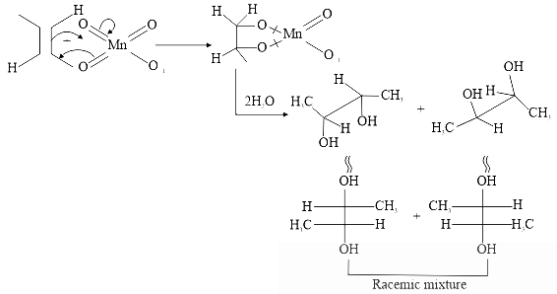
D) A is a racemic mixture of d and l-2, 3-butanediol formed by syn addition

Solution : (Correct Answer: D)

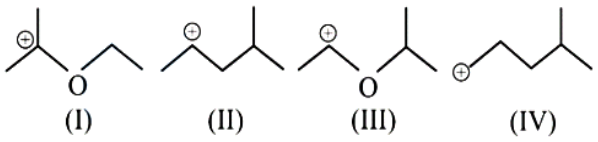
Alkenes form diol, when treated with alkaline $KMnO_4$. The reaction occurs by syn-addition



Reaction follows syn addition



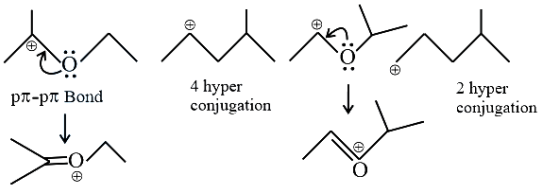
65. The correct stability order for the following species is



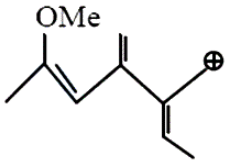
A) $(II) > (IV) > (I) > (III)$
B) $(I) > (II) > (III) > (IV)$
C) $(II) > (I) > (IV) > (III)$
D) $(I) > (III) > (II) > (IV)$

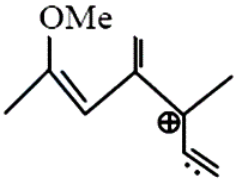
Solution : (Correct Answer: D)

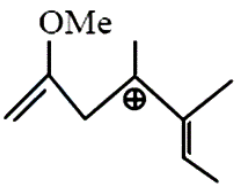
Carbocations with more no of the hyperconjugation structures and charge delocalization are more stable.

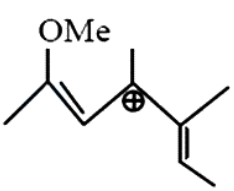


66. Select the most stable carbocation:

A) 

B) 

C) 

D) 

Solution : (Correct Answer: D)

It is stabilized by resonance. Resonance in (D) is maximum with involvement of lone pair of oxygen.

67. Which among the following is a false statement?

A) SiO_2 has a structure similar to that of CO_2
B) Natural Si exists only in the combined state
C) Si can be prepared by reducing SiO_2 with Mg
D) Si does not exist in graphite-like structure, but exists only in diamond like structure

Solution : (Correct Answer: A)

SiO_2 has three-dimensional network of $Si-O$ bonds; whilst carbon dioxide consists of discrete CO_2 molecules . SiO_2 is solid, whereas CO_2 is a gas.

B. Because of its great affinity for oxygen, Si always occurs as the oxide, silica (SiO_2) or in the form of silicates, which are the compounds of SiO_2 with other metal oxides.

C. $SiO_2 + 2Mg \rightarrow Si + 2MgO$

D. the reluctance of silicon to form $p\pi - p\pi$ bonds to itself is clearly shown by the fact that silicon does not exists in graphite-like structure, but only in diamond like structure.

68. Which of the following statement is/are true -

(I) Borazine is aromatic

(II) There are four isotopic disubstituted borazine molecules $B_3N_3H_4X_2$

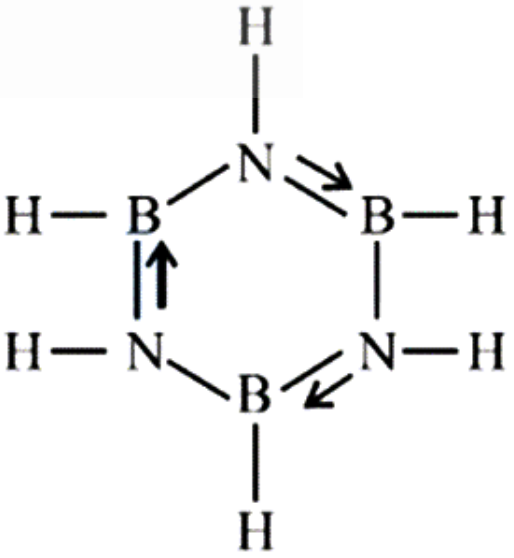
(III) Borazine is more reactive towards addition reactions than benzene

(IV) Banana bonds in B_2H_6 are longer but stronger than normal $B-H$ bonds

A) I, II and III
B) I, II and IV
C) I , II , III and IV
D) Only II

Solution : (Correct Answer: C)

Borazine is inorganic benzene



69. The following compounds have been arranged in the order of increasing thermal stabilities. Identify the correct order.

K_2CO_3 (I) , $MgCO_3$ (II) , $CaCO_3$ (III) , $BeCO_3$ (IV)

A) I < II < III < IV
B) IV < II < III < I

C) IV < II < I < III D) II < IV < III < I

Solution : (Correct Answer: B)

Carbonates of group 2 decompose to give oxides. Thermal stabilities of carbonates increase from Mg to Ba. Beryllium carbonate in unstable and is kept only in the atmosphere of CO_2 .

Group 1 carbonates (and also hydroxides) except lithium do not decompose on heating. In this problem, K_2CO_3 remains unchanged on heating.

70. Which compound will liberate oxygen when reacts with ice cold water?

A) Na_2O_2 B) KO_2 C) Na_2O D) Cs_2O_2

Solution : (Correct Answer: B)

KO_2 will liberate oxygen when reacts with ice cold water as follows

$2O_2^- + 2H_2O\,(l) \rightarrow 2OH^-\,(aq) + H_2O_2\,(l) + O_2\,(g)$

71. Hard water can block radiators due to the formation of

A) Insoluble calcium and magnesium salts
B) Insoluble sodium salts
C) Insoluble phosphate salts
D) Insoluble potassium salts

Solution : (Correct Answer: A)

Insoluble calcium and magnesium salts formation can block radiators

72. Ratio in hydrogen and oxygen in water molecule by volume is

A) 2 : 1 B) 3 : 1 C) 1 : 2 D) 1 : 1

Solution : (Correct Answer: A)

Formula of water is H_2O .

So, 2 : 1

73. In the reaction Bromine

$3\ Br_2 + 6\ OH^- \rightarrow 5\ Br^- + BrO_3^- + 3\ H_2O$

A) is reduced B) is oxidised
C) disproportionates D) disintergrates

Solution : (Correct Answer: C)

$\overset{(0)}{3Br_2} + 6OH^- \rightarrow 5Br^- + BrO_3^- + 3H_2O$

In this reaction, O.S. of bromine changes from (i) to 0 to -1 and (ii) 0 to +5. Hence, Br_2 is reduced to Br^- and also oxidized to BrO_3^- . Thus, Br_2 is oxidised as well as reduced. In other words, Br_2 undergoes disproportionation.

74. The reaction of aqueous $KMnO_4$ with H_2O_2 in acidic conditions gives

A) Mn^{4+} and MnO_2 B) Mn^{2+} and O_2
C) Mn^{4+} and O_2 D) Mn^{2+} and O_3

Solution : (Correct Answer: B)

$KMnO_4$ is a strong oxidising agent & wll oxidise H_2O_2 to O_2.

$2KMnO_4 + 3H_2SO_4 + 5H_2O_2 \rightarrow K_2SO_4 + 2MnSO_4 + 8H_2O + 5O_2$

75. How many litres of water must be added to 1 litre of an aqueous solution of HNO_3 with a pH of 1 to create an aqueous solution with pH of 2?

A) 5 B) 7 C) 9 D) 11

Solution : (Correct Answer: C)

$pH = 1$

$[H^+] = 10^{-1} = 0.1\ M$

$pH = 2$

$[H^+] = 10^{-2} = 0.01\ M$

For dilution of HNO_3 , we have

$M_1V_1 = M_2V_2$

$0.1 \times 1 = 0.01 \times V_2$

$V_2 = 10$ litre

Volume of water added $= 10 - 1 = 9$ litre

76. Solubility product (K_{sp}) of saturated $PbCl_2$ in water is $1.8 \times 10^{-4} mol^3\ dm^{-9}$. What is the concentration of Pb^{2+} in the solution?

A) $(0.45 \times 10^{-4})^{\frac{1}{3}}\ mol\ dm^{-3}$
B) $(1.8 \times 10^{-4})^{\frac{1}{3}}\ mol\ dm^{-3}$
C) $(0.9 \times 10^{-4})^{\frac{1}{3}}\ mol\ dm^{-3}$
D) $(2.0 \times 10^{-4})^{\frac{1}{3}}\ mol\ dm^{-3}$

Solution : (Correct Answer: A)

For the reaction of the AB_2 i.e. $(PbCl_2)$

$K_{sp} = 4s^3$

Or, $S = \left[\frac{K_{sp}}{4}\right]^{\frac{1}{3}}$

Given, $K_{sp} = 1.8 \times 10^{-4} mol^3 dm^{-9}$

$\therefore$ Solubility of Pb^{+2} ions will be

$\therefore \quad S = \left[\frac{1.8 \times 10^{-4}}{4}\right]^{\frac{1}{3}}$

$= \left[0.45 \times 10^{-4}\right]^{\frac{1}{3}}\ mol.\ dm^{-3}$

77. Which of the following is not a characteristic property of chemical equilibrium?

A) Rate of forward reaction is equal to rate of backward reaction at equilibrium
B) After reaching the chemical equilibrium, the concentrations of reactants and products remain unchanged with time
C) For $A\,(g) \rightleftharpoons B\,(g)$, K_c is 10^{-2}. If this reaction is carried out in the presence of catalyst, the value of K_c decreases
D) After reaching the equilibrium, both forward and backward reactions continue to take place

Solution : (Correct Answer: C)

There will be no effect on equilibrium constant (K_c) in presence of catalyst. So, statement (c) is wrong.

78. For the following equilibrium in gaseous phase, $N_2O_4 \rightleftharpoons 2NO_2$

NO_2 is 50 % of the total volume, when equilibrium is set up. Hence, percent dissociation of N_2O_4 is:

A) 50 % **B)** 25 %

C) 66.66 % **D)** 33.33 %

Solution : (Correct Answer: D)

	$N_2O_4 \rightleftharpoons$	$2NO_2$
Initially	1	0
At equilibrium	$1-x$	$2x$

Total number of moles $= 1 - x + 2x = 1 + x$

$\therefore$ % of NO_2 by volume $= \frac{2x}{1+x} \times 100 = 50$

i.e. $x = \frac{1}{3}$ (i.e. 0.333)

Hence, % dissociation $=$ 33.33 %

79. What is the melting point of benzene if $\Delta H_{fusion} = 9.95$ kJ/mol and $\Delta S_{fusion} 35.7$ J/K-mol?

A) 278.7°C **B)** 278.7 K

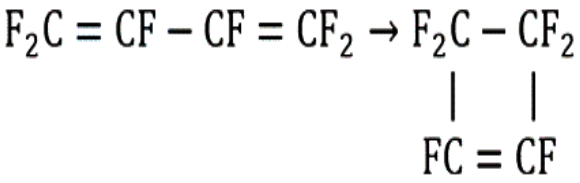
C) 300 K **D)** 298 K

Solution : (Correct Answer: B)

$T = \frac{\Delta H}{\Delta S} = \frac{9.95 \times 1000}{35.7}$

$= 278.7$ K

80.



For this reaction (ring closure), $\Delta H = -49$ kJ mol^{-1} , $\Delta S = -40.2$ Jk^{-1} mol^{-1} upto what temperature is the forward reaction spontaneous?

A) 1492°C **B)** 1219°C **C)** 946°C **D)** 1080°C

Solution : (Correct Answer: C)

For spontaneous process,

$\Delta G = \Delta H - T\Delta S$ (should be negative)

$\therefore T > \frac{\Delta H}{\Delta S}$, $T > \frac{-49 \times 1000}{-40.2}$,

$T > 1219$ K, i.e., 946°C

81. Which is correct for a diatomic molecule, according to the kinetic theory of gases

A) The root mean square velocity is inversely proportional to the temperature

B) The pressure exerted by the gas is proportional to the root mean square velocity of the molecules

C) The mean translational kinetic energy of the molecules is proportional to the absolute temperature

D) The pressure exerted by the gas is proportional to the mean velocity of the molecules

Solution : (Correct Answer: D)

All molecules of an ideal gas show random motion. They collide with each other and walls of container during which they lose or gain energy so they may not have same kinetic energy always.

82. A gaseous mixture containing He, CH_4 and SO_2 was allowed to effuse through a fine hole then find what molar ratio of gases coming out initially? (Given mixture contains He, CH_4 and SO_2 in 1 : 2 : 3 mole ratio)

A) $\sqrt{2} : \sqrt{2} : 3$ **B)** $2 : 2 : 3$

C) $4 : 4 : 3$ **D)** $1 : 1 : 3$

Solution : (Correct Answer: C)

$\frac{n_{He}}{n_{CH4}} = \frac{1}{2}\sqrt{\frac{16}{4}} = \frac{1}{1}$

$\frac{n_{He}}{n_{SO2}} = \frac{1}{3}\sqrt{\frac{64}{4}} = \frac{4}{3}$

So, $n_{He} : n_{CH_4} : n_{SO_2} = 4 : 4 : 3$

83. Select incorrect order

A) $H_2O > H_2S > H_2Se > H_2Te$ (Order of bond angle)

B) $HF > HCl > HBr > HI$ (Order of boiling point)

C) $LiCl < BeCl_2 < BCl_3 < CCl_4$ (Order of covalent character)

D) $CaF_2 > CaCl_2 > CaBr_2 > CaI_2$ (Order of melting point)

Solution : (Correct Answer: B)

Correct order boiling point is $HF > HI > HBr > HCl$ rest other orders are correct as per as given properties.

84. Which of the following has the regular tetrahedral structure?

A) BF_4^- **B)** SF_4

C) $[Ni(CN)_4]^{2-}$ **D)** XeF_4

Solution : (Correct Answer: A)

Tetrahedral structure is associated with sp^3 hybridized central atom with 4 bond pairs of electrons and without any lone pair of electrons. Here BF_4^- is Tetrahedral in structure as it has 4 bond pairs of electrons

The shapes of SF_4 , $[Ni(CN)_4]^{2-}$ and XeF_4 are sea-saw, square planar and square planar respectively.

85. The correct order of the decreasing ionic radii among the following isoelectronic species is

A) $K^+ > Ca^{2+} > Cl^- > S^{2-}$
B) $Ca^{2+} > K^+ > S^{2-} > Cl^-$
C) $Cl^- > S^{2-} > Ca^{2+} > K^+$
D) $S^{2-} > Cl^- > K^+ > Ca^{2+}$

Solution : (Correct Answer: D)

In case of isoelectronic species the value of Ionic radius follows the order $M^{-4} > M^{-3} > M^{-2} > M^{-1} > M^+ > M^{+2} > M^{+3}$ as the electron / proton number increase effective nuclear charge decreases hence radius increases.

Here $S^{-2} > Cl^- > K^+ > Ca^{+2}$ is the decreasing order of size.

86. The correct decreasing order of electropositive character among the following elements Fe, Sc, Rb, Br, Te, F and Ca is:

A) $Fe > Sc > Rb > Br > Te > F > Ca$
B) $Ca > Rb > Sc > Fe > Te > F > Br$
C) $Rb > Ca > Sc > Fe > Br > Te > F$
D) $Rb > Ca > Sc > Fe > Te > Br > F$

Solution : (Correct Answer: D)

(i) Alkali metals are more Electropositive than alkaline earth metals.

(ii) *d*-Block Elements which are near to alkaline earth metals are more Electropositive than other P-Block Elements.

(iii) Metalloids are more Electropositive than non-metals.

87. The ratio of orbit of first excited state of electron to the area of orbit of ground level, for hydrogen atom, will be

A) 16 : 1 **B)** 4 : 1 **C)** 8 : 1 **D)** 2 : 1

Solution : (Correct Answer: A)

For first excited state

n = 2

$\frac{A_2}{A_1} = \frac{\pi r_2^2}{\pi r_1^2} = \frac{n_2^4}{n_1^4} = \frac{16}{1}$

$\left(r = \frac{n^2}{Z} \times 0.529\text{Å}\right)$.

88. For a hypothetical hydrogen like atom, the potential energy of the system is given by $U(r) = \frac{-Ke^2}{r^3}$, where r is the distance between the two particles. If Bohr's model of quantization of angular momentum is applicable then velocity of particle is given by :

A) $v = \frac{n^2h^3}{Ke^2 8\pi^3 m^2}$ **B)** $v = \frac{n^3h^3}{8Ke^2\pi^3 m^2}$
C) $v = \frac{n^3h^3}{24Ke^2\pi^3 m^2}$ **D)** $v = \frac{n^2h^3}{24Ke^2\pi^3 m^2}$

Solution : (Correct Answer: C)

$\frac{d[U(r)]}{dr} = \frac{3Ke^2}{r^4} \Rightarrow$ Magnitude of the centripetal force (= Electrostatic force)

$\therefore \frac{3Ke^2}{r^4} = \frac{mv^2}{r}$

and we know $mvr = \frac{nh}{2\pi}$ or $r = \frac{nh}{2\pi m \cdot v}$

$3Ke^2 \times \frac{8\pi^3 m^3 v^3}{n^3 h^3} = mv^2, v = \frac{n^3h^3}{24Ke^2\pi^3 m^2}$

89. What mass of $CaCO_3$ is required to react completely with 25 ml of 0.75 M HCl according to the reaction $CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$

A) 1 g **B)** 0.3 g **C)** 0.8 g **D)** 0.93 g

Solution : (Correct Answer: D)

Given

$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$

Moles present in 25 ml of 0.75 M HCl $= \frac{0.75}{1000} \times 25$

$= 0.01875$ moles

Since 2 moles react completely with $CaCO_3 = 100$ g

0.01875 moles react completely with

$CaCO_3 = \frac{100}{2} \times 0.01875$

$= 0.9375$ g

90. Analysis shows that nickel oxide consists of nickel ion with 96% ions having d^8 configuration and 4% having d^7 configuration. Which amongst the following best represents the formula of the oxide?

A) $Ni_{1.02}O_{1.00}$ **B)** $Ni_{0.96}O_{1.00}$
C) $Ni_{0.98}O_{0.98}$ **D)** $Ni_{0.98}O_{1.00}$

Solution : (Correct Answer: D)

$Ni = 3d^8 4s^2$ (Atomic number = 28)

So $Ni^{2+} = 3d^8$ and $Ni^{3+} = 3d^7$

Hence, 96% ion of Ni^{2+} and 4% ions of Ni^{3+} are present.

Let number of O^{2-} ion present in the crystal = x

Using electroneutrality rule,

Total positive charge = Total negative charge

$96 \times 2\,(+\text{vecharge}) + 4 \times 3\,(+\text{vecharge})$

$= x \times 2\,(-\text{vecharge})$

So $96 \times 2 + 4 \times 3 - 2x = 0$

So x = 1.02

Hence formula of the crystal is $Ni_{1.00}O_{1.02}$ or $Ni_{0.98}O_{1.00}$.

Biology - (Zoology)

91. Given below are two statements :

Statement I : Fig fruit is a non-vegetarian fruit as it has enclosed fig wasps in it.

Statement II : Fig wasp and fig tree exhibit mutual relationship as fig wasp completes its life cycle in fig fruit and fig fruit gets pollinated by fig wasp.

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

A) Both statement I and statement II are correct
B) Both statement I and statement II are incorrect
C) Statement I is correct but statement II is incorrect
D) Statement I is incorrect but statement II is correct

Solution : (Correct Answer: B)

Fig fruit is a vegetarian fruit as it only gets pollinated by wasp. Fig tree and fig wasps shows mutualism in which both species are benefitted. So, statement I is incorrect. Statement II is also not correct as fig inflorescence/flower gets pollinated by fig wasp.

92. Which of the following genetically engineered organisms was used by Eli Lilly to prepare human insulin?

A) Bacterium
B) Yeast
C) Virus
D) Phage

Solution : (Correct Answer: A)

The correct answer is bacterium.

In 1983, Eli Lilly, an American company, prepared two DNA sequences corresponding to ' A ' and ' B ' chains of human insulin and introduced them in plasmids of E.coli (a gram negative bacterium) to produce insulin chains.

93. Which of the following enzyme(s) are NOT essential for gene cloning?

A. Restriction enzymes
B. DNA ligase
C. DNA mutase
D. DNA recombinase
E. DNA polymerase

Choose the correct answer from the options given below:

A) C and D only
B) A and B only
C) D and E only
D) B and C only

Solution : (Correct Answer: A)

Gene cloning is a process where a specific gene or DNA sequence is isolated and replicated, creating multiple identical copies.

In gene cloning, restriction enzymes, DNA ligase and DNA polymerase are primarily used.

94. Which of the following are the post-transcriptional events in an eukaryotic cell?

A. Transport of pre-mRNA to cytoplasm prior to splicing.
B. Removal of introns and joining of exons.
C. Addition of methyl group at 5' end of hnRNA.
D. Addition of adenine residues at 3 ' end of hnRNA.
E. Base pairing of two complementary RNAs.

Choose the correct answer from the options given below :

A) A, B, C only
B) B, C, D only
C) B, C, E only
D) C, D, E only

Solution : (Correct Answer: B)

The process of copying genetic information from one strand of the DNA into RNA is known as transcription. It occurs in the cytoplasm with the help of transcripting enzyme.

Transport of pre-mRNA to cytoplasm prior to splicing is a part of transcription.

The primary transcript is converted into functional mRNA after post transcriptional processing involves 3 steps as follows-

- Modification of 5' end by capping,
- Tailing,
- Splicing.

Base pairing of two complementary RNA is not on event of post-transcription. Hence, statements B, C, D are post-transcriptional modification events in eukaryotic cell.

95. Choose the correct sequence for cranial menings. (Outer to inner)

A) Arachnoid → Duramater → Pia mater
B) Dura mater → Arachnoid → Pia mater
C) Piamater → Arachnoid → Duramater
D) Duramater → Pia mater → Arachnoid.

Solution : (Correct Answer: B)

96. When a nerve fibre is stimulated the inside of the membrane becomes

A) Negatively charged
B) Positively charged
C) Depolarised
D) Filled with acetylcholine

Solution : (Correct Answer: B)

It's Obvious

97. Which one of the following pairs is WRONGLY matched?

A) Fruit juice - pectinase
B) Textile - amylase
C) Detergents - lipase

D) Alcohol - nitrogenase

Solution : (Correct Answer: D)

Alcoholic drinks are produced by fermentation process (anaerobic respiration). The various alcoholic drinks are formed by fermenting different types of raw material and with distillation or without distillation. Yeast is used in the production of alcohol by fermentation process where yeast produces the enzyme zymase for catalysing the process.

98. Match the following bacteria with the diseases and select the correct option

	Column I		Column II
A.	*Treponema pallidum*	1.	Plague
b.	*Yersinia pestis*	2.	Anthrax
C.	*Bacillus anthracis*	3.	Syphilis
D.	*Vibrio*	4.	Cholera

A) A-1, B-3, C-2, D-4 B) A-3, B-1, C-2, D-4
C) A-2, B-3, C-1, D-4 D) A-4, B-3, C-1, D-2

Solution : (Correct Answer: B)

Treponema pallidum	Syphilis
Yersinia pestis	Plague
Bacillus anthracis	Anthrax
Vibrio	Cholera

99. Which one of the following is heterosporous?

A) *Dryopteris* B) *Salvinia*
C) *Adiantum* D) *Equisetum*

Solution : (Correct Answer: B)

The sporophyte of pteridophyte produces meiospores inside the sporangia. *Selaginella* and *Salvinia* (aquatic fern) are heterosporous i.e., with two types of spores, microspores, and megaspores.

100. Which one of the following conditions in humans is correctly matched with its chromosomal abnormality?

A) Sickle cell anaemia - X linked
B) Down's syndrome - 44 autosomes + XO
C) Klinefelter's syndrome - 44 autosomes + XXY
D) Colour blindness - Y linked

Solution : (Correct Answer: C)

Klinefelter's syndrome is a genetic disorder in which there are three sex chromosomes, XXY, rather than the normal XX or XY. The number of autosomes are normal i.e., 44. Affected individuals are apparently male but are tall and thin, with small testes, failure of normal sperm production (azoospermia), enlargement of the breasts (gynaecomastia) and absence of facial and body hairs.

101. Foetal ejection reflex is produced by

A) Fully developed foetus only
B) Placenta only
C) Fully developed foetus and placenta
D) Fully developed foetus, placenta and endometrium

Solution : (Correct Answer: C)

The process of delivery of the foetus (childbirth) is called parturition. Parturition is induced by a complex neuroendocrine mechanism. The signals for parturition originate from the fully developed foetus and the placenta which induce mild uterine contractions called foetal ejection reflex. This triggers the release of oxytocin from the maternal pituitary.

102. In a monoecious plant:

A) Male and female sex organs are on different individuals
B) Male and female gametes are of two morphologically distinct types
C) Male and female sex organs are on the same individual
D) All the stamens are fused to form one unit

Solution : (Correct Answer: C)

When a single plant produces both male and female flower than the plant is called as monoecious. When two different plant body occurs one producing male flower and the other producing different flower than the plant is called as dioecious.

103. Diaphragms, cervical caps and vaults prevent conception by

A) increasing phagocytosis of sperms within uterus
B) suppressing sperm motility
C) inhibiting ovulation and implantation
D) blocking the entry of sperms through the cervix

Solution : (Correct Answer: D)

Contraceptive methods avoid pregnancy. These can be Natural methods, Barrier methods, IUD's, Chemical methods, Surgical methods and Implants. Barrier methods are condoms, femidoms, diaphragms, cervical caps and vaults etc. Barrier methods are popular as they are easy to use without the help of a practioner. These are effective methods, and their use does not interfere with coitus and also prevents sexually transmitted diseases. These are barrier methods because these block the entry of sperms through the cervix. The remaining three options are mechanisms of IUD's.

104. The thick filament of a myofibril is part of the muscle fibre. Select the incorrect statement regarding it.

A) Each thick filament is a polymerized protein of monomeric meromyosins.
B) Each meromyosin has two important parts, a globular head with a short arm and a tail.
C) The heavy meromyosin components form the cross arms of thick filaments.
D) Short arm of the light meromyosin has an active ATPase enzyme activity.

Solution : (Correct Answer: D)

Each myosin (thick) filament is also a polymerised protein. Many monomeric proteins called Meromyosins constitute one thick filament. Each meromyosin has two important parts, a globular head with a short arm and a tail, the former being called the heavy meromyosin (HMM) and the latter, the light meromyosin (LMM). The HMM component, i.e.; the head and short arm projects outwards at regular distance and angle from each other from the surface of a polymerised myosin filament and is known as cross arm. The globular head is an active ATPase enzyme and has binding sites for ATP and active sites for actin.

105.

Which one of the following organs in the human body is most affected due to shortage of oxygen?

A) Lungs B) Heart C) Kidney D) Brain

Solution : (Correct Answer: D)

Brain is the most vital organ. It stops functioning in the absence of O_2.

106. In DCT, antidiuretic hormone makes the filtrate _____ to blood plasma.

A) hypertonic B) hypotonic
C) isotonic D) both (A) and (B)

Solution : (Correct Answer: A)

Nephron is the structural and functional part of the kidney. It consists of the renal corpuscle, and renal tubule. PCT is the main site of absorption as all essential nutrients and 70-80% of electrolytes and water are reabsorbed here. thus the filtrate remains isotonic here. The ascending limb of Henle's loop is impermeable to water and permeable to electrolytes.The filtrate from here passes into the DCT hence it is hypotonic to it.ADH hormone absorbs water from DCT and thus filtrate becomes hypertonic.

107. Bipolar neurons are found in

A) retina and cerebral cortex both
B) retina but not in cerebral cortex
C) cerebral cortex but not in retina
D) neither retina nor cerebral cortex

Solution : (Correct Answer: B)

Types of neurons on the basis of number of axon and dendrites:

Types of neurons	Number of Dendrite (D)	Number of Axon (A)	D + A	Found in
1. Unipolar neuron	0	1	1	Embryonic stage
2. Bipolar neuron	1	1	2	Retina
3. Multipolar neuron	2 or more	1	Many	Cerebral cortex

108. Mechanism of blood clotting is given below:

An injury or a trauma stimulates the platelets in the blood to release certain factors which activate the mechanism of coagulation. An enzyme complex, _____P_____ is formed by a series of linked enzymic reactions (_____Q_____process) involving a number of factors present in the plasma in an inactive state. This enzyme complex is required for formation of_____R_____. _____S_____ ions play a very important role in clotting.

Identify the correct option that represents P, Q, R, and S.

A)

P	Q	R	S
thrombokinase	inhibitory	prothrombin	magnesium

B)

P	Q	R	S
prothrombin	cascade	thrombin	magnesium

C)

P	Q	R	S
thrombin	cascade	thrombokinase	calcium

D)

P	Q	R	S
thrombokinase	cascade	thrombin	calcium

Solution : (Correct Answer: D)

Mechanism of blood coagulation or clotting

A. Injury or trauma results in:

I. Stimulation of platelets → Release of certain factors that activate the mechanism of coagulation.

II. Damaged tissues → Release of certain factors that can also initiate coagulation.

B. A series of linked enzymic reactions (cascade process) that involves a number of clotting factors

present in the plasma in an inactive state is initiated that finally results in the formation of an enzyme complex - Thrombokinase.

C. Prothrombin ---------- Thrombokinase--------- → Thrombin

D. Fibrinogens in the plasma ---------- Thrombin--------- → Fibrins

- Calcium ions are very important for clotting.

109. Which of the following enzymes is found in pancreatic juice?

A) Nuclease **B)** Enterokinase
C) Aminopeptidase **D)** Dipeptidase

Solution : (Correct Answer: A)

Secretion	Components
Pancreatic Juice	Inactive enzymes: trypsinogen, chymotrypsinogen, procarboxypeptidases, amylases, lipases and nucleases.
Bile juice	Bile pigments (bilirubin and biliverdin), bile salts, cholesterol and phospholipids (but no enzymes).
Intestinal juice (Succus entericus)	Enzymes: disaccharidases (e.g., maltase), dipeptidases, lipases, nucleosidases, etc. It also includes mucus secreted from the Goblet cells.

110. If the level of glucose drops in the blood, the body releases _____ to bring it back to normal.

A) insulin from beta cells of pancreas
B) calcitonin from thyroid gland
C) glucagon from alpha cells of pancreas
D) adrenaline from adrenal medulla

Solution : (Correct Answer: C)

When the blood glucose level goes down, glucagon is secreted by the alpha cells of pancreas. Glucagon signals the liver to break down glycogen to glucose and release it into the blood stream. Thus bringing the level of glucose back to normal.

111. In cockroach, the common duct of salivary reservoir opens at the base of the

A) Pharynx **B)** Maxilla **C)** Mandible **D)** Hypopharynx

Solution : (Correct Answer: D)

Hypopharynx is a small, cylindrical mouthpart, present between first maxillae and covered by labrum and labium on dorsal and ventral sides respectively. It bears several sensory setae on its free end and the opening of common salivary duct upon its basal part.

112. The connective tissue which connects bones to muscles are called

A) Tendons **B)** Ligaments **C)** Cartilage **D)** Bones

Solution : (Correct Answer: A)

In the dense regular connective tissues, the collagen fibres are present in rows between many parallel bundles of fibres. Tendons, which attach skeletal muscles to bones and ligaments which attach one bone to another are examples of this tissue.

113. Which of the following phylum possess multicellular, organ grade level of organisation?

1. Platyhelminthes
2. Porifera
3. Nematode
4. Protozoa

A) 1, 2 and 3 are correct
B) 1 and 2 are correct
C) 2 and 4 are correct
D) 1 and 3 are correct

Solution : (Correct Answer: D)

Though all members of Animalia are multicellular, all of them do not exhibit the same pattern of organisation of cells. For example, in sponges, the cells are arranged as loose cell aggregates, i.e., they exhibit cellular level of organisation. In coelenterates, the arrangement of cells is more complex. Here the cells performing the same function are arranged into tissues, hence is called tissue level of organisation. Organ level is exhibited by members of Platyhelminthes and other higher phyla where tissues are grouped together to form organs, each specialised for a particular function.

114. An acoelomate animal with bilateral symmetry is:

A) Jelly Fish **B)** Liver Fluke
C) *Pleurobrachia* **D)** *Ancylostoma*

Solution : (Correct Answer: B)

Animals possessing coelom are called coelomates, e.g., annelids, molluscs, arthropods, echinoderms, hemichordates and chordates. In some animals, the body cavity is not lined by mesoderm, instead, the mesoderm is present as scattered pouches in between the ectoderm and endoderm. Such a body cavity is called pseudocoelom and the animals possessing them are called pseudocoelomates, e.g., aschelminthes. The animals in which the body cavity is absent are called acoelomates, e.g., Platyhelminthes.

They have dorso-ventrally flattened body, hence are called flatworms. Flatworms are bilaterally symmetrical, triploblastic and acoelomate animals

with organ level of organisation.
Examples: *Taenia* (Tapeworm), *Fasciola* (Liver fluke).

115. Ethanol is commercially produced through a particular species of

A) Saccharomyces **B)** Clostridium
C) Trichoderma **D)** Aspergillus.

Solution : (Correct Answer: A)

(a) : Ethanol is commercially produced through a particular species of yeast Saccharomyces (Saccharomyces cerevisiae).

116. The term 'active immunity' means

A) Resistance developed after disease
B) Resistance developed before disease
C) Resistance rate of heart beat
D) Increasing quantity of blood

Solution : (Correct Answer: A)

It's obvious.

117. Similarity developed in distantly related groups as an adaptation to the same function is called

A) Convergent evolution **B)** Connecting link
C) Missing link **D)** Divergent evolution

Solution : (Correct Answer: A)

It's Obvious

118. A girl of normal vision whose father was colourblind marries a man of normal vision whose father was also colourblind. Their sons would be (of total number of $sons$)

A) All colourblind **B)** 50% colourblind
C) All normal **D)** 25% colourblind

Solution : (Correct Answer: B)

(b) Infact the girl with normal vision is carrier because her father is colourblind (daughter of colourblind father are either colourblind or carrier) and when she marries a normal man the possibility of their sons being colourblind is 50% because the genotype of parents is X^CX and XY,

so only half of the possible combinations of XY have the X-linked recessive genes which exhibit the disease.

119. Diaphragms, cervical caps and vaults are

A) Are non-usable **B)** For female use only
C) For male use only **D)** None of these

Solution : (Correct Answer: B)

Mostly female barrier contraceptive like diaphragms, cervical caps, vaults are reusable

120. The layer of cells immediately surrounding the ovum but outside the zona pellucida is called

A) Corona radiata **B)** Membrana granulosa
C) Theca interna **D)** Germinal epithelium

Solution : (Correct Answer: A)

(a) Human egg or ovum is non cleidoic and alecithal.

The ovum possesses three coverings-Inner plasma membrane, middle glycoprotein zona pellucida and outer cellular corona radiata with radially elongated scattered cells held in mucopolysaccharide

121. Polar bodies are formed during

A) Spermatogenesis **B)** Oogenesis
C) Gametogenesis **D)** Spermateleosis

Solution : (Correct Answer: B)

(b) Polar bodies are smaller cells produced during oogenesis that do not develop into egg cells.

122. Which one of the following pairs is incorrectly matched?

A) Glucagon - Beta cells (source)
B) Somatostatin - Delta cells (source)
C) Corpus luteum - Relaxin (secretion)
D) Insulin - Diabetes mellitus (disease)

Solution : (Correct Answer: A)

In pancreatic islets, alpha or α-cells constitute about 15% of pancreatic islets cells and secrete glucagon. Glucagon intensifies glycogenolysis deamination and gluconeogenesis, and inhibits glycogenesis in liver cells. It also intensifies lipolysis in adipose tissue. Thus, it is a promoter of catabolic metabolism.

123. Which hormone stimulates the secretion of milk during sucking of milk by baby

A) Oxytocin **B)** Relaxin
C) Prolactin **D)** Progesteron

Solution : (Correct Answer: A)

It's Obvious

124. The dark bands (A-bands) of a skeletal muscle are known as

A) Isotropic bands **B)** Anisotropic bands
C) Intercalated disc **D)** Cross bridges

Solution : (Correct Answer: B)

It's obvious.

125. Phallangeal formula of hand of man is

A) $1, 2, 2, 2, 2$ **B)** $2, 1, 1, 1, 1$
C) $2, 3, 3, 3, 3$ **D)** $2, 3, 3, 2, 2$

Solution : (Correct Answer: C)

(c) 1 humerus, 1 radius, 1 ulna, 8 carpal bones 5 metacarpal bones, 5 digits (14 phalanges) phalangeal formula : $2, 3, 3, 3, 3$

126. Which of the following nitrogenous substance is highly toxic

A) Urea **B)** Uric acid
C) Amino acid **D)** Ammonia

Solution : (Correct Answer: D)

(d) The ammonia is highly toxic because it has high pH, So, it must either be metabolised or expelled immediately out of body, so its concentration remains low in the blood.

127. In distal convoluted tubule of the nephrons

A) Na reabsorption requires energy
B) Secretion of K ions does not require energy
C) Water reabsorption requires energy
D) Ammonia is secreted

Solution : (Correct Answer: A)

(a)Reabsorption of Na^+ in the tubules is an active process.

128. A patch of nodal tissue responsible for initiating the rhythmic contractile activity of heart is present in

A) Lower left corner of the left ventricle
B) Upper right corner of the right atrium
C) Lower left corner of the right ventricle
D) Upper left corner of the left atrium

Solution : (Correct Answer: B)

A patch of nodal tissue responsible initiating the rhythmic contractile activity of heart is SAN (Sino Atrial Node)
which is located at upper right corner of the right atrium

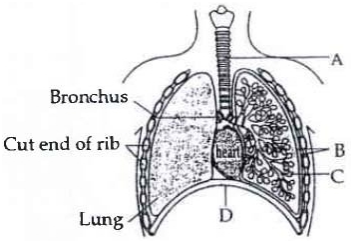
129. Match the following column.

Column - I	Column - II
(a) Lymphocytes	(I) Responsible for the immune responses of the body
(b) Monocytes	(II) Are the agranulocytes
(c) Neutrophiles	(III) Most abundant cells of the total WBCs.
(d) Basophiles	(IV) Inflammatory reactions

A) $a-II; b-III, c-IV, d-I$
B) $a-I, b-II, c-III, d-IV$
C) $a-IV, b-III, c-II, d-I$
D) $a-III, b-IV, c-I, -II$

Solution : (Correct Answer: B)

130. The figure shows a diagrammatic view of human respiratory system with labels A, B, C and D. Select the option which gives correct identification and main function and / or characteristic.



A) C - Alveoli - Thin walled vascular bag like structures for exchange of gases.
B) D - Lower end of lungs - Diaphragm pulls it down during inspiration.
C) A - Trachea - Long tube supported by complete cartilaginous rings for conducting inspired air.
D) B - Pleural membrane - Surround ribs on both sides to provide cushion against rubbing.

Solution : (Correct Answer: A)

(a) : In the given figure A is trachea. It is supported by incomplete cartilaginous rings which prevent its collapse during inspiration. B is pleural membrane. It encloses lungs. C are alveoli. They are thin walled sacs having extensive network of capillaries for gaseous exchange. D is diaphragm.

131. In which form CO_2 is mostly carried by blood

A) Bicarbonate ions
B) Carbonic acid
C) Carbamino compound
D) Carboxyhaemoglobin

Solution : (Correct Answer: A)

(a) CO_2 is transported by blood in three forms, 7% as dissolved in plasma, 23% as carbaminohaemoglobin and 70% as bicarbonates.

132. In cockroach, ootheca coveres...

A) Sperms, in male
B) Fertilised eggs, in female
C) Fertilised eggs, in male
D) Spermatheca, in female

Solution : (Correct Answer: B)

133. Which is incorrect about compound epithelium tissue ?

A) Multi layered and limited role in secretion.
B) Function is to provide protection against chemical and mechanical stresses.
C) They cover dry surface of the skin and moist surface of buccal cavity.
D) Produces hormone only

Solution : (Correct Answer: D)

134. Give the correct match in the following

column $-I$	column $-II$
(A) Flame Cells	(p) sponges
(B) Collar Cells	(q) Hydra
(C) stinging cell	(r) Planaria
	(s) Ascaris

A) $\mathrm{A} = r, \mathrm{B} = p, \ \mathrm{C} = q$
B) $\mathrm{A} = r, \mathrm{B} = p, \ \mathrm{C} = s$
C) $\mathrm{A} = r, \mathrm{B} = s, \ \mathrm{C} = p$
D) $\mathrm{A} = r, B = q, \ \mathrm{C} = s$

Solution : (Correct Answer: A)
It's obvious.

135. 'Portuguese man of war' is

A) Soldier of World War $-I$
B) Portuguese soldier
C) A sponge
D) A polymorphic, colonial coelenterate

Solution : (Correct Answer: D)
It's obvious.

Biology - (Botany)

136. While trying to find out the characteristic of a newly found animal, a researcher did the histology of adult animal and observed a cavity with presence of mesodermal tissue towards the body wall but no mesodermal tissue was observed towards the alimentary canal. What could be the possible coelome of that animal?

A) Acoelomate **B)** Pseudocoelomate
C) Schizocoelomate **D)** Spongocoelomate

Solution : (Correct Answer: B)
In pseudocoelomates, the body cavity is not entirely lined with mesoderm, instead, mesodermal tissue is present along the body wall but not towards the gut.
- Schizocoelomates are animals whose coelom or body cavity develops middle from a split in the mesoderm, the middle germ layer of the embryo.
- In acoelomates, coelom is absent.
Spongocoel is a central cavity found in Sponges.

137. Role of the water vascular system in Echinoderms is _____.
A. Respiration and Locomotion
B. Excretion and Locomotion
C. Capture and transport of food
D. Digestion and Respiration
E. Digestion and Excretion
Choose the correct answer from the options given below :

A) A and B Only **B)** A and C Only
C) B and C Only **D)** B, D and E Only

Solution : (Correct Answer: B)
Water vascular system in Echinoderms helps in locomotion, capture and transport of food and respiration. Excretory system is absent in echinoderms. Excretion takes place through general body surface.

138. Which of the following statements are true?

1. Gross Primary Productivity is always greater than Net Primary Productivity.

2. Gross Primary Productivity plus the respiration losses give us Net Primary Productivity.

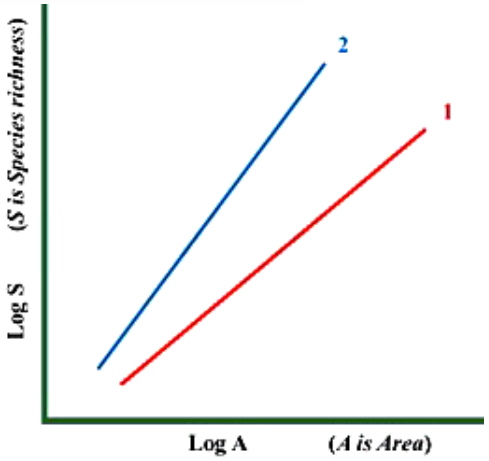
3. The rate of respiration of plants affects the Net Primary Productivity.

4. Net Primary Productivity + Gross Primary Productivity = Respiratory loss.

A) 1 –True ; 2 –False ; 3 –True ; 4 –False
B) 1 –True ; 2 –True ; 3 –False ; 4 –False
C) 1 –False ; 2 –False ; 3 –True ; 4 –False
D) 1 –True ; 2 –True ; 3 –True ; 4 –False

Solution : (Correct Answer: A)
The rate at which the organic matter is produced by photosynthesis is called gross primary productivity. Plants make use of a substantial amount of GPP in respiration. The available biomass for consumption by heterotrophs is called as net primary productivity. So, respiratory losses minus the GPP will give the NPP. $\mathrm{GPP} - \mathrm{R} = \mathrm{NPP}$. Therefore NPP can never be greater than GPP.

139. Observe the graph of area versus species richness and select the options that explain lines 1 and 2.



A) 1 - Molluscs in New York State and 2 - plants in Britain
B) 1 - plants in Britain and 2 - birds in California
C) 1 - frugivorous birds and mammals in the tropical forests of different continents and 2 - plants in Britain
D) 1 - Molluscs in New York state and 2 - frugivorous birds and mammals in the tropical

forests of different continents

Solution : (Correct Answer: D)

Alexander von Humboldt observed that within a region species richness increased with increasing explored area, but only up to a limit. In fact, the relation between species richness and area for a wide variety of taxa turns out to be a rectangular hyperbola. On a logarithmic scale, the relationship is a straight line described by the equation log S $=$ $log\ C\ +\ Z\ log\ A$ where $S =$ Species richness A $=$ $\mathrm{Area}\ \mathrm{Z}\ =$ slope of the line (regression coefficient) $C\ =\ Y-$ intercept Ecologists have discovered that the value of Z lies in the range of 0.1 to 0.2 , regardless of the taxonomic group or the region (whether it is the plants in Britain, birds in California or molluscs in New York state). But, if you analyse the species-area relationships among very large areas like the entire continents, you will find that the slope of the line to be much steeper. For example, for frugivorous (fruit-eating) birds and mammals in the tropical forests of different continents, the slope is found to be 1.15 . In this graph line 2 is steeper than line 1 . Thus Z value is higher.

140. When resources are limited, populations exhibit logistic growth. In logistic growth, population expansion decreases as resources become scarce, levelling off when the carrying capacity of the environment is reached, resulting in a _____ curve.

A) S-shaped. **B)** J-shaped.
C) Straight line. **D)** Circular.

Solution : (Correct Answer: A)

Logistic growth: No population of any species in nature has at its disposal unlimited resources to permit exponential growth. This leads to competition between individuals for limited resources. Eventually, the 'fittest' individual will survive and reproduce. In nature, a given habitat has enough resources to support a maximum possible number, beyond which no further growth is possible. This limit of nature is called carrying capacity (K) for that species in that habitat. A population growing in a habitat with limited resources show initially a lag phase, followed by phases of acceleration and deceleration and finally an asymptote when the population density reaches the carrying capacity. A plot of N in relation to time (t) results in a sigmoid curve.

141. Which of the following will inactivate the process of catalysis in the catalytic converters fitted in automobiles?

A) Running very fast
B) Use of leaded petrol
C) Using BS IV fuel
D) Use of low sulphur fuel

Solution : (Correct Answer: A)

In collaboration with Humbodlt state University, the towns people of Arcata created an integrated wastewater treatment process within a natural ecosystem. The biologist develops a series of six interconnected marshes over 60 hectares of marshland. The marshes now constitute a sanctuary which is looked after by FOAM (Friends of Arcata Marsh.)

142. The vector must also have one unique recognition site to enable foreign DNA to be inserted into the vector during the generation of an rDNA molecule. Most of the commonly used vectors contain unique recognition sites for several restriction enzymes in a small region of DNA which is referred to as a polylinker or multiple cloning site (MCS). An MCS provides:

A) Ability to separate DNA fragments
B) Flexibility in the choice of restriction enzyme
C) Flexibility in selectable marker
D) Ability of DNA to mutate itself

Solution : (Correct Answer: B)

Multiple cloning site (MCS), also called a polylinker, is a short segment of DNA which contains many (up to ~20) restriction sites. Multiple cloning site allows considerable flexibility in the choice of restriction enzymes for cloning.

143. To produce insulin via a non-human cell, which of the following would be required to be inserted in the vector's plasmid?

A) a segment of DNA from a human
B) a segment of DNA from another bacterium
C) a molecule of insulin
D) an enzyme

Solution : (Correct Answer: A)

To induce human insulin production in a bacterial cell, the human insulin gene (DNA) must be ligated to the bacterial (example *E. coli*) plasmid successfully. On successful ligation in the plasmid will enable the expression of the insulin gene and produce human insulin without any demerits.

144. Which of the following are common freshwater fishes?

A) *Mackerel* and Rohu
B) Rohu, common carp and *Catla*
C) Hilsa and Sardine
D) None of these

Solution : (Correct Answer: B)

Some of the freshwater fishes which are very common include *Catla,* Rohu, and common carp. Some of the marine
fishes that are eaten include – Hilsa, Sardines, *Mackerel,* and Pomfrets.

145. How many of these statements are correct?

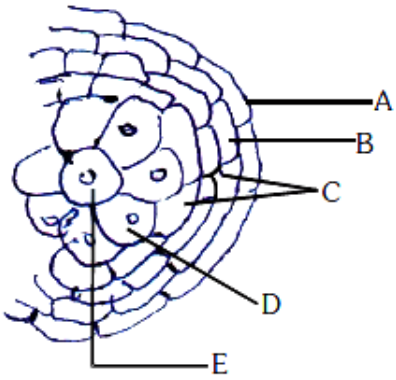
(i) In transcription, adenosine pairs with uracil.
(ii) Regulation of lac operon by a repressor is referred to as positive regulation.
(iii) The human genome has approximately 50,000 genes.
(iv) DNA fingerprinting utilizes VNTRs and RFLP.

A) Two **B)** Three **C)** Four **D)** One

Solution : (Correct Answer: A)

In the transcription process, mRNA is synthesized from DNA as a template. In it, for making RNA adenine of DNA pairs with Uracil as thymine is not part of RNA. DNA fingerprinting is the analysis of the minisatellites in the genome which are unique for the various organisms. It utilizes VNTRs and RFLP for this analysis. Regulation of lac operon is a negative feedback regulation depended on the presence or absence of lactose.

146. Observe the diagram of T.S. of young anther given here and find the incorrect match.



A) B - Helps in dehiscence of anther
B) C - Absent in mature dehiscent anther
C) D - Provides protection
D) E - Undergoes meiosis to form microspores

Solution : (Correct Answer: C)

A= Epidermis, B = Endithecium, C = Middle layers,(These, outer three wall layers perform the function of protection and help in dehiscence of anther to release the pollen)D= tapetum (The innermost wall layer is the tapetum. It nourishes the developing pollen grains), E=microspore mother cell.

147. Who demonstrated that photosynthesis is essentially a light-dependent reaction?

A) Cornelius van Niel **B)** Julius van Sach
C) Ingenhousz **D)** T.W. Engelmann

Solution : (Correct Answer: A)

Cornelius van Niel, who based on his studies of purple and green bacteria, demonstrated that photosynthesis is essentially a light-dependent reaction in which hydrogen from a suitable oxidizable compound reduces carbon dioxide to carbohydrate.

148. Which one of the following is not a nitrogen fixing organism?

A) Anabaena **B)** Nostoc
C) Azotobacter **D)** Pseudomonas.

Solution : (Correct Answer: D)

Certain prokaryotic organisms are capable fixing nitrogen available in the air and reduce it to ammonia. They have presence of an enzyme called nitrogenase which helps in reduction of nitrogen to ammonia. This process is called biological nitrogen fixation and the organisms are called nitrogen fixers. These nitrogen fixers could be free living or symbiotic. The examples of these free living microbes are Azotobacter, Rhodospirillum, Anabaena, Nostoc, etc. Pseudomonas are not nitrogen fixing bacterias.

149. When $12H^+$ pass through $F_0 - F_1$ particle, how many ATPs are produced?

A) 6 ATP **B)** 4 ATP **C)** 8 ATP **D)** 10 ATP

Solution : (Correct Answer: A)

ATP synthase is an enzyme that helps in generating ATP which is used for all cell activities. It is a globular protein having two subunits -a headpiece - F_1 and integral base- F_0 . The head part is the peripheral protein and the site for ATP synthesis. The integral base protein forms the channel for movement of proton across the inner membrane. The proton movement is coupled to the catalytic site of ATP synthesis. For every ATP produced, $2H^+$ passes through the F_0 and into the matrix down the electrochemical gradient. For $12H^+$, 6ATP will be synthesized.

150. Root pressure is maximum when

A) Transpiration is high and absorption is very low
B) Transpiration is very low and absorption is high
C) Transpiration and absorption both are high
D) Transpiration and absorption both are low.

Solution : (Correct Answer: B)

Root pressure is the pressure that develops in tracheary elements of xylem due to the accumulation of water. It occurs due to active absorption of water and is maximum when the rate of absorption is high and the rate of transpiration is low.

151. Auxin increases the _____ of cell walls.

A) Plasticity **B)** Thickness
C) Porosity **D)** Rigidity

Solution : (Correct Answer: A)

Auxin is known to elongate the cell. It causes certain changes across the membrane such that cellulase enzyme cause loosening of the fibers of the cell wall. Loosening of fiber increase the plasticity of the cell wall.

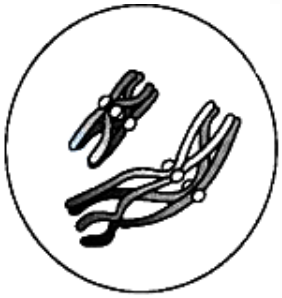
152. The main organelle involved in modification and routing of newly synthesized proteins to their destinations is

A) Chloroplast **B)** Glyoxysomes
C) Endoplasmic reticulum **D)** Golgi apparatus

Solution : (Correct Answer: D)

The Golgi apparatus principally performs the function of packaging materials, to be delivered either to the intracellular targets or secreted outside the cell. A number of proteins synthesized by ribosomes on the endoplasmic reticulum are modified in the cisternae of the Golgi apparatus before they are released from its trans face. Golgi apparatus is the important site of the formation of glycoproteins and glycolipids.

153. Correctly identify the stage of cell division shown in the given diagram.



A) Prophase-I **B)** Prophase-II
C) Anaphase of Mitosis. **D)** Metaphase -II

Solution : (Correct Answer: A)

Prophase - I

- It is subdivided into 5 phases :

A. Leptotene (Lepto = thin or delicate)

- Chromosomes gradually become visible.

- Condensation or compaction of the chromosomes continues.

B. Zygotene (Zygo = related to pairing or joining)

- Synapsis or pairing of chromosomes occur to bring the homologous chromosomes together.

- Synapsis is followed by the formation of synaptonemal complex (or bivalent or tetrad).

C. Pachytene (Pachy = thick)

- Bivalent chromosomes clearly appear as tetrad as condensation is in progress.

- In this stage crossing over occurs.

D. Diplotene (Diplo = double)

- Starting of diplotene is characterized by the dissolution of the synaptonemal complex and the separation of the homologous chromosomes from each other except at the X shaped sites of cross over. These X shapes sites are termed as Chiasmata.

E. Diakinesis (= Movement or separation of both)

- It is characterized by the terminalization of chiasmata.

154. A tissue is characterized by the presence of thin walls and isodiametric cells that are either closely packed or have intercellular spaces. This tissue is found in

A) Shoot apex **B)** Wood fibres
C) Pith of monocot root **D)** Bast fibres

Solution : (Correct Answer: C)

Parenchyma forms the major component within organs. The cells of the parenchyma are generally isodiametric. They may be spherical, oval, round, polygonal or elongated in shape. Their walls are thin and made up of cellulose. They may either be closely packed or have small intercellular spaces. The parenchyma performs various functions including photosynthesis, storage, secretion.

155. Lateral roots in higher plants arise from

A) Endodermis **B)** Epidermis **C)** Cortex **D)** Pericycle

Solution : (Correct Answer: D)

The lateral roots arise from the cells of pericycle and hence, the root branches are said to be endogenous in origin (arising from a layer inner to endodermis). The lateral roots help in absorption of water and mineral salts from the soil. The meristematic cells of the lateral root push through the endodermis and cortex and then pierce through the epidermis to come out to form the lateral root.

156. The property not shown by the "amphibians of the plant kingdom" is

A) The plant body is thallus like, attached to substratum by help of rhizoids

B) The antherozoids are released in water for fertilization

C) Zygote formed undergoes meiotic division immediately

D) They have leaf like, stem like and root like structures

Solution : (Correct Answer: C)

Bryophytes (amphibians of the plant kingdom) are plants that can live on soil but are dependent on water for fertilization. The plant body of bryophytes is thallus like and attached to the substratum by unicellular or multicellular rhizoids. The male gametes produce antherozoids which are released in the water to come in contact with archegonium and form a zygote which does not undergo reduction immediately. It undergoes mitosis to form sporophyte which is attached to the gametophyte

157. The slime moulds are characterized by the presence of

A) elaters B) pseudoelaters

C) myxamoebae D) capitulum

Solution : (Correct Answer: C)

The slime mould plasmodium of a slime mold is formed by the fusion of myxamoebae or swarm cells that acts as a gametes. Myxamoebae possess pseudopodia and have amoeba-like appearance and behaviour. Elaters and pseudoelaters are present in some bryophytes where as capitulum is a type of inflorescence.

158. A homonym is

A) Two or more names for the same taxon

B) Species name repeats the generic name

C) Identical name of two different species

D) Name given to a taxon in local language

Solution : (Correct Answer: C)

The identical name of two different taxa is called homonym. There is a rule in the International code of zoological nomenclature is that first name to be published in the senior homonym that should be used and the other names are junior homonyms that must be replaced with new names.

159. Which of the following is not according to the Binomial nomenclature?

A) The first word represents the genus and the second represents species.

B) The names are written in Latin and are italicized

C) Biological names can be written in any language

D) If the name is hand written, it has to be underlined separately.

Solution : (Correct Answer: C)

Biological names are written in Latin only if derived from other languages then they are Latinized. The names are written in italicized to indicate Latin origin. The scientific name consists of two parts the first name is the name of genus and the second is the name of species called as a specific epithet.

160. Initially ...A... biodiversity hot spots were identified but subsequently nine more have been added to the list, bringing the total number of biodiversity hot spot in the world to .....B... These hot spots are the regions of accelerated habitat loss. Three of these hot spots-Western ghats and Sri Lanka, Indo-Burma and Himalaya, covers our country's, exceptionally high biodiversity regions Although all the biodiversity hot spots put together covers less than ...C... $\%$ of the earth's land area, the number of species they collectively harbour is extremely high and the strict protection of these hot spots could reduce the ongoing mass extinctions by almost ..D... $\%, A, B, C$ and D in the paragraph refers to

A) $A-25, B-26, C-2, D-30$

B) $A-25, B-34, C-2, D-30$

C) $A-15, B-20, C-2, D-30$

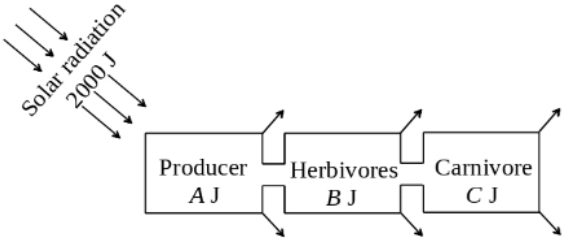
D) None of these

Solution : (Correct Answer: B)

Initially 25 biodiversity hot spots were identified but subsequently nine more have been added to the list, bringing the total number of biodiversity hot spots in the world to 34 , These hot spots are also the regions of accelerated habitat loss. Three of these hot spots are Western ghats, Sri Lanka, Indo-Burma and Himalaya-cover:

Our country is exceptionally high in biodiversity regions. Although, all the biodiversity hot spots put together covers less than $2\ \%$ of the earth's land area, the number of species they collectively harbor is extremely high and the strict protection of these hot spots could reduce the ongoing man extinctions by almost 30

161. Suppose $2000\ \mathrm{J}$ of solar energy is incident on green vegetation. On the basis of $10\ \%$ law of Lindeman. Identify A, B and C



A) $A-20\ \mathrm{J},\ \mathrm{B}-2\ \mathrm{J}, \mathrm{C}-0.2\ \mathrm{J}$

B) $A-200\ \mathrm{J},\ \mathrm{B}-20\ \mathrm{J}, \mathrm{C}-2\ \mathrm{J}$

C) $A-400\ \mathrm{J},\ \mathrm{B}-40\ \mathrm{J}, \mathrm{C}-4\ \mathrm{J}$

D) $A-40\ \mathrm{J},\ \mathrm{B}-4\ \mathrm{J}, \mathrm{C}-0.4\ \mathrm{J}$

Solution : (Correct Answer: A)

Only about $10\ \%$ is stored at higher trophic level and the remaining $90\ \%$ is lost in respiration, decomposition and waste in the form of heat. Suppose $2000\ \mathrm{J}$ of solar energy is incident on green vegetation. The latter having about $1\ \%$ efficiency, trap about $20\ \mathrm{J}$ of energy and convent it into chemical energy by photosynthesis. The remaining 1980 j would be lost to the environment. The herbivore that feed on producers get $10\ \%$ of the energy stored in plants, $i.e.,\ 2\ \mathrm{J}$. The remaining $18\ \mathrm{J}$ are lost to the environment. Carnivores feeding on herbivores would be able to store only $0.2\ \mathrm{J}$ of energy as flow

162. Two most important factors influencing the life of organisms are

A) Soil, temperature **B)** Light, water
C) Water, temperature **D)** Soil, Light

Solution : (Correct Answer: C)

Water and temperature

163. Choose the false pair

A) Lepidopterans - armyworm
B) Coleopterans - beetles
C) Insects - Crab
D) Dipterans – Mosquitoes

Solution : (Correct Answer: C)

164. Restriction in Restriction endonuclease enzyme refers to

A) Cleaving of phosphodiester bond in DNA by the enzyme
B) Cutting of DNA at specific position only
C) Prevention of bacteriophage multiplication in bacteria
D) Cutting each of the two strands of DNA at specific points in sugar phosphate backbone

Solution : (Correct Answer: C)

The term 'restriction' refers to the function of these enzymes in restricting the propagation of foreign DNA of bacteriophages in the host bacterium.

165. The element absent in RNA is

A) Nitrogen **B)** Sulpher **C)** Oxygen **D)** Hydrogen

Solution : (Correct Answer: B)

It's Obvious

166. Haploids can be obtained form

A) A pollen grains **B)** Root apex
C) Shoot apex **D)** Embryo

Solution : (Correct Answer: A)

(a)Haploids can be obtained by culturing pollen grains. Only pollen grains are haploids. Root apex, shoot apex and embryo are diploid.

167. The cells in the root and shoot apex

A) Are rich is protoplasm
B) Have conspicuous nuclei
C) Have their cell wall which are primary in nature, thin and cellulosic with abundant plasmodesmatal connections
D) All of the above

Solution : (Correct Answer: D)

The cells in the root and shoot apex shows the following characteristics

(i) rich in protoplasm

(ii) conspicuous nuclei

(iii) cell wall are primary in nature, thin and cellulosic with abundant plasmodesmata connection

168. Which one of the following is incorrect statement for mitochondrial ETC and oxidative phosphorylation?

A) Enzyme complex I accepts electrons and H^* from $NADH$ and $FADH_2$
B) Passage of protons through the channel is coupled to the catalytic site of the F_1 for ATP production
C) Cytochrome-c is a mobile protein attached to outer surface of inner membrane
D) $6H^*$ passes through F_0 from intermembrane space to the matrix down the electrochemical proton gradient to produce $3ATP$

Solution : (Correct Answer: A)

Complex $I \rightarrow (NADH$ Dehydrogenase) $\rightarrow$ it accepts only from $NADPH$. Complex II receives it from $FADH_2$.

169. $NADP$ reductase is located

A) On stroma side of membrane
B) On outer membrane of chloroplast
C) In stromal lamallae
D) In cytoplasm

Solution : (Correct Answer: A)

170. The appearance of recombination nodules on homologous chromosomes during meiosis characterizes:

A) Bivalent
B) Sites at which crossing over occurs
C) Terminalization
D) Synaptonemal complex

Solution : (Correct Answer: B)

171. Melonate inhibits the growth of pathogenic bacteria by inhibiting the activity of

A) Dinitrogenase
B) Succinic dehydrogenase
C) Amylase
D) Lipase

Solution : (Correct Answer: B)

Option (2) is correct answer of this question because malonate is a competitive inhibitor of enzyme succinate dehydrogenase.

Inhibition of succinic dehydrogenase by malonate occurs due to close resemblance of malonate with substrate succinate in structure. Competitive inhibitors are often used in the control of bacterial pathogens.

172. The genomic DNA of a bacterium is

A) Circular **B)** Linear
C) Segmented **D)** Rod shaped

Solution : (Correct Answer: A)

Circular $i.e.$, close ends

173. The vessel elements of angiosperms differ from other elements of xylem in having

A) Simple pits on their radial walls
B) Bordered pits on their lateral walls
C) Simple and bordered pits on their end walls
D) Simple perforation on their end walls

Solution : (Correct Answer: D)

(d) The wall area bearing perforation is called perforation plate.

Usually the perforations in vessels are present in the end walls but they may be present in the lateral wall too.

174. Underground food is stored in

A) Solanaceae and Leguminosae
B) Liliaceae and Cruciferae
C) Cruciferae and Solanaceae
D) Solanaceae and Malvaceae

Solution : (Correct Answer: C)

It's obvious.

175. Which one of the following is a non-vascular embryophyte

A) Thallophyta **B)** Bryophyta
C) Pteridophyta **D)** All the above

Solution : (Correct Answer: B)

(b) In bryophyta, xylem and phloem is not found, so they are called as non-vascular embryophyta.

176. Filaments of Spirogyra are

A) Uniseriate and unbranched
B) Uniseriate and branched
C) Multiseriate and unbranched
D) Multiseriate and branched

Solution : (Correct Answer: A)

It's obvious.

177. Which of the following is/are example(s) of deuteromycetes?

A) Alternaria **B)** Colletotrichum
C) Trichoderma **D)** All of these

Solution : (Correct Answer: D)

Deuteromycetes is also known as fungi imperfecti because the perfect (sexual) stage is either absent or not reported. Alternaria, Colletotrichum and Trichoderma belong to deuteromycetes.

178. What is the nuclear material of a bacterium

A) Nucleic acid and histone protein
B) Nucleic acid and cytoplasm
C) Only nucleic acid
D) All the above

Solution : (Correct Answer: C)

It's Obvious

179. Included in Solanum.

A) Melongena, Nigrum **B)** Mangifera, Panthera
C) Felidae, Canidae **D)** Nigrum, Felis

Solution : (Correct Answer: A)

180. In which book has "binomial nomenclature" been used for the first time

A) Histoire naturelle **B)** Systema naturae
C) Historia naturalis **D)** Historia plantarum

Solution : (Correct Answer: B)

(b) Carolus Linnaeus introduced binomial nomenclature in his tenth edition of 'system naturae'.