

Jupiter Academy

Subjects : Physics , Chemistry ,
Maths , English , Aptitude

VITEEE SAMPLE PAPER

Date : 13-10-2026

Set - C

Hours : 3 Hours

Total Marks : 500

(Solutions)

Physics - Section A (MCQ.)

1. Eight spherical rain drops of the same mass and radius are falling down with a terminal speed of 6 cm s^{-1} . If they coalesce to form one big drop, what will be the terminal speed of bigger drop? (Neglect the buoyancy of the air)

- 1) 1.5 cm s^{-1} 2) 6 cm s^{-1}
 3) 24 cm s^{-1} 4) 32 cm s^{-1}

Solution : (Correct Answer: 3)

Let radius of big drop = R .

$$\therefore \frac{4}{3}\pi R^3 = \frac{4}{3} \times \pi r^3 \cdot 8$$

$$R = 2r$$

Here r = radius of small drops.

Now, terminal velocity of drop in liquid

$$v_T = \frac{2}{9} \times \frac{r^2}{\eta} (\rho - \sigma)g$$

where η is coefficient of viscosity and ρ is density of drop σ is density of liquid. Terminal speed drop is 6 cm s^{-1}

$$\therefore 6 = \frac{2}{9} \times \frac{r^2}{\eta} (\rho - \sigma)g \dots (i)$$

Let terminal velocity becomes v' after coalesce, then

$$v' = \frac{2}{9} \frac{R^2}{\eta} (\rho - \sigma)g \dots (ii)$$

Dividing Eq. (i) by (ii), we get

$$\frac{6}{v'} = \frac{\frac{2}{9} \frac{r^2}{\eta} (\rho - \sigma)g}{\frac{2}{9} \frac{R^2}{\eta} (\rho - \sigma)g} \Rightarrow \frac{6}{v'} = \frac{r^2}{(2r)^2}$$

$$\text{or } v' = 24 \text{ cm s}^{-1}$$

2. The average depth of Indian ocean is about 3000 m. The fractional compression, $\frac{\Delta V}{V}$ of water at the bottom of the ocean (given, that the Bulk modulus of the water = $2.2 \times 10^9 \text{ Nm}^{-2}$ and $g = 10 \text{ ms}^{-2}$) is

- 1) 0.82% 2) 0.91% 3) 1.36% 4) 1.24%

Solution : (Correct Answer: 3)

We know that $B = \frac{\Delta p}{\Delta V/V}$

$$\Rightarrow \frac{\Delta V}{V} = \frac{\Delta p}{B} = \frac{\rho gh}{B}$$

$$= \frac{10^3 \times 10 \times 3000}{2.2 \times 10^9} = 1.36\%$$

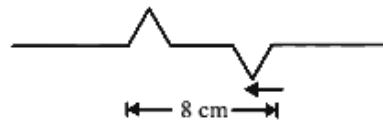
3. The maximum range, d_{max} of radar is

- 1) proportional to the cube root of the peak transmitted power
 2) proportional to the fourth root of the peak transmitted power
 3) proportional to the square root of the peak transmitted power
 4) not related to the peak transmitted power at all

Solution : (Correct Answer: 2)

Maximum range of radar $d_{\text{max}} \propto \sqrt{1}$ and power transmitted by antenna of length 1 is $p \propto (1/\lambda)^2$
 $\Rightarrow 1 \propto \sqrt{p}$ and $d \propto (p)^{1/4}$

4. In the adjoining figure, two pulses in a stretched string are shown. If initially their centres are 8 cm apart and they are moving towards each other, with speed of 2 cm/s, then total energy of the pulses after 2 s will be



- 1) Zero
 2) Purely kinetic
 3) Purely potential
 4) Partly kinetic and partly potential

Solution : (Correct Answer: 2)

Given, speed of each pulse = 2 cm/s Therefore distance travelled by both pulses in 2 s = 4 cm toward each other. On their superposition, the resultant displacement at every point will be zero. Hence, total energy will be purely kinetic.

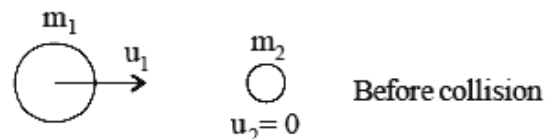
5. A square current carrying loop is changed to a circular loop in time t_1 . Then

- 1) emf is induced in loop for time $t < t_1$
 2) emf is induced in loop for time $t > t_1$
 3) no emf is induced in loop during whole process
 4) emf is induced due to change in magnetic field

Solution : (Correct Answer: 1)

For the time $t < t_1$, area of loop changes. Hence, magnetic flux linked with it changes during this time and emf is induced thereby.

6. For the given case which figure is correctly showing the after inelastic collision situation?



- 1) 2)
 3) 4)

Solution : (Correct Answer: 2)

When $m_1 > m_2$ & m_2 at rest then the bodies collide in elastically and move together as one body without

changing the direction.

7. The threshold frequency for a photo-sensitive metal is 3.3×10^{14} Hz. If light of frequency 8.2×10^{14} Hz is incident on this metal, the cut-off voltage for the photo-electric emission is nearly

- 1) 2 V 2) 3 V 3) 5 V 4) 1 V

Solution : (Correct Answer: 1)

$$\begin{aligned} \text{Here, } V_0 &= \frac{E - V}{e} = \frac{h(\nu - \nu_0)}{e} \\ &= \frac{6.62 \times 10^{-34} (8.2 \times 10^{14} - 3.3 \times 10^{14})}{1.6 \times 10^{-19}} \\ &= \frac{6.62 \times 10^{-34}}{1.6} \times 4.9 \times 10^{33} \\ &= \frac{6.62 \times 4.9 \times 10^{-1}}{1.6} \\ V_0 &= 2 \text{ volt} \end{aligned}$$

8. A potential difference of 300 V is applied to a combination of $2.0 \mu\text{F}$ and $8.0 \mu\text{F}$ capacitors connected in series. The charge on the $2.0 \mu\text{F}$ capacitor is

- 1) $2.4 \times 10^{-4} \text{C}$ 2) $4.8 \times 10^{-4} \text{C}$
3) $7.2 \times 10^{-4} \text{C}$ 4) $9.6 \times 10^{-4} \text{C}$

Solution : (Correct Answer: 2)

$V = 300 \text{ V}$, $C_1 = 2.0 \mu\text{F}$, $C_2 = 8.0 \mu\text{F}$,
Net capacitance, $\frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2}$

$$\begin{aligned} \Rightarrow C_s &= \frac{C_1 C_2}{C_1 + C_2} \\ \Rightarrow C_s &= \frac{2 \times 8}{2 + 8} = \frac{16}{10} = 1.6 \mu\text{F} \end{aligned}$$

Now total charge,

$$Q = V_s \times C_s = 300 \times 1.6 \times 10^{-6} = 4.8 \times 10^{-4} \text{C}$$

$\therefore$ In series charge is same on capacitors

$$\Rightarrow \text{Charge on } 2 \mu\text{F capacitor is } 4.8 \times 10^{-4} \text{C}$$

9. A meter bridge is used to determine the resistance of an unknown wire by measuring the balance point length l . If the wire is replaced by another wire of same material but with double the length and half the thickness, the balancing point is expected to be

- 1) $\frac{1}{8}l$ 2) $\frac{1}{4}l$
3) $8l$ 4) None of these

Solution : (Correct Answer: 4)

If the wire is replaced by another wire of same material but with double the length and half the thickness, the resistance of the wire as a whole will change. Let us calculate this change.

$$\text{Initial resistance, } R = \rho \frac{L}{A} = \rho \frac{L}{\pi r^2}$$

$$\text{Final resistance, } R' = \rho \frac{2L}{A'} = \rho \frac{2L}{\pi (\frac{r}{2})^2}$$

$$= \rho \frac{8L}{\pi r^2} = 8 \left(\rho \frac{L}{\pi r^2} \right) = 8R$$

Therefore, the resistance will increase by eight times.

In a meter-bridge, we have

$$\frac{R}{S} = \frac{l}{100-l}$$

where R = unknown resistor

S = known resistor

l = balancing length

$$\therefore l = \frac{100R}{S+R}$$

When the resistance of the new wire is $8R$ then the new balancing length will be

$$\begin{aligned} l &= \frac{100 \times 8R}{S + 8R} = \frac{100 \times 8R}{(S + R) + 7R} \\ &= \frac{100 \times 8R}{\left(\frac{100R}{l}\right) + 7R} \quad \therefore l' = \frac{800l}{100 + 7l} \end{aligned}$$

No option is correct.

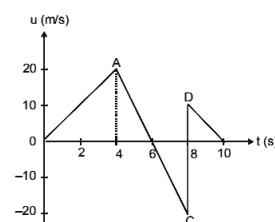
10. If $x = at + bt^2$, where x is the distance travelled by the body in kilometers while t is the time in seconds, then the unit of b is

- 1) km/s 2) kms 3) km/s² 4) kms²

Solution : (Correct Answer: 3)

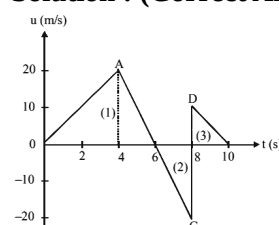
$$[x] = [bt^2]. \text{ Hence } [b] = [x/t^2] = \text{km/s}^2.$$

11. The velocity-time graph of a body moving in a straight line is shown in fig. Find the displacement and distance travelled by the body in 10 seconds.



- 1) 50 m, 90 m 2) 5 m, 9 m
3) 9 m, 5 m 4) 90 m, 50 m

Solution : (Correct Answer: 1)



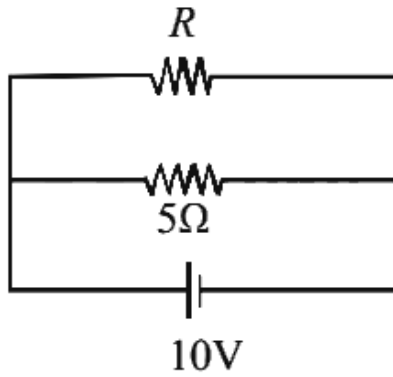
Total distance covered in 10 s = Area 1 + Area 2 + Area 3

$$\Rightarrow \frac{1}{2} \times 6 \times 20 + \frac{1}{2} \times 2 \times 20 + \frac{1}{2} \times 2 \times 10 = 90 \text{ m}$$

Total displacement in 10 s = Area 1 - Area 2 + Area 3

$$\Rightarrow \frac{1}{2} \times 6 \times 20 - \frac{1}{2} \times 2 \times 20 + \frac{1}{2} \times 2 \times 10 = 50 \text{ m}$$

12. The power dissipated in the circuit shown in the figure is 30 Watts. The value of R is



- 1) 20Ω 2) 15Ω
 3) 10Ω 4) 30Ω

Solution : (Correct Answer: 3)

The power dissipated in the circuit.

$$P = \frac{V^2}{R_{eq}} \dots (i)$$

$$V = 10\text{volt}$$

$$\frac{1}{R_{eq}} = \frac{1}{R} + \frac{1}{5} = \frac{5+R}{5R}$$

$$R_{eq} = \left(\frac{5R}{5+R} \right)$$

$$P = 30 \text{ W}$$

Substituting the values in equation (i)

$$30 = \frac{(10)^2}{\left(\frac{5R}{5+R} \right)}$$

$$\frac{15R}{5+R} = 10 \Rightarrow 15R = 50 + 10R$$

$$5R = 50 \Rightarrow R = 10\Omega$$

13. In young's double-slit experiment, the intensity of light at a point on the screen where the path difference is λ is I , λ being the wavelength of light used. The intensity at a point where the path difference is $\frac{\lambda}{4}$ will be

- 1) $\frac{I}{4}$ 2) $\frac{I}{2}$ 3) I 4) zero

Solution : (Correct Answer: 2)

For path difference λ , phase

$$\text{difference} = 2\pi \left(Q = \frac{2\pi}{\lambda} x = \frac{2\pi}{\lambda} \lambda = 2\pi \right)$$

$$\Rightarrow I = I_0 + I_0 + 2I_0 \cos 2\pi$$

$$\Rightarrow I = 4I_0 (\because \cos 2\pi = 1)$$

For $x = \frac{\lambda}{4}$, phase difference = $\frac{\pi}{2}$

$$\therefore I' = I_1 + I_2 + 2\sqrt{I_1}\sqrt{I_2} \cos \frac{\pi}{2}$$

$$\text{If } I_1 = I_2 = I_0 \text{ then } I' = 2I_0 = 2 \cdot \frac{I}{4} = \frac{I}{2}$$

14. A marble block of mass 2 kg lying on ice when given a velocity of 6 m/s is stopped by friction in 10 s. Then the coefficient of friction is (Take $g = 10 \text{ ms}^{-2}$)

- 1) 0.06 2) 0.03 3) 0.04 4) 0.01

Solution : (Correct Answer: 1)

$$a = \mu g = \frac{6}{10} \quad [\text{using } v = u + at]$$

$$\Rightarrow \mu = \frac{6}{10 \times g} = \frac{6}{10 \times 10} = 0.06$$

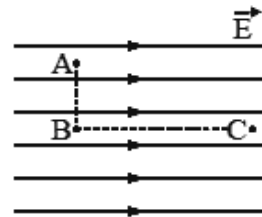
15. Escape velocity when a body of mass m is thrown vertically from the surface of the earth is v , what will be the escape velocity of another body of mass 4 m is thrown vertically

- 1) v 2) $2v$
 3) $4v$ 4) None of these

Solution : (Correct Answer: 1)

Escape velocity does not depend upon the mass of the body.

16. Figure shows three points A, B and C in a region of uniform electric field $\vec{E}$. The line AB is perpendicular and BC is parallel to the field lines. Then which of the following holds good?



Where V_A , V_B and V_C represent the electric potentials at the points A, B and C respectively.

- 1) $V_A = V_B = V_C$ 2) $V_A = V_B > V_C$
 3) $V_A = V_B < V_C$ 4) $V_A > V_B = V_C$

Solution : (Correct Answer: 2)

Here the electric field at A and B is same but at C it will decrease,

so $V_A = V_B$

and V_C is less than V_A or V_B

$$V_A = V_B > V_C$$

17. When a solid with a band gap has a donor level just below its empty energy band, the solid is

- 1) an insulator
 2) a conductor
 3) a p-type semiconductor
 4) an n-type semiconductor

Solution : (Correct Answer: 4)

The solid is an n-type semiconductor. In an n-type semiconductor, the impurity is pentavalent which is also called the Donor impurity because one impurity atom generate one electron. The Donor energy level lies just below the conduction band as shown in the

figure.

Conduction band
Donor levels
Valence band

18. The pressure on a square plate is measured by measuring the force on the plate. If the maximum error in the measurement of force and length are respectively 4% and 2%, then the maximum error in the measurement of pressure is

1) 1% 2) 2% 3) 4% 4) 8%

Solution : (Correct Answer: 4)

$$\text{Pressure} = \frac{\text{force}}{\text{area}} = \frac{F}{L^2}$$

$$\therefore \frac{\Delta p}{p} = \frac{\Delta F}{F} + \frac{2\Delta L}{L} = 4\% + 2(2\%)$$

or percentage error, = 8%

19. A particle covers half of the circle of radius r . Then the displacement and distance of the particle are respectively

1) $2\pi r, 0$ 2) $2r, \pi r$ 3) $\frac{\pi r}{2}, 2r$ 4) $\pi r, r$

Solution : (Correct Answer: 2)

When a particle cover half of circle of radius r , then displacement is $AB = 2r$

Distance = half of circumference of circle = πr

20. Which of the following relation is true?

1) $3Y = K(1 - \sigma)$

2) $K = \frac{9\eta Y}{Y + \eta}$

3) $\sigma = (6K + \eta)Y$

4) $\sigma = \frac{0.5Y - \eta}{\eta}$

Solution : (Correct Answer: 4)

$$Y = 2\eta(1 + \sigma) \Rightarrow \sigma = \frac{0.5Y - \eta}{\eta}$$

21. A clock pendulum made of invar has a period of 0.5 s, at 20°C . If the clock is used in a climate where the temperature averages to 30°C , how much time does the clock lose in each oscillation? (For invar, $\alpha = 9 \times 10^{-7}/^\circ\text{C}$, $g = \text{constan } t$)

1) $2.25 \times 10^{-6} \text{ s}$

2) $2.5 \times 10^{-7} \text{ s}$

3) $5 \times 10^{-7} \text{ s}$

4) $1.125 \times 10^{-6} \text{ s}$

Solution : (Correct Answer: 1)

Time period of oscillation,

$$T = 2\pi\sqrt{\frac{l}{g}} \Rightarrow \frac{dT}{T} = \frac{1}{2} \frac{dl}{l}$$

$$\text{As, } \frac{dl}{l} = \alpha dt$$

$$\Rightarrow \frac{dT}{T} = \frac{1}{2} \alpha dt = \frac{1}{2} \times 9 \times 10^{-7} \times (30 - 20) = 4.5 \times 10^{-6}$$

$$\therefore \text{Loss in time} = 4.5 \times 10^{-6} \times 0.5 = 2.25 \times 10^{-6} \text{ s}$$

22. A fish looking up through the water sees the outside world contained in a circular horizon. If the refractive index of water is $4/3$ and the fish is 12 cm below the surface, the radius of this circle (in cm) is

1) $36\sqrt{5}$ 2) $4\sqrt{5}$ 3) $36\sqrt{7}$ 4) $36/\sqrt{7}$

Solution : (Correct Answer: 4)

No Solution

23. A running man has half the kinetic energy of that of a boy of half of his mass. The man speeds up by 1 m/s so as to have same K.E. as that of the boy. The original speed of the man will be

1) $\sqrt{2} \text{ m/s}$ 2) $(\sqrt{2} - 1) \text{ m/s}$

3) $\frac{1}{(\sqrt{2}-1)} \text{ m/s}$ 4) $\frac{1}{\sqrt{2}} \text{ m/s}$

Solution : (Correct Answer: 3)

Let m = mass of boy, M = mass of man v = velocity of boy, V = velocity of man

$$\frac{1}{2} MV^2 = \frac{1}{2} \left[\frac{1}{2} mv^2 \right] \dots (i)$$

$$\frac{1}{2} M(V + 1)^2 = 1 \left[\frac{1}{2} mv^2 \right] \dots (ii)$$

Putting $m = \frac{M}{2}$ and solving $V = \frac{1}{\sqrt{2}-1}$

24. The molar specific heats of an ideal gas at constant pressure and volume are denoted by C_p and C_v , respectively. If $\gamma = \frac{C_p}{C_v}$ and R is the universal gas constant, then C_v is equal to

1) $\frac{R}{(\gamma-1)}$

2) $\frac{(\gamma-1)}{R}$

3) γR

4) $\frac{1+\gamma}{1-\gamma}$

Solution : (Correct Answer: 1)

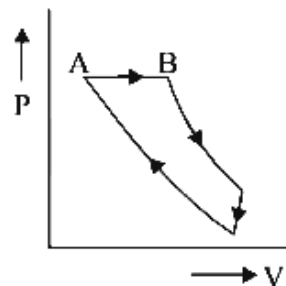
$$C_p - C_v = R \Rightarrow C_p = C_v + R$$

$$\therefore \gamma = \frac{C_p}{C_v} = \frac{C_v + R}{C_v} = \frac{C_v}{C_v} + \frac{R}{C_v}$$

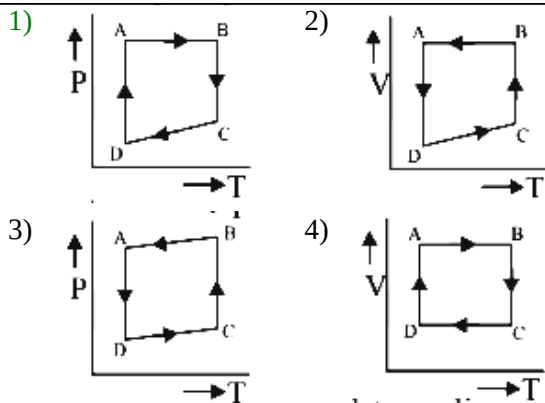
$$\Rightarrow \gamma = 1 + \frac{R}{C_v} \Rightarrow \frac{R}{C_v} = \gamma - 1$$

$$\Rightarrow C_v = \frac{R}{\gamma-1}$$

25. An ideal gas is subjected to a cyclic process ABCD as depicted in the $p - V$ diagram given below:

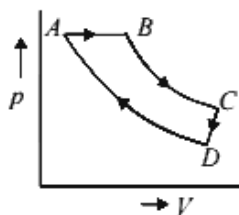


Which of the following curves represents the equivalent cyclic process?

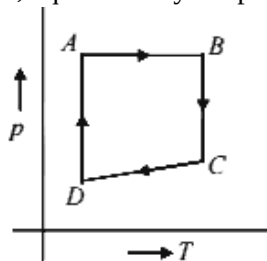


Solution : (Correct Answer: 1)

Process $A \rightarrow B \rightarrow C \rightarrow D \rightarrow A$ is clockwise. During $A \rightarrow B$, pressure is constant and $B \rightarrow C$, process follows $p \propto \frac{1}{V}$ i.e., T is constant. During process $C \rightarrow D$, both p and V changes and process $D \rightarrow A$ follows $p \propto \frac{1}{V}$ i.e., T is constant.



Hence, equivalent cyclic process is as follows.



26. The dipole moment of the short bar magnet is $12.5 \text{ A} \cdot \text{m}^2$. The magnetic field on its axis at a distance of 0.5 m from the centre of the magnet is

- 1) $1.0 \times 10^{-4} \text{ N/A} \cdot \text{m}$ 2) $4 \times 10^{-2} \text{ N/A} \cdot \text{m}$
 3) $2 \times 10^{-6} \text{ N/A} \cdot \text{m}$ 4) $6.64 \times 10^{-8} \text{ N/A} \cdot \text{m}$

Solution : (Correct Answer: 3)

The magnetic field, $B = \frac{\mu_0}{4\pi} \cdot \frac{2M}{d^3}$

$$= 10^{-7} \times \frac{2 \times 12.5}{(0.5)^3} = 2 \times 10^{-6} \text{ N/A} \cdot \text{m}$$

27. A radioactive sample contains 10^{-3} kg each of two nuclear species A and B with half-life 4 days and 8 days respectively. The ratio of the amounts of A and B after a period of 16 days is

- 1) 1 : 2 2) 4 : 1 3) 1 : 4 4) 2 : 1

Solution : (Correct Answer: 3)

Ratio of number of half life taken is given as:

After 16 days

$$n_{A1/2} = \frac{16}{4} = 4; n_{B1/2} = \frac{16}{8} = 2$$

$$N = N_0 \left(\frac{1}{2} \right)^n \Rightarrow \frac{N_A}{N_B}$$

$$= \frac{1}{2^4} : \frac{1}{2^2} = 2^2 : 2^4 \\ = 4 : 16, = 1 : 4$$

28. An inductive circuit contains a resistance of 10Ω and an inductance of 2.0H . If an AC voltage of 120 V and frequency of 60 Hz is applied to this circuit, the current in the circuit would be nearly

- 1) 0.32 A 2) 0.16 A
 3) 0.43 A 4) 0.80 A

Solution : (Correct Answer: 2)

Here, impedance $z = \sqrt{R^2 + X_L^2}$

$$\therefore \sqrt{(10)^2 + (2\pi \times 60 \times 2)^2} = 753.7$$

$$\therefore \text{Current } i = \frac{V}{Z} = \frac{120}{753.7} = 0.159 \text{ A}$$

29. The dimensional formula of magnetic flux is

- 1) $[M^1 L^2 T^{-1} A^{-2}]$
 2) $[M^1 L^2 T^{-2} A^{-1}]$
 3) $[M^1 L^2 T^{-1} A^{-1}]$
 4) $[M^1 L^0 T^{-2} A^{-1}]$

Solution : (Correct Answer: 2)

Magnetic flux, $\phi = \mathbf{B} \cdot \mathbf{A} = \frac{F}{l\lambda} \mathbf{A}$

$$= \frac{[M^1 L^1 T^{-2} A^{-1}] L^2}{[A L]} = [M^1 L^2 T^{-2} A^{-1}]$$

30. The displacement of a particle executing SHM is given by

$$y = 5 \sin \left(4t + \frac{\pi}{3} \right)$$

If T is the time period and the mass of the particle is 2 g , the kinetic energy of the particle when $t = T/4$ is given by

- 1) 0.4 J 2) 0.5 J 3) 3 J 4) 0.3 J

Solution : (Correct Answer: 4)

Particle executing SHM.

$$\text{Displacement } y = 5 \sin \left(4t + \frac{\pi}{3} \right) \dots (i)$$

Velocity of particle

$$\left(\frac{dy}{dt} \right) = \frac{5d}{dt} \sin \left(4t + \frac{\pi}{3} \right)$$

$$= 5 \cos \left(4t + \frac{\pi}{3} \right) \cdot 4 = 20 \cos \left(4t + \frac{\pi}{3} \right)$$

Velocity at $t = \left(\frac{T}{4} \right)$

$$\left(\frac{dy}{dt} \right)_{t=\frac{T}{4}} = 20 \cos \left(4 \times \frac{T}{4} + \frac{\pi}{3} \right)$$

or $u = 20 \cos \left(T + \frac{\pi}{3} \right) \dots (ii)$

Comparing the given equation with standard equation of SHM.

$$y = a \sin(\omega t + \phi)$$

We get, $\omega = 4$

$$\text{As } \omega = \frac{2\pi}{T} \Rightarrow T = \frac{2\pi}{\omega}$$

$$\text{or } T = \frac{2\pi}{4} = \left(\frac{\pi}{2}\right)$$

Now, putting value of T in Eq. (ii), we get

$$u = 20 \cos\left(\frac{\pi}{2} + \frac{\pi}{3}\right) = -20 \sin \frac{\pi}{3} \\ = -10 \times \sqrt{3}$$

The kinetic energy of particle,

$$\text{KE} = \frac{1}{2} m u^2 = \frac{1}{2} \times 2 \times 10^{-3} \times (-10\sqrt{3})^2 \\ = 10^{-3} \times 100 \times 3 = 0.3 \text{ J}$$

31. An electromagnetic wave going through vacuum is described by

$$E = E_0 \sin(kx - \omega t)$$

Which of the following is/are independent of the wavelength?

- 1) k 2) ω^2 3) k/ω 4) $k\omega^2$

Solution : (Correct Answer: 3)

$\frac{k}{\omega}$ is independent of λ

32. A body is projected vertically upwards at time $t = 0$ and it is seen at a height H at time t_1 and t_2 second during its flight. The maximum height attained is (g is acceleration due to gravity)

- 1) $\frac{g(t_2 - t_1)^2}{8}$
 2) $\frac{g(t_1 + t_2)^2}{4}$
 3) $\frac{g(t_1 + t_2)^2}{8}$
 4) $\frac{g(t_2 - t_1)^2}{4}$

Solution : (Correct Answer: 2)

Let t' be the time taken by the body to fall from point C to B .

$$\text{Then } t_1 + 2t' = t_2 \Rightarrow t' = \left(\frac{t_2 - t_1}{2}\right) \dots (i)$$



Total time taken to reach point C

$$T = t_1 + t' = t_1 + \frac{t_2 - t_1}{2} \\ = \frac{2t_1 + t_2 - t_1}{2} = \left(\frac{t_1 + t_2}{2}\right)$$

Maximum height attained

$$H_{\max} = \frac{1}{2} g (T)^2 = \frac{1}{2} g \left(\frac{t_1 + t_2}{2}\right)^2 \\ = \frac{1}{2} g \cdot \frac{(t_1 + t_2)^2}{4}$$

$$\text{Or, } H_{\max} = \frac{1}{8} g \cdot (t_1 + t_2)^2 m$$

33. In a double slit experiment, 5th dark fringe is formed opposite to one of the slits, the wavelength of light is

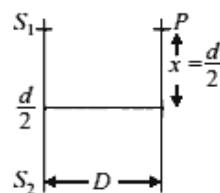
- 1) $\frac{d^2}{6D}$ 2) $\frac{d^2}{5D}$
 3) $\frac{d^2}{15D}$ 4) $\frac{d^2}{9D}$

Solution : (Correct Answer: 4)

For dark fringe,

$$\frac{xd}{D} = (2m - 1) \frac{\lambda}{2}$$

$$\text{Here, } m = 5, x = \frac{d}{2}$$



$$\therefore \frac{d}{2} \cdot \frac{d}{D} = (2 \times 5 - 1) \frac{\lambda}{2}$$

$$\text{or } \frac{d^2}{D} = 9\lambda$$

$$\therefore \text{Wavelength, } \lambda = \frac{d^2}{9D}$$

34. The resultant of $\mathbf{A}$ and $\mathbf{B}$ is $\mathbf{R}_1$. On reversing the vector $\mathbf{B}$, the resultant becomes $\mathbf{R}_2$. What is the value of $R_1^2 + R_2^2$?

- 1) $A^2 + B^2$ 2) $A^2 - B^2$
 3) $2(A^2 + B^2)$ 4) $2(A^2 - B^2)$

Solution : (Correct Answer: 3)

$$R_1^2 = A^2 + B^2 + 2AB \cos \theta$$

$$R_2^2 = A^2 + B^2 - 2AB \cos \theta$$

$$\therefore R_1^2 + R_2^2 = 2(A^2 + B^2)$$

35. In producing chlorine through electrolysis 100 W power at 125 V is being consumed. How much chlorine per minute is liberated? (ECE of chlorine is $0.367 \times 10^{-6} \text{ kg/C}$)

- 1) 24.3mg 2) 16.6mg
 3) 17.6mg 4) 21.3mg

Solution : (Correct Answer: 3)

No Solution

Chemistry - Section A (MCQ)

36. Reaction of PCl_3 and PhMgBr would give

- 1) bromobenzene 2) chlorobenzene
 3) triphenylphosphine 4) dichlorobenzene

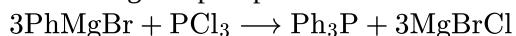
Solution : (Correct Answer: 3)

In a reaction the alkyl part of grignard reagent acts as a nucleophile as carbon is more electronegative than magnesium. Hence the alkyl part will get attached to

the electron deficient species.

In PCl_3 , chlorine is more electronegative than phosphorous.

Hence the Ph^- will attack the phosphorous in PCl_3 to form organic phosphine with formula Ph_3P



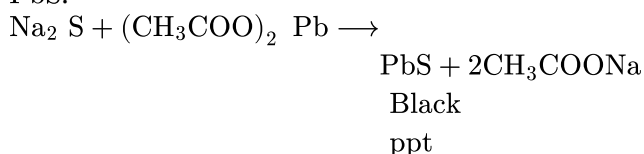
Triphenylphosphine

37. The sodium extract of an organic compound on acidification with acetic acid and addition of lead acetate solution gives a black precipitate. The organic compound contains

- 1) nitrogen 2) halogen
3) sulphur 4) phosphorus

Solution : (Correct Answer: 3)

The organic compounds containing sulphur when react with sodium metal give Na_2S . The Na_2S when react with lead acetate forms black ppt. of PbS .



38. The oxidation number of oxygen in KO_3 , Na_2O_2 is

- 1) 3,2 2) 1,0 3) 0,1 4) $-0.33, -1$

Solution : (Correct Answer: 4)

To find the oxidation number of a given compound we have to equate the charge on the overall compound with the charge on individual atom of which the compound is made of.

In KO_3 , K is an alkali metal, hence its oxidation number is +1.

$$(+1) + 3 \times (x) = 0 \text{ or } x = \frac{-1}{3} \cong -0.33$$

hence oxidation number of oxygen i.e. $x = -0.33$

In Na_2O_2 , again Na is an alkali metal.

$$\text{Hence } 2 \times (+1) + 2 \times x = 0$$

$$x = \frac{-2}{2} = -1$$

39. Fructose reduces Tollen's reagent due to

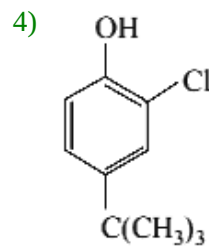
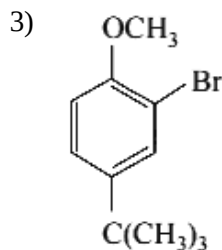
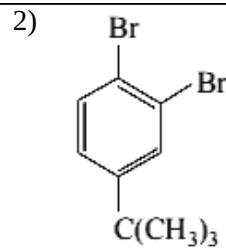
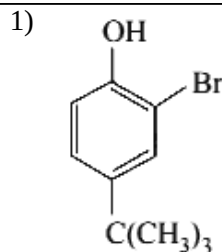
- 1) asymmetric carbons
2) primary alcoholic group
3) secondary alcoholic group
4) enolisation of fructose followed by conversion to aldehyde by base

Solution : (Correct Answer: 4)

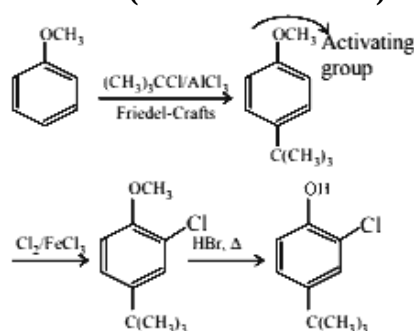
In aqueous medium, fructose is enolised and converted into aldehyde in basic medium. Generally all aldehydes reduce Tollen's reagent, thus fructose can also reduce Tollen's reagent.

40. Treating anisole with the following reagents, the major product obtained is

- I. $(\text{CH}_3)_3\text{CCl}$, AlCl_3
II. Cl_2 , FeCl_3
III. HBr , Heat



Solution : (Correct Answer: 4)



41. Which metal aprons are worn by radiographer to protect him from radiation?

- 1) Mercury coated apron 2) Lead apron
3) Copper apron 4) Aluminium apron

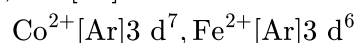
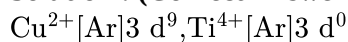
Solution : (Correct Answer: 2)

Radiographer to protect themselves from radiation worn lead apron.

42. Which group contains coloured ions out of

- (1) Cu^{2+}
(2) Ti^{4+}
(3) Co^{2+}
(4) Fe^{2+}
1) 1, 2, 3, 4 2) 1, 3, 4 3) 2, 3 4) 1, 2

Solution : (Correct Answer: 2)



1, 3, 4 are coloured ions hence the answer is b.

43. The sequence of basic strength of alkyl amines follows the order

- 1) $\text{RNH}_2 < \text{R}_2\text{NH} < \text{R}_3\text{N}$
2) $\text{R}_2\text{NH}_2 < \text{R}_2\text{NH} < \text{R}_3\text{N}$
3) $\text{R}_2\text{NH} < \text{RNH}_2 < \text{R}_3\text{N}$
4) $\text{RNH}_2 < \text{R}_2\text{NH} < \text{R}_3\text{N}$

Solution : (Correct Answer: 1)

It is expected that the basic nature of amines should be in order tertiary > secondary > primary but the observed order in the case of lower members is

found to be as secondary > Primary > tertiary. This anomalous behaviour of tertiary amines is due to steric factors i.e crowding of alkyl groups cover nitrogen atom from all sides thus makes the approach and bonding by a proton relatively difficult which results the maximum steric strain in tertiary amines. The electrons are there but the path is blocked, resulting the reduction in basicity. Thus the correct order is

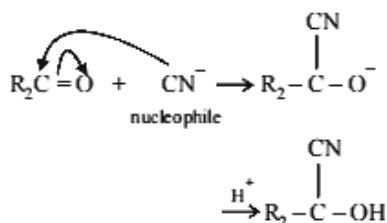


44. Formation of cyanohydrin from a ketone is an example of

- 1) electrophilic addition
- 2) nucleophilic addition
- 3) nucleophilic substitution
- 4) electrophilic substitution

Solution : (Correct Answer: 2)

As CN is a nucleophile. So it is an example of nucleophilic addition



45. A certain metal when irradiated by light ($r = 3.2 \times 10^{16}$ Hz) emits photoelectrons with twice kinetic energy as did photoelectrons when the same metal is irradiated by light ($r = 2.0 \times 10^{16}$ Hz). The v_0 of metal is

- 1) 1.2×10^{14} Hz
- 2) 8×10^{15} Hz
- 3) 1.2×10^{16} Hz
- 4) 4×10^{12} Hz

Solution : (Correct Answer: 2)

$$(KE)_1 = h\nu_1 - h\nu_0$$

$$(KE)_2 = h\nu_2 - h\nu_0$$

$$\text{As, } (KE)_1^2 = 2 \times (KE)_2$$

$$\therefore h\nu_1 - h\nu_0 = 2(h\nu_2 - h\nu_0)$$

$$\text{or, } h\nu_0 = 2h\nu_2 - h\nu_1$$

$$\text{or, } \nu_0 = 2\nu_2 - \nu_1$$

$$= 2 \times (2 \times 10^{16}) - (3.2 \times 10^{16})$$

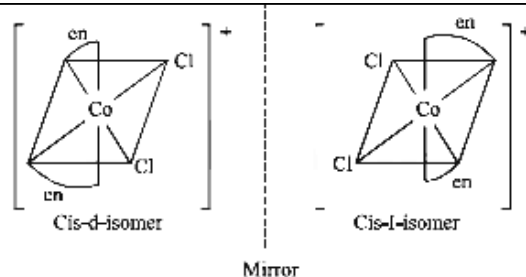
$$= 0.8 \times 10^{16} \text{ Hz} = 8 \times 10^{15} \text{ Hz}$$

46. Which one of the following is expected to exhibit optical isomerism?

(en = ethylenediamine)

- 1) cis-[Pt(NH₃)₂Cl₂]
- 2) trans-[Pt(NH₃)₂Cl₂]
- 3) cis-[Co(en)₂Cl₂]
- 4) trans-[Co(en)₂Cl₂]

Solution : (Correct Answer: 3)



Transform of $[M(AA)_2a_2]^{n\pm}$ does not show optical isomerism.

47. Match List-I with List-II.

	List I (Atoms)	List II (Properties)
A.	He	I. High electron affinity
B.	Cl	II. Most electropositive element
C.	Ca	III. Strong reducing agent
D.	Li	IV. Highest ionisation energy

Choose the correct answer from the options given below.

- 1) A-IV, B-I, C-II, D-III
- 2) A-IV, B-I, C-III, D-II
- 3) A-IV, B-II, C-I, D-II
- 4) A-IV, B-II, C-III, D-I

Solution : (Correct Answer: 1)

The correct match is A-IV, B-I, C-II, D-III

- He has highest ionisation energy due to inert gas configuration.

- Cl has highest electron affinity among given atoms.

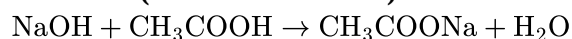
- Ca is the most electropositive element among given atoms.

- Li is strongest reducing agent among given atoms.

48. 20 mL of 0.2M NaOH is added to 50 mL of 0.2M acetic acid. The pH of this solution after mixing is ($K_a = 1.8 \times 10^{-5}$)

- 1) 4.5
- 2) 2.3
- 3) 3.8
- 4) 4

Solution : (Correct Answer: 1)



$$\begin{array}{ccccccc}
 \text{mmol} & 20 & \times 0.2 & 50 \times 0.2 & 0 & 0 \\
 \text{added} & = 4 & = 10 & & &
 \end{array}$$

$$\begin{array}{ccccccc}
 \text{reaction} & 0 & 6 & 4 & & 4 \\
 \text{mol after} & & & & &
 \end{array}$$

$$\text{reaction} \quad 0 \quad 6 \quad 4 \quad = \frac{4}{70}$$

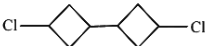
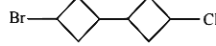
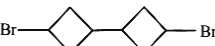
$$[\text{CH}_3\text{COOH} = \frac{6}{70} : [\text{CH}_3\text{COONa}]$$

Now since for a basic buffer

$$\text{pH} = -\log K_a + \log \frac{[\text{salt}]}{[\text{base}]}$$

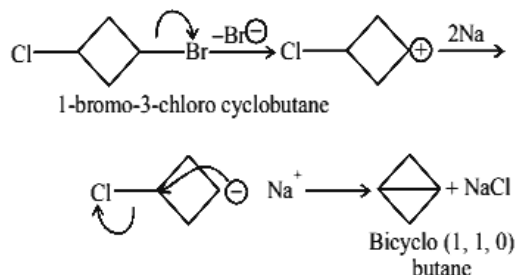
$$\begin{aligned}
 \therefore \text{pH} &= -\log(1.8 \times 10^{-5}) + \log \frac{4/70}{6/70} \\
 &= 4.56
 \end{aligned}$$

49. The reaction of 1-bromo-3-chlorocyclobutane with metallic sodium in dioxane under reflux conditions gives

- 1)  2) 
 3)  4) 

Solution : (Correct Answer: 4)

This is Wurtz reaction. Bromides have high reactivity than chlorides in Wurtz reaction therefore, reaction occurs from Br atoms,



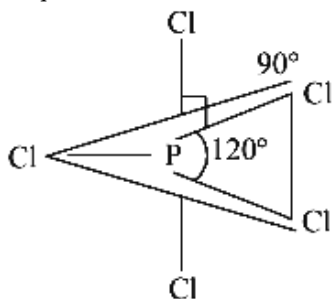
50. Cl – P – Cl bond angles in PCl_5 molecule are

- 1) 120° and 90°
 2) 60° and 90°
 3) 60° and 120°
 4) 120° and 30°

Solution : (Correct Answer: 1)

In PCl_5 , phosphorous undergoes $sp^3 d$ hybridization and has trigonal bipyramidal geometry. It has two axial chlorine atoms & three equatorial chlorine atoms bonded to the central P.

Hence bond angles for axial are 90° , Cl – P – Cl & for equatorial Cl-P-Cl it is 120° .



51. Standard entropy of X_2 , Y_2 and XY_3 are 60, 40 and $50 \text{ JK}^{-1} \text{ mol}^{-1}$, respectively. For the reaction, $\frac{1}{2}X_2 + \frac{3}{2}Y_2 \rightarrow XY_3$, $\Delta H = -30 \text{ kJ}$, to be at equilibrium, the temperature will be

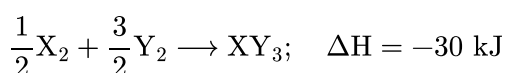
- 1) 1250 K 2) 500 K 3) 750 K 4) 1000 K

Solution : (Correct Answer: 3)

For a reaction to be at equilibrium $\Delta G = 0$. Since $\Delta G = \Delta H - T\Delta S$ so at equilibrium $\Delta H - T\Delta S = 0$

or $\Delta H = T\Delta S$

For the reaction



(given)

Calculating ΔS for the above reaction, we get

$$\Delta S = 50 - \left[\frac{1}{2} \times 60 + \frac{3}{2} \times 40 \right] \text{ JK}^{-1}$$

$$= 50 - (30 + 60) \text{ JK}^{-1} = -40 \text{ JK}^{-1}$$

At equilibrium, $T\Delta S = \Delta H$

$$[\because \Delta G = 0]$$

$$\therefore T \times (-40) = -30 \times 1000 [\because 1 \text{ kJ} = 1000 \text{ J}]$$

$$\text{or } T = \frac{-30 \times 1000}{-40} \text{ or } 750 \text{ K}$$

52. An organic compound having carbon, hydrogen and sulphur contains 4% of sulphur. The minimum molecular weight of the compound is

- 1) 200 2) 400 3) 600 4) 800

Solution : (Correct Answer: 4)

The minimum m. wt. must contain at least one S atom.

$$\therefore \% S = \frac{\text{weight of one S-atom}}{\text{minimum m.wt.}} \times 100$$

$$4 = \frac{32}{\text{minimum m.wt.}} \times 100$$

$$\text{minimum m. wt.} = \frac{32}{4} \times 100 = 800$$

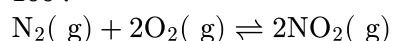
53. Dipping iron article into a strongly alkaline solution of sodium phosphate

- 1) does not affect the article
 2) forms $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ on the surface
 3) forms iron phosphate film
 4) forms ferric hydroxide

Solution : (Correct Answer: 3)

Rusting of iron is generally promoted in an acidic aqueous medium. Alkaline medium prevents availability of H^+ ions. Sodium phosphate will cause formation of a protective film of iron phosphate on the iron preventing rusting. These solutions are used in car radiators to prevent rusting of iron parts.

54. The equilibrium constant for the given reaction is 100.

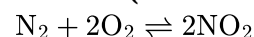


What is the equilibrium constant for the reaction given below?



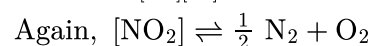
- 1) 10 2) 1 3) 0.1 4) 0.01

Solution : (Correct Answer: 3)



$$K_1 = \frac{[\text{NO}_2]^2}{[\text{N}_2][\text{O}_2]^2}$$

$$\text{or } 100 = \frac{[\text{NO}_2]^2}{[\text{N}_2][\text{O}_2]^2} \dots (i)$$



$$K_2 = \frac{[\text{N}_2]^{1/2}[\text{O}_2]}{[\text{NO}_2]}$$

$$\text{or } K_2^2 = \frac{[\text{N}_2][\text{O}_2]^2}{[\text{NO}_2]^2} \dots (ii)$$

Eqs. (i) $\times$ (ii), we get $100 \times K_2^2 = 1$

$$\Rightarrow K_2^2 = \frac{1}{100} \text{ or } K_2 = \frac{1}{10} = 0.1$$

55. Match List-I with List-II.

List - I (Mixture)		List - II (Distinguishing test)	
A.	Ethanal, propanone	I.	Brady's reagent
B.	Benzaldehyde, acetophenone	II.	Tollen's reagent
C.	Phenol, aniline	III.	Neutral $FeCl_3$
D.	Cyclohexene, cyclohexane	IV.	Baeyer's reagent

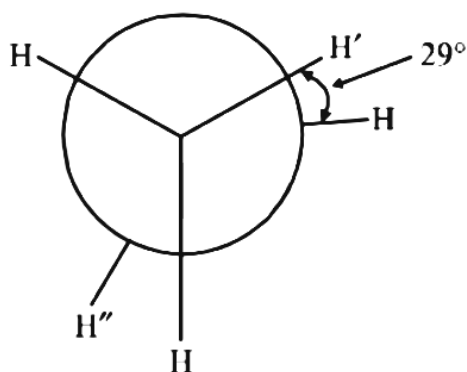
Choose the correct match from the options given below

- 1) A-I, B-II, C-III, D-IV 2) A-II, B-I, C-IV, D-III
 3) A-III, B-I, C-II, D-IV 4) A-II, B-IV, C-I, D-III

Solution : (Correct Answer: 1)

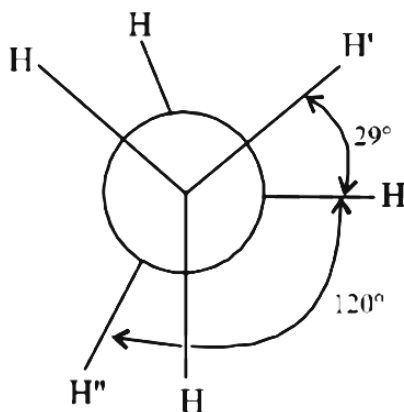
The correct match is A-I, B-II, C-III, D-IV. Ethanal and propanone $\rightarrow$ 2,4-DNP (Brady's) Benzaldehyde $\rightarrow$ Tollen's reagent (silver mirror) Phenol $\rightarrow$ Violet colour with neutral $FeCl_3$ Cyclohexene $\rightarrow$ Decolourises Baeyer's reagent (alkene test)

56. In the following skew conformation of ethane, $H' - C - C - H''$ dihedral angle is :



- 1) 58° 2) 149° 3) 151° 4) 120°

Solution : (Correct Answer: 2)



$\therefore$ Angle between H' and $H'' = 120^\circ + 29^\circ = 149^\circ$

57. The chemical entities present in thermosphere of the atmosphere are

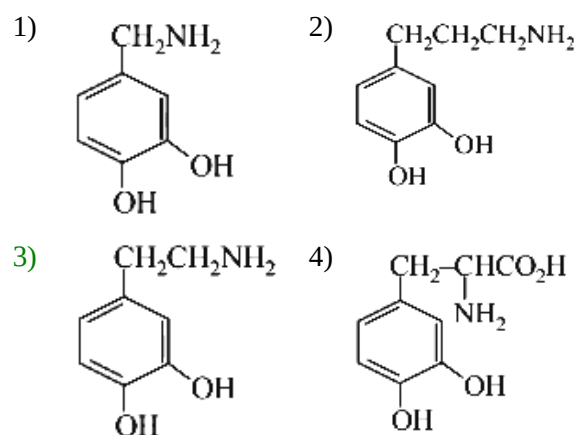
- 1) O_2^+ , O^+ , NO^+

- 2) O_3
 3) N_2 , O_2 , CO_2 , H_2O
 4) O_3 , O_2^+ , O_2

Solution : (Correct Answer: 1)

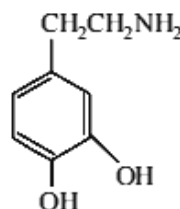
The earth's thermosphere also includes the region of the atmosphere, called the ionosphere. The ionosphere is the region of the atmosphere that is filled with charged particles such as O_2^+ , O^+ , NO^+ . The high temperature in the thermosphere can cause molecules to ionize.

58. Parkinson's disease is linked to abnormalities in the levels of dopamine in the body. The structure of dopamine is



Solution : (Correct Answer: 3)

The IUPAC name of dopamine is 2-(3,4-dihydroxyphenyl) ethylamine and its structure is as follows :



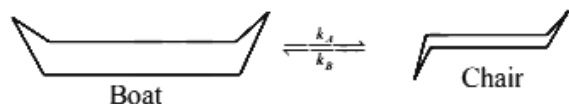
59. Two glass bulbs A and B are connected by a very small tube having a stop-cock. Bulb A has a volume of 100 cm^3 and contained the gas while bulb B was empty. On opening stop-cock, the pressure fell down to 40%. The volume of the bulb B must be

- 1) 75 cm^3 2) 150 cm^3
 3) 125 cm^3 4) 250 cm^3

Solution : (Correct Answer: 3)

$\therefore 100 \times p = V_2 \times \frac{40p}{100}$ $V_2 = 250 \text{cc}$ (Total volume) Volume of bulb B = $250 - 100 = 150 \text{cc}$

60. Consider the following reaction,



The reaction is of first order in each diagram, with an equilibrium constant of 10^4 . For the conversion of chair form to boat form $e^{-E_a/RT} = 4.35 \times 10^{-8}$ at 298 K with pre-exponential factor of 10^{12} s^{-1} . Apparent rate constant ($= k_A/k_B$) at 298 K is

- 1) $4.35 \times 10^4 \text{ s}^{-1}$ 2) $4.35 \times 10^8 \text{ s}^{-1}$
 3) $4.35 \times 10^{-8} \text{ s}^{-1}$ 4) $4.35 \times 10^{12} \text{ s}^{-1}$

Solution : (Correct Answer: 2)

$$K_B = A e^{-E_a/RT}$$

$$= 10^{12} \times 4.35 \times 10^{-8}$$

$$= 4.35 \times 10^4 \text{ s}^{-1}$$

Also equilibrium constant,

$$k = \frac{k_A}{k_B} = 10^4$$

$$\therefore k_A = k_B \times 10^4 = 4.35 \times 10^8 \text{ s}^{-1}$$

61. The osmotic pressure of solution prepared by dissolving 25 mg of K_2SO_4 in 2 litre of water at 25°C is (Assuming that it is completely dissociated)

- 1) $5.27 \times 10^{-7} \text{ atm}$ 2) $5.27 \times 10^{-3} \text{ atm}$
 3) 527 atm 4) $5.27 \times 10^{-4} \text{ atm}$

Solution : (Correct Answer: 2)

K_2SO_4 dissolved = 25mg = 0.025 g

Volume of solution = 2 L Temperature, $T = 25^\circ\text{C}$
 $= 298 \text{ K}$

Molar mass of $\text{K}_2\text{SO}_4 = 2 \times 39 + 32 + 4 \times 16$
 $= 174 \text{ g mol}^{-1}$

As, K_2SO_4 dissolve completely

$\text{K}_2\text{SO}_4 \rightarrow 2 \text{ K}^+ + \text{SO}_4^{2-}$ i.e. ions produced (1°)
 $= 3$

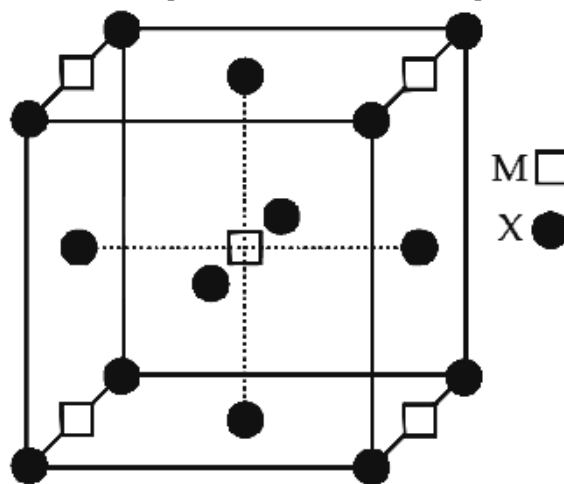
$\therefore i = 3$

$$\pi = iCRT = i \frac{n}{V} RT = \frac{i}{M} + \frac{1}{V} \times RT$$

$$= 3 \times \frac{0.025}{174} \times \frac{1}{2} \times 0.0821 \times 298$$

$$\pi = 5.27 \times 10^{-3} \text{ atm}$$

62. A compound M_pX_q has cubic close packing (ccp) arrangement of X. Its unit cell structure is shown below. The empirical formula of the compound is



- 1) MX 2) MX_2 3) M_2X 4) M_5X_{14}

Solution : (Correct Answer: 2)

No. of M atoms = $\frac{1}{4} \times 4 + 1 = 1 + 1 = 2$

No. of X atoms = $\frac{1}{2} \times 6 + \frac{1}{8} \times 8 = 3 + 1 = 4$

So, formula = $\text{M}_2\text{X}_4 = \text{MX}_2$

63. The O - H stretching vibration of alcohols absorbs in the region $3700 - 3500 \text{ cm}^{-1}$. The O H stretching of carboxylic acids absorb in the region

- 1) $3900 - 3700 \text{ cm}^{-1}$ 2) $3000 - 2500 \text{ cm}^{-1}$
 3) $3700 - 3500 \text{ cm}^{-1}$ 4) $1700 - 2000 \text{ cm}^{-1}$

Solution : (Correct Answer: 4)

The O-H stretching of carboxylic acid absorb in region of $1700 - 2000 \text{ cm}^{-1}$

64. Which one of the following is amorphous?

- 1) Polystyrene 2) Table salt
 3) Silica 4) Diamond

Solution : (Correct Answer: 1)

Polystyrene is thermoplastic substance.

65. Ethanol and dimethyl ether form a pair of functional isomers. The boiling point of ethanol is higher than that of dimethyl ether, due to the presence of

- 1) H-bonding in ethanol
 2) H-bonding in dimethyl ether
 3) CH_3 group in ethanol
 4) CH_3 group in dimethyl ether

Solution : (Correct Answer: 1)

Due to H-bonding, the boiling point of ethanol is much higher than that of the isomeric diethyl ether.

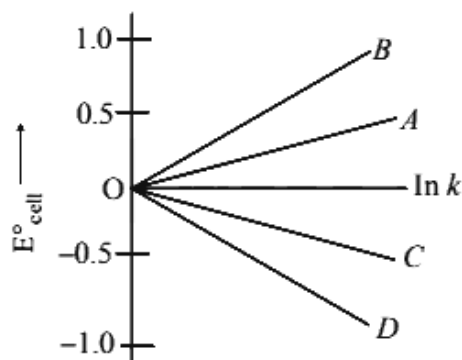
66. In the extraction of Cu, the metal is formed in the bessemer converter due to the reaction :

- 1) $\text{Cu}_2\text{S} + 2\text{Cu}_2\text{O} \rightarrow 6\text{Cu} + \text{SO}_2$
 2) $\text{Cu}_2\text{S} \rightarrow 2\text{Cu} + \text{S}$
 3) $\text{Fe} + \text{Cu}_2\text{O} \rightarrow 2\text{Cu} + \text{FeO}$
 4) $2\text{Cu}_2\text{O} \rightarrow 4\text{Cu} + \text{O}_2$

Solution : (Correct Answer: 4)

Decomposition of carbonates and hydrated oxides.

67. Given, $\Delta G^\circ = -nFE^\circ_{\text{cell}}$ and $\Delta G^\circ = -RT \ln k$. The value of $n = 2$ will be given by the slope of which line in the figure



- 1) OA 2) OB 3) OC 4) OD

Solution : (Correct Answer: 2)

As we know that $-nFE^\circ_{\text{cell}} = -RT \ln k$ or

$$E^\circ_{\text{cell}} = \frac{RT}{nF} \ln k$$

Plot of $\ln k$ or E°_{cell} will have slope

$$= \frac{1}{2} \frac{RT}{F}$$

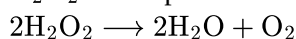
68. How many mL of perhydrol is required to produce sufficient oxygen which can be used to completely convert 2 L of SO_2 gas to SO_3 gas?

- 1) 10 mL 2) 5 mL 3) 20 mL 4) 30 mL

Solution : (Correct Answer: 1)

30% solution of H_2O_2 is known as perhydrol

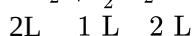
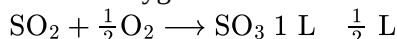
H_2O_2 decomposes as



Volume strength of 30% H_2O_2 solution is 100 i.e.,

1 mL of this solution on decomposition gives

100 mL oxygen.



Since, 100 mL of oxygen is obtained by

= 1 mL of H_2O_2

$\therefore$ 1000 mL of oxygen will be obtained by

$$= \frac{1}{100} \times 1000 \text{ mL of } \text{H}_2\text{O}_2 = 10 \text{ mL of } \text{H}_2\text{O}_2$$

69. Gaseous benzene reacts with hydrogen gas in presence of a nickel catalyst to form gaseous cyclohexane according to the reaction, $\text{C}_6\text{H}_6(g) + 3\text{H}_2(g) \rightarrow \text{C}_6\text{H}_{12}(g)$
A mixture of C_6H_6 and excess H_2 has a pressure of 60 mm of Hg in an unknown volume. After the gas had been passed over a nickel catalyst and all the benzene converted to cyclohexane, the pressure of the gas was 30 mm of Hg in the same volume at the same temperature. The fraction of C_6H_6 (by volume) present in the original volume is

- 1) $\frac{1}{3}$ 2) $\frac{1}{4}$
3) $\frac{1}{5}$ 4) $\frac{1}{6}$

Solution : (Correct Answer: 4)

Let initially, pressure of C_6H_6 (g) is p_1 mm and for H_2 (g) is p_2 mm

$$\therefore p_1 + p_2 = 60 \text{ mm}$$

After the reaction pressure of

$\text{C}_6\text{H}_6(g) = 0$ (as all C_6H_6 has reacted)

$$\text{H}_2(g) = p_2 - 3p_1$$

So, total pressure = $p_2 - 3p_1 + p_1 = 30 \text{ mm}$

$$- 2p_1 = 30 \text{ mm}$$

$\therefore$ (ii)

On solving equation (i) and (ii)

$$p_1 = 10 \text{ mm}, p_2 = 50 \text{ mm}$$

Fraction of C_6H_6 by volume = moles

$$\text{fraction of pressure} = \frac{10}{60} = \frac{1}{6}$$

70. The continuous phase contains the dispersed phase throughout, Example is

- 1) Water in milk
2) Fat in milk
3) Water droplets in mist
4) Oil in water

Solution : (Correct Answer: 1)

In a colloidal system, the substance present in large amount in the mixture is called the dispersed

medium & the solute is called dispersed phase. In

case of milk and water solution the dispersed phase

is milk protein & fat and water is dispersed medium.

Maths - Section A (MCQ)

71. If $\frac{x^2+2x+7}{2x+3} < 6$, $x \in \mathbb{R}$, then

- 1) $x > 11$ or $x < -\frac{3}{2}$
2) $x > 11$ or $x < -1$
3) $-\frac{3}{2} < x < -1$
4) $-1 < x < 11$ or $x < -\frac{3}{2}$

Solution : (Correct Answer: 4)

$$\begin{aligned} \frac{x^2 + 2x + 7}{2x + 3} &< 6 \\ \Rightarrow \frac{x^2 + 2x + 7}{2x + 3} - 6 &< 0 \\ \Rightarrow \frac{x^2 - 10x - 11}{2x + 3} &< 0 \\ \Rightarrow \frac{(x - 11)(x + 1)}{2x + 3} &< 0 \\ \Rightarrow \frac{(x - 11)(x + 1)(2x + 3)}{(2x + 3)^2} &< 0 \\ \Rightarrow (x - 11)(x + 1)(2x + 3) &< 0 \\ \Rightarrow x \in \left(-\infty, -\frac{3}{2}\right) \cup (-1, 11) \end{aligned}$$

72. Let P, Q, R and S be statements and suppose that $P \rightarrow Q \rightarrow R \rightarrow P$. if $\sim S \rightarrow R$, then

- 1) $S \rightarrow \sim Q$, 2) $\sim Q \rightarrow S$
3) $\sim S \rightarrow \sim Q$ 4) $Q \rightarrow \sim S$

Solution : (Correct Answer: 2)

But $\sim S \rightarrow R$

$\therefore Q \rightarrow R$, True [As $P \rightarrow Q \rightarrow R \rightarrow P$]

Hence $\sim Q \rightarrow S$ is true

73. If $A = \begin{pmatrix} 2 & -1 \\ -7 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} 4 & 1 \\ 7 & 2 \end{pmatrix}$ then which statement is true ?

- 1) $AA^T = I$ 2) $BB^T = I$
 3) $AB \neq BA$ 4) $(AB)^T = I$

Solution : (Correct Answer: 3)

Here

$$AA^T = \begin{pmatrix} 2 & -1 \\ -7 & 4 \end{pmatrix} \begin{pmatrix} 2 & -7 \\ -1 & 4 \end{pmatrix} \neq \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

$$(BB^T)_{11} = (4)^2 + (1)^2 \neq 1$$

$$(AB)_{11} = 8 - 7 = 1, (BA)_{11} = 8 - 7 = 1$$

$\therefore AB \neq BA$ may be not true.

$$\begin{aligned} \text{Now, } AB &= \begin{pmatrix} 2 & -1 \\ -7 & 4 \end{pmatrix} \begin{pmatrix} 4 & 1 \\ 7 & 2 \end{pmatrix} \\ &= \begin{pmatrix} 8-7 & 2-2 \\ -28+28 & -7+8 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \\ \therefore (AB)^T &= \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \end{aligned}$$

74. Solve : $(D^2 + 6D + 8)y = e^{-2x}$.

- 1) $y = Ae^{4x} + Be^{2x} + \frac{1}{2}xe^{-2x}$
 2) $y = Ae^{-4x} + Be^{-2x} + \frac{1}{2}xe^{-2x}$
 3) $y = Ae^{-4x} - Be^{2x} + \frac{1}{2}xe^{-2x}$
 4) $y = Ae^{4x} + Be^{-2x} - \frac{1}{2}xe^{-2x}$

Solution : (Correct Answer: 2)

The characteristic equation is $p^2 + 6p + 8 = 0$

$$\Rightarrow (p+4)(p+2) = 0 \Rightarrow p = -4 \text{ and } -2$$

The C.F. is $Ae^{-4x} + Be^{-2x}$

Particular integral,

$$\begin{aligned} \text{P.I.} &= \frac{1}{D^2 + 6D + 8} e^{-2x} \\ &= \frac{1}{(D+4)(D+2)} e^{-2x} \end{aligned}$$

Since, $f(D) = (D+2)q(D)$

$$= \frac{1}{\theta(-2)} xe^{-2x} = \frac{1}{2} xe^{-2x}$$

Hence the general solution is

$$y = Ae^{-4x} + Be^{-2x} + \frac{1}{2}xe^{-2x}$$

75. If $f(x) = \begin{cases} x^2, & x \leq 0 \\ 2 \sin x, & x > 0 \end{cases}$, then $x = 0$ is

- 1) point of minima
 2) point of maxima
 3) point of discontinuity
 4) None of the above

Solution : (Correct Answer: 1)

$$\text{Given } f(x) = \begin{cases} x^2, & x \leq 0 \\ 2 \sin x, & x > 0, \end{cases}$$

$$f'(x) = \begin{cases} 2x, & x < 0 \\ \text{nondifferentiable,} & x = 0 \\ 2 \cos x, & x > 0 \end{cases}$$

So, $x = 0$ is a critical point $f'(0^-) > 0$ as well as

$$f'(0^+) > 0 \text{ and } f(0) = 0$$

Hence, it is a point of minima.

76. The number of real solutions of the equation $\left(\frac{9}{10}\right) = -3 + x - x^2$ is

- 1) 0 2) 1
 3) 2 4) None of these

Solution : (Correct Answer: 1)

$$\text{Let } f(x) = -3 + x - x^2$$

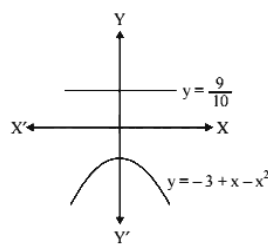
Then, $f(x) < 0$ for all x because coefficient of $x^2 < 0$ and disc < 0 . Thus, LHS of the given equation is always positive whereas the RHS is always less than zero.

Hence, the given equation has no solution.

Alternate Solution :

Given, equation is

$$\frac{9}{10} = -3 + x - x^2$$



Let $y = \frac{9}{10}$, therefore

$$\begin{aligned} y &= -3 + x - x^2 \\ y &= -\left[x^2 - x + \frac{1}{4}\right] - 3 + \frac{1}{4} \\ \Rightarrow y + \frac{11}{4} &= -\left(x - \frac{1}{2}\right)^2 \end{aligned}$$

It is clear from the graph that two curves do not intersect. Hence, no solution exists.

77. If H is the harmonic mean between P and Q , then the value of $\frac{H}{P} + \frac{H}{Q}$ is

- 1) 2 2) $\frac{PQ}{P+Q}$ 3) $\frac{1}{2}$ 4) $\frac{P+Q}{PQ}$

Solution : (Correct Answer: 1)

Given : H is the harmonic mean between P & Q

$$\begin{aligned} \therefore H &= \frac{2PQ}{P+Q} \Rightarrow \frac{1}{H} = \frac{P+Q}{2PQ} \\ \Rightarrow \frac{2}{H} &= \frac{1}{Q} + \frac{1}{P} \Rightarrow \frac{H}{P} + \frac{H}{Q} = 2 \end{aligned}$$

78. If the normal at $(ap^2, 2ap)$ on the parabola $y^2 = 4ax$, meets the parabola again at $(aq^2, 2aq)$, then

- 1) $p^2 + pq + 2 = 0$ 2) $p^2 - pq + 2 = 0$
 3) $q^2 + pq + 2 = 0$ 4) $p^2 + pq + 1 = 0$

Solution : (Correct Answer: 1)

Since the normal at $(ap^2, 2ap)$ on $y^2 = 4ax$ meets the curve again at $(aq^2, 2aq)$, therefore $px + y$

$$= 2ap + ap^3 \text{ passes through } (aq^2, 2aq)$$

$$\Rightarrow paq^2 + 2aq = 2ap + ap^3$$

$$\Rightarrow p(q^2 - p^2) = 2(p - q)$$

$$\Rightarrow p(q + p) = -2$$

$$\Rightarrow p^2 + pq + 2 = 0$$

79. If X is a binomial variate with the range $\{0, 1, 2, 3, 4, 5, 6\}$ and $P(X = 2) = 4P(X = 4)$, then the parameter p of X is

- 1) $\frac{1}{3}$ 2) $\frac{1}{2}$ 3) $\frac{2}{3}$ 4) $\frac{3}{4}$

Solution : (Correct Answer: 1)

Here, $n = 6$

According to the question

$${}^6C_2 p^2 q^4 = 4 \cdot {}^6C_4 p^4 q^2$$

$$\Rightarrow q^2 = 4p^2 \Rightarrow (1 - p)^2 = 4p^2$$

$$\Rightarrow 3p^2 + 2p - 1 = 0$$

$$\Rightarrow (p + 1)(3p - 1) = 0$$

$$\Rightarrow p = \frac{1}{3} \quad (\because p \text{ cannot be negative})$$

80. The value of $\tan^{-1} \frac{1}{2} + \tan^{-1} \frac{1}{3} + \tan^{-1} \frac{7}{8}$ is

- 1) $\tan^{-1} \frac{7}{8}$ 2) $\cot^{-1} 15$
3) $\tan^{-1} 15$ 4) $\tan^{-1} \frac{15}{24}$

Solution : (Correct Answer: 3)

$$\tan^{-1} \frac{1}{2} + \tan^{-1} \frac{1}{3} + \tan^{-1} \frac{7}{8}$$

$$= \left[\frac{\frac{1}{2} + \frac{1}{3} + \frac{7}{8} - \frac{1}{2} \times \frac{1}{3} \times \frac{7}{8}}{1 - \frac{1}{2} \times \frac{1}{3} - \frac{1}{3} \times \frac{7}{8} - \frac{7}{8} \times \frac{1}{2}} \right]$$

$$\left[\because \tan^{-1} x + \tan^{-1} y + \tan^{-1} z \right. \\ \left. = \tan^{-1} \left(\frac{x+y+z-xyz}{1-xy-yz-zx} \right) \right]$$

$$= \tan^{-1} \left[\frac{\frac{41}{24} - \frac{7}{48}}{1 - \frac{1}{6} - \frac{7}{24} - \frac{7}{16}} \right]$$

$$= \tan^{-1} \left[\frac{\frac{75}{48}}{1 - \frac{43}{48}} \right] = \tan^{-1} \left(\frac{75}{48-43} \right)$$

$$= \tan^{-1} \left[\frac{75}{5} \right] = \tan^{-1} 15$$

81. The locus of the mid-points of the focal chord of the parabola $y^2 = 4ax$ is

- 1) $y^2 = a(x - a)$ 2) $y^2 = 2a(x - a)$
3) $y^2 = 4a(x - a)$ 4) None of these

Solution : (Correct Answer: 2)

Any chord PQ which bisected point $R(h, k)$ is T = S

$$\text{i.e., } ky - 2a(x + h) = k^2 - 4ah$$

Since, it is a focal chord, so it must pass through focus $(a, 0)$.

$$\therefore k(0) - 2a(a + h) = k^2 - 4ah \Rightarrow k^2 = 2ah - 4a^2$$

Hence, locus is

82. Ten different letters of an alphabet are given, words with five letters are formed from these given letters. Then the number of words which have at least one letter repeated is

- 1) 69760 2) 30240
3) 99784 4) None of these

Solution : (Correct Answer: 1)

Total number of words that can be formed = 10^5 .

Number of words in which no letter is repeated

= ${}^{10}P_5$. So, number of words in which at least one letter is repeated = $10^5 - {}^{10}P_5 = 69760$

83. $\lim_{x \rightarrow \pi/4} \frac{\tan x - 1}{\cos 2x}$ is equal to

- 1) 1 2) 0 3) -2 4) -1

Solution : (Correct Answer: 4)

$$\lim_{x \rightarrow \pi/4} \frac{\tan x - 1}{\cos 2x} = \lim_{h \rightarrow 0} \frac{\tan(\frac{\pi}{4} + h) - 1}{\cos 2(\frac{\pi}{4} + h)}$$

$$= [\because x = \frac{\pi}{4} + h]$$

$$= \lim_{h \rightarrow 0} \frac{\left(\frac{1 + \tan h}{1 - \tan h} \right) - 1}{\cos(\frac{\pi}{2} + 2h)}$$

$$= \lim_{h \rightarrow 0} \frac{1 + \tan h - 1 + \tan h}{-\sin 2h(1 - \tanh)}$$

$$= \lim_{h \rightarrow 0} \frac{-2 \tan h}{2 \sin h \cos h(1 - \tanh)}$$

$$= \lim_{h \rightarrow 0} \frac{-1}{\cos^2 h(1 - \tanh)} = -1$$

84. The value of $I = \int_0^1 x \left| x - \frac{1}{2} \right| dx$ is

- 1) $\frac{1}{3}$ 2) $\frac{1}{4}$
3) $\frac{1}{8}$ 4) None of these

Solution : (Correct Answer: 3)

$$\text{Let } I = \int_0^1 x \left| x - \frac{1}{2} \right| dx$$

$$= - \int_0^{1/2} x \left(x - \frac{1}{2} \right) dx + \int_{1/2}^1 x \left(x - \frac{1}{2} \right) dx$$

$$= \int_0^{1/2} \left(\frac{x}{2} - x^2 \right) dx + \int_{1/2}^1 x \left(x^2 - \frac{x}{2} \right) dx$$

$$= \left[\frac{x^2}{4} - \frac{x^3}{3} \right]_0^{1/2} + \left[\frac{x^3}{3} - \frac{x^2}{4} \right]_{1/2}^1$$

$$= \left(\frac{1}{16} - \frac{1}{24} \right) + \left(\frac{1}{3} - \frac{1}{4} - \frac{1}{24} + \frac{1}{16} \right)$$

$$= \left(\frac{6-4}{96} \right) + \left(\frac{32-24-4+6}{96} \right)$$

$$= \frac{12}{96} = \frac{1}{8}$$

85. A four digit number is formed by the digits 1, 2, 3, 4 with no repetition. The probability that the number is odd, is

- 1) zero 2) $\frac{1}{3}$
3) $\frac{1}{4}$ 4) None of these

Solution : (Correct Answer: 4)

Given digits are 1, 2, 3, 4.

Possibilities for units place digit

(either 1 or 3) = 2

Possibilities for ten's digit = 3

Possibilities for hundred's place digit = 2

Possibilities for thousand place's digit = 1

$$\therefore \text{Number of favourable outcomes} = 2 \times 3 \times 2 \times 1 = 12$$

Number of numbers formed by 1, 2, 3, 4

(without repetitions) = 4!

$$\therefore \text{Required probability} = \frac{12}{4 \times 3 \times 2} = \frac{1}{2}$$

86. A random variable X follows binomial distribution with mean α and variance β . Then

- 1) $0 < \alpha < \beta$
2) $0 < \beta < \alpha$
3) $\alpha < 0 < \beta$
4) $\beta < 0 < \alpha$

Solution : (Correct Answer: 2)

Mean, $npq = \alpha$; and variance, $npq = \beta$ where n = number of trials and $p + q = 1$

$$\text{So, } \frac{npq}{np} = \frac{\beta}{\alpha} \Rightarrow q = \frac{\beta}{\alpha} \Rightarrow (1 - p) = \frac{\beta}{\alpha}$$

$$\therefore 0 < p < 1$$

$$\therefore -1 < -p < 0 \Rightarrow 0 < 1 - p < 1$$

$$\Rightarrow 0 < \frac{\beta}{\alpha} < 1 \Rightarrow 0 < \beta < \alpha$$

87. Let S be a set containing n elements. Then, number of binary operations on S is

- 1) n^n 2) 2^{n^2}
 3) n^{n^2} 4) n^2

Solution : (Correct Answer: 3)

The number of binary operations on a set S having n elements in n^{n^2} .

88. Negation of the proposition : If we control population growth, we prosper

- 1) If we do not control population growth, we prosper
 2) If we control population growth, we do not prosper
 3) We control population but we do not prosper
 4) We do not control population, but we prosper

Solution : (Correct Answer: 3)

p : we control population, q : we prosper $\therefore$ we have $p \Rightarrow q$

Its negation is $\sim (p \Rightarrow q)$ i.e. $p \wedge \sim q$ i.e., we control population but we do not prosper.

89. If A and B be two sets such that $A \times B$ consists of 6 elements. If three elements $A \times B$ are $(1, 4)$, $(2, 6)$ and $(3, 6)$, find $B \times A$.

- 1) $\{(1, 4), (1, 6), (2, 4), (2, 6), (3, 4), (3, 6)\}$
 2) $\{(4, 1), (4, 2), (4, 3), (6, 1), (6, 2), (6, 3)\}$
 3) $\{(4, 4), (6, 6)\}$
 4) $\{(4, 1), (6, 2), (6, 3)\}$

Solution : (Correct Answer: 2)

Since, $(1, 4)$, $(2, 6)$ and $(3, 6)$ are the elements of $A \times B$, therefore 1, 2, 3 are the elements of A and 4, 6 are the elements of B .

Also, $A \times B$ has 6 elements

$$\therefore A = \{1, 2, 3\}$$

$$\text{and } B = \{4, 6\}$$

$$\therefore B \times A = \{(4, 1), (4, 2), (4, 3), (6, 1), (6, 2), (6, 3)\}$$

$$\text{and } B = \{4, 6\}$$

$$\therefore B \times A = \{(4, 1), (4, 2), (4, 3), (6, 1), (6, 2), (6, 3)\}$$

90. For which of the following values of m , the area of the region bounded by the curve $y = x - x^2$ and the line $y = mx$ equals $\frac{9}{2}$

- 1) -4 2) -2 3) 2 4) 4

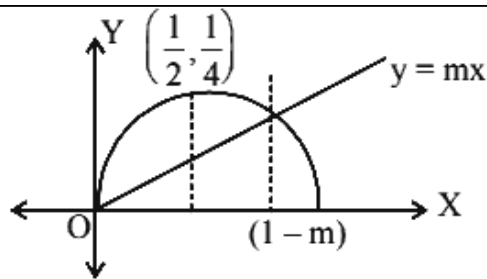
Solution : (Correct Answer: 2)

The equation of curve is $y = x - x^2$

$$\Rightarrow x^2 - x = y$$

$$\Rightarrow \left(x - \frac{1}{2}\right)^2 = -\left(y - \frac{1}{4}\right)$$

which is a parabola whose vertex is $\left(\frac{1}{2}, \frac{1}{4}\right)$



Hence, finding the point of intersection of the curve and the line,

$$x - x^2 = mx \Rightarrow x(1 - x - m) = 0$$

$$\text{i.e., } x = 0 \text{ or } x = 1 - m$$

$$\therefore \frac{9}{2} = \int_0^{1-m} (x - x^2 - mx) dx$$

$$= \left\{ \frac{x^2}{2} - \frac{x^3}{3} - m \frac{x^2}{2} \right\}_0^{1-m}$$

$$= (1-m) \frac{(1-m)^2}{2} - \frac{(1-m)^3}{3} = \frac{(1-m)^3}{6}$$

$$\therefore (1-m)^3 = \frac{6 \times 9}{2} = 27 \Rightarrow 1-m = (27)^{1/3} = 3$$

$$\Rightarrow m = -2$$

$$\text{Also, } (1-m)^3 - (3)^3 = 0$$

$$\therefore (1-m)^3 = 3^3 \Rightarrow 1-m = 3$$

$$\text{or } m = -2$$

91. The mid point of the chord $4x - 3y = 5$ of the hyperbola $2x^2 - 3y^2 = 12$ is

- 1) $(0, -\frac{5}{3})$ 2) $(2, 1)$
 3) $(\frac{5}{4}, 0)$ 4) $(\frac{11}{4}, 2)$

Solution : (Correct Answer: 2)

Solving $4x - 3y = 5$ and $2x^2 - 3y^2 = 12$

$$\therefore 2 \left(\frac{5+3y}{4} \right)^2 - 3y^2 = 12$$

$$\Rightarrow \frac{(25+9y^2+30y)}{8} - 3y^2 = 12$$

$$\Rightarrow 15y^2 - 30y + 71 = 0$$

$$\Rightarrow y = \frac{30 \pm \sqrt{900-4260}}{30} = 1 \pm \frac{\sqrt{-3360}}{30}$$

$$\text{Also, } 2x^2 - 3 \left(\frac{4x-5}{3} \right)^2 = 12$$

$$\Rightarrow 10x^2 - 40x + 61 = 0$$

$$\Rightarrow x = \frac{40 \pm \sqrt{1600 - 4 \times 10 \times 61}}{2 \times 10}$$

$$= \frac{40 \pm \sqrt{-840}}{20} = 2 \pm \frac{\sqrt{-840}}{20}$$

$$\therefore \text{Points are } A \left(2 + \frac{\sqrt{-840}}{20}, 1 + \frac{\sqrt{-3360}}{30} \right)$$

$$\text{and } B \left(2 - \frac{\sqrt{-840}}{20}, 1 - \frac{\sqrt{-3360}}{30} \right).$$

$$\therefore \text{Mid point of } AB \text{ is } (2, 1).$$

92. The maximum value of $\left(\frac{1}{x}\right)^x$ is

- 1) e 2) e^e
 3) $e^{\frac{1}{e}}$ 4) $\left(\frac{1}{e}\right)^{\frac{1}{e}}$

Solution : (Correct Answer: 3)

$$\text{Let } y = \left(\frac{1}{x}\right)^x \Rightarrow y = x^{-x}$$

$$\text{Then } \log y = -x \log x$$

$$\therefore \frac{1}{y} \frac{dy}{dx} = -(1 + \log x)$$

or $\frac{dy}{dx} = -y(1 + \log x)$

$$\& \frac{dy}{dx} = -y \cdot \frac{1}{x} - (1 + \log x) \cdot \frac{dy}{dx}$$

$$\Rightarrow \frac{d^2y}{dx^2} = -\left(\frac{1}{x}\right)^{x+1} - (1 + \log x) \cdot \frac{dy}{dx}$$

Now, $\frac{dy}{dx} = 0 \Rightarrow 1 + \log x = 0$

$$\Rightarrow \log x = -1 = -\log e = \log\left(\frac{1}{e}\right)$$

$$\Rightarrow x = \left(\frac{1}{e}\right)$$

Also, $\frac{d^2y}{dx^2}$ at $x = \left(\frac{1}{e}\right)$ is $-e^{1+\frac{1}{e}} < 0$

$$\left[\because \frac{dy}{dx} = 0\right]$$

So, $x = \left(\frac{1}{e}\right)$ is a point of local maxima.

$\therefore$ Maximum value

$$= (\text{value of } y \text{ when } x = \frac{1}{e}) = e^{\frac{1}{e}}$$

93. If $f(2) = 4$ and $f'(2) = 1$,
then $\lim_{x \rightarrow 2} \frac{xf(2) - 2f(x)}{x-2}$ is equal to

- 1) 0 2) $\frac{1}{2}$ 3) 1 4) 2

Solution : (Correct Answer: 4)

Let $f(x) = ax + b$

Given $f(2) = 4$ & $f'(2) = 1$

$$\therefore f(2) = a \cdot 2 + b = 4 \Rightarrow 2a + b = 4 \dots (1)$$

$$\& f'(x) = a \Rightarrow f'(2) = a = 1 \Rightarrow a = 1$$

$$\therefore 2 \times 1 + b = 4 \Rightarrow b = 2 \text{ [using equation (1)]}$$

$$\therefore f(x) = x + 2$$

Now, $\lim_{x \rightarrow 2} \frac{xf(2) - 2f(x)}{x-2}$

$$= \lim_{x \rightarrow 2} \frac{4x - 2(x+2)}{x-2} = \lim_{x \rightarrow 2} \frac{2x-4}{x-2}$$

$$= \lim_{x \rightarrow 2} \frac{2(x-2)}{(x-2)} = 2$$

94. The value of the integral $\int_1^9 e^{\sqrt{t}} dt =$

- 1) e^3 2) $4e^3$
3) $4(e^3 - e)$ 4) $4e^3 - 2e$

Solution : (Correct Answer: 2)

Let $I = \int_1^9 e^{\sqrt{t}} dt$

Put $t = x^2 \Rightarrow dt = 2x \cdot dx$

For limit : $x = 1$ & $x = 3$

$$I = \int_1^3 e^x \cdot 2x dx = 2 \int_1^3 e^x \cdot x dx$$

$$\Rightarrow I = 2 \left[\{x \cdot e^x\}_1^3 - \int_1^3 e^x dx \right]$$

$$= 2 \left[\{xe^x\}_1^3 - \{e^x\}_1^3 \right]$$

$$\Rightarrow I = 2 [3e^3 - e^1 - e^3 + e^1] = [2e^3] \cdot 2 = 4e^3$$

95. The locus of mid points of tangents intercepted between the axes of ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ will be

- 1) $\frac{a^2}{x^2} + \frac{b^2}{y^2} = 1$
2) $\frac{a^2}{x^2} + \frac{b^2}{y^2} = 2$
3) $\frac{a^2}{x^2} + \frac{b^2}{y^2} = 3$
4) $\frac{a^2}{x^2} + \frac{b^2}{y^2} = 4$

Solution : (Correct Answer: 4)

Let mid-point of part PQ which is in between the axis is R (x_1, y_1) , then coordinates of P and Q will be $(2x_1, 0)$ and $(0, 2y_1)$, respectively.

$$\therefore \text{Equation of line PQ is } \frac{x}{2x_1} + \frac{y}{2y_1} = 1$$

$$\Rightarrow y = -\left(\frac{y_1}{x_1}\right)x + 2y_1$$

If this line touches the ellipse

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

then it will satisfy the condition, $c^2 = a^2m^2 + b^2$

$$\text{So, } (2y_1)^2 = a^2 \left(\frac{-y_1}{x_1}\right)^2 + b^2$$

$$\Rightarrow 4y_1^2 = \left\{ \frac{a^2 y_1^2}{x_1^2} \right\} + b^2$$

$$\Rightarrow 4 = \left(\frac{a^2}{x_1^2}\right) + \left(\frac{b^2}{y_1^2}\right) \Rightarrow \left(\frac{a^2}{x_1^2}\right) + \left(\frac{b^2}{y_1^2}\right) = 4$$

$\therefore$ Required locus of (x_1, y_1) is

$$\left(\frac{a^2}{x^2} + \frac{b^2}{y^2}\right) = 4$$

96. The coefficient of x^{53} in the following expansions

$$\sum_{m=0}^{100} 100C_m (x-3)^{100-m} \cdot 2^m \text{ is}$$

- 1) $^{100}C_{47}$
2) $^{100}C_{53}$
3) $-^{100}C_{53}$
4) $-^{100}C_{53}$

Solution : (Correct Answer: 3)

$$\sum_{m=0}^{100} 100C_m (x-3)^{100-m} \cdot 2^m$$

Above expansion can be rewritten as

$$[(x-3) + 2]^{100} = (x-1)^{100} = (1-x)^{100}$$

$$\therefore x^{53} \text{ will occur in } T_{54}$$

$$\Rightarrow T_{54} = ^{100}C_{53} (-x)^{53}$$

$$\therefore \text{Required coefficient is } -^{100}C_{53}$$

97. If tangent to the curve $f(x) = x^3 - \alpha x^2 - x + \beta$ at point $(1, 3)$ on the curve, cut equals non zero intercepts on co-ordinate axes, then

- 1) $\alpha + \beta = 6$ 2) $\alpha - \beta = 3$
3) $\alpha\beta = 27$ 4) $\frac{\beta}{\alpha} = 6$

Solution : (Correct Answer: 1)

$\therefore (1, 3)$ lies on the curve.

Then, $f(1) = 3$

$$\Rightarrow 1 - \alpha - 1 + \beta = 3 \Rightarrow \beta - \alpha = 3$$

$\therefore$ Tangent cuts equal intercepts that means, slope = -1

$$\Rightarrow f'(1) = -1$$

$$\Rightarrow 3(1)^2 - 2(1)\alpha - 1 = -1$$

$$\Rightarrow -2\alpha = -3$$

$$\Rightarrow 2\alpha = 3$$

$$\Rightarrow \alpha = \frac{3}{2}$$

$$\text{Then, } \beta = 3 + \frac{3}{2} = \frac{9}{2}$$

$$\text{Therefore, } \alpha + \beta = \frac{3}{2} + \frac{9}{2} = 6$$

98. If N is a set of natural numbers, then under binary operation $a \cdot b = a + b$, $(N, \cdot)$ is

- 1) quasi-group 2) semi-group
3) monoid 4) group

Solution : (Correct Answer: 2)

The structure $(N, \cdot)$ satisfies the closure property, associativity and commutativity but the identity element 0 does not belong to N .

So, N is a semi-group.

99. If $\sin^{-1} x + \sin^{-1} y = \frac{\pi}{2}$, then $\cos^{-1} x + \cos^{-1} y$ is equal to

- 1) $\frac{\pi}{2}$ 2) $\frac{\pi}{4}$ 3) π 4) $\frac{3\pi}{4}$

Solution : (Correct Answer: 1)

Given $\sin^{-1} x + \sin^{-1} y = \frac{\pi}{2}$
 we know that $\sin^{-1} x + \cos^{-1} x = \frac{\pi}{2}$
 $\Rightarrow \sin^{-1} x = \pi/2 - \cos^{-1} x$
 $\therefore$ Equation (1) becomes.
 $\frac{\pi}{2} - \cos^{-1} x + \frac{\pi}{2} - \cos^{-1} y = \frac{\pi}{2}$
 $\Rightarrow \cos^{-1} x + \cos^{-1} y = \frac{\pi}{2}$

100. The probability density $f(x)$ of a continuous random variable is given by $f(x) = Ke^{-|x|}$, $-\infty < x < \infty$. Then the value of K is

- 1) $\frac{1}{2}$ 2) 2 3) $\frac{1}{4}$ 4) 4

Solution : (Correct Answer: 1)

Since $f(x)$ is the probability density function of random variable X .

$$\therefore \int_{-\infty}^{\infty} f(x) dx = 1$$

Now we have

$$\begin{aligned} \int_{-\infty}^{\infty} Ke^{-|x|} dx &= 1 \Rightarrow 2 \int_0^{\infty} K \cdot e^{-x} dx = 1 \\ \Rightarrow 2 \int_0^{\infty} K \cdot e^{-x} dx &= 1 \\ \Rightarrow -2K \cdot [e^{-x}]_0^{\infty} &= 1 \Rightarrow 2K = 1 \\ \Rightarrow K &= \frac{1}{2} \end{aligned}$$

101. Which of the following statement is correct?

- 1) Every L.P.P. admits an optimal solution
- 2) A L.P.P. admits a unique optimal solution
- 3) If a L.P.P. admits two optimal solutions, it has an infinite number of optimal solutions
- 4) The set of all feasible solutions of a L.P.P. is not a convex set.

Solution : (Correct Answer: 3)

No Solution Available

102. The integral $\int \frac{\sin^2 x}{\cos^4 x} dx$ is

- 1) a polynomial of degree 5 in $\sin x$
- 2) a polynomial of degree 4 in $\tan x$
- 3) a polynomial of degree 3 in $\tan x$
- 4) a polynomial of degree 5 in $\cos x$

Solution : (Correct Answer: 3)

$$\begin{aligned} \text{Let } I_{2,4} &= \int \frac{\sin^2 x}{\cos^4 x} dx = \frac{\sin x}{3 \cdot \cos^3 x} - \frac{1}{3} I_{0,2} \\ &= \frac{\sin x}{3 \cos^3 x} - \frac{1}{3} \tan x + c \\ &= \frac{1}{3} \tan x (1 + \tan^2 x) - \frac{1}{3} \tan x + c \\ &= \frac{1}{3} \tan^3 x + c \end{aligned}$$

ALTERNATE :

$$\begin{aligned} \int \frac{\sin^2 x}{\cos^4 x} dx &= \int \tan^2 x \cdot \sec^2 x dx \\ \text{put } \tan x &= t \\ &= \int t^2 \cdot dt = \frac{1}{3} t^3 + c = \frac{1}{3} \tan^3 x + c \end{aligned}$$

103. The imaginary part of $\frac{(1+i)^2}{i(2i-1)}$ is

- 1) $\frac{4}{5}$ 2) 0 3) $\frac{2}{5}$ 4) $-\frac{4}{5}$

Solution : (Correct Answer: 4)

$$\begin{aligned} \frac{(1+i)^2}{i(2i-1)} &= \frac{1+i^2+2i}{2i^2-i} \\ &\Rightarrow \frac{1-1+2i}{-2-i} = -\frac{2i}{2+i} \times \frac{(2-i)}{(2-i)} = \frac{-4i+2i^2}{4-i^2} \\ &\quad [\because i^2 = -1] \\ &\therefore \frac{-4i-2}{4+1} = \frac{-2-4i}{5} \Rightarrow \frac{-2}{5} - \frac{4i}{5} \\ &\therefore \text{The imaginary part} = -\frac{4}{5} \end{aligned}$$

104. If a, b and c are distinct positive numbers, not equal to unity. Such that $abc = 1$, then the value of $\log_b a \cdot \log_c a + \log_c b \cdot \log_a b + \log_a c \log_b c$ is

- 1) 0 2) 1 3) 2 4) 3

Solution : (Correct Answer: 4)

$$\because abc = 1$$

$$\Rightarrow \log a + \log b + \log c = 0$$

that means,

$$\begin{aligned} \log^3 a + \log^3 b + \log^3 c &= 3 \log a \cdot \log b \cdot \log c \\ \Rightarrow \frac{\log^2 a}{\log b \cdot \log c} + \frac{\log^2 b}{\log a \cdot \log c} + \frac{\log^2 c}{\log a \cdot \log b} &= 3 \\ \Rightarrow \frac{\log a \cdot \log a}{\log b \cdot \log c} + \frac{\log b \cdot \log b}{\log a \cdot \log c} + \frac{\log c \cdot \log c}{\log a \cdot \log b} &= 3 \\ \Rightarrow \frac{\log_b a}{\log_a c} + \frac{\log_c b}{\log_b a} + \frac{\log_a c}{\log_c b} &= 3 \\ \Rightarrow \log_b a \cdot \log_c a + \log_c b \cdot \log_a b &+ \log_a c \cdot \log_b c = 3 \end{aligned}$$

105. The sum of $1 + \frac{1}{4} + \frac{1 \cdot 3}{4 \cdot 8} + \frac{1 \cdot 3 \cdot 5}{4 \cdot 8 \cdot 12} + \dots \infty$ is

- 1) $\sqrt{3}$ 2) $\frac{1}{\sqrt{2}}$ 3) $\sqrt{2}$ 4) $2^{\frac{3}{2}}$

Solution : (Correct Answer: 3)

Comparing with $1 + nx + \frac{n(n-1)}{2!} x^2 + \dots$

$$nx = \frac{1}{4} \dots (i)$$

$$\text{and } \frac{n(n-1)}{2!} x^2 = \frac{1 \cdot 3}{4 \cdot 8}$$

$$\Rightarrow \frac{n \times (n-1)x}{2!} = \frac{1 \cdot 3}{4 \cdot 8}$$

$$\text{put : } nx = \frac{1}{4}$$

$$\Rightarrow \frac{1}{4} \frac{(n-1)x}{2!} = \frac{1 \cdot 3}{4 \cdot 8}$$

$$\Rightarrow \frac{(n-1)x}{2} = \frac{3}{8}$$

$$\Rightarrow \frac{nx}{2} - \frac{x}{2} = \frac{3}{8}$$

$$\Rightarrow \frac{1}{8} - \frac{x}{2} = \frac{3}{8}$$

$$\Rightarrow \frac{x}{2} = -\frac{2}{8}$$

$$\Rightarrow x = -\frac{1}{2}$$

Putting the value of x in Eq. (i),

$$\begin{aligned} n \times \left(-\frac{1}{2}\right) &= \frac{1}{4} \\ \Rightarrow n &= -\frac{1}{2} \end{aligned}$$

$$\begin{aligned} \therefore \text{Sum of series} &= (1+x)^n = \left(1 - \frac{1}{2}\right)^{-\frac{1}{2}} \\ &= \left(\frac{1}{2}\right)^{-\frac{1}{2}} = \sqrt{2} \end{aligned}$$

106. The equation of a straight line passing through (1, 2) and having intercept of length 3 between the straight lines $3x + 4y = 24$ and $3x + 4y = 12$ is

- 1) $7x + 24y - 55 = 0$
- 2) $24x + 7y - 38 = 0$
- 3) $24x - 7y - 10 = 0$
- 4) $7x - 24y + 41 = 0$

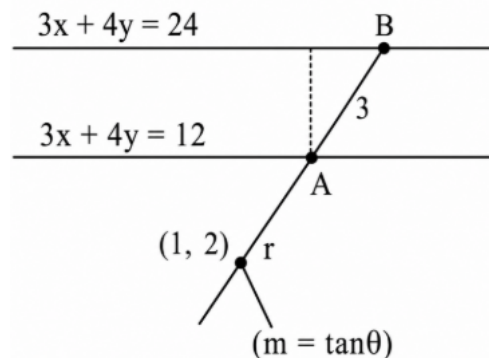
Solution : (Correct Answer: 4)

Let the required line be $y - 2 = m(x - 1)$

This line meets $3x + 4y - 12 = 0$ and $3x + 4y - 24 = 0$ at

$A\left(\frac{4+4m}{3+4m}, \frac{6+9m}{3+4m}\right)$ and $B\left(\frac{16+4m}{3+4m}, \frac{6+21m}{3+4m}\right)$, respectively.

It is given that $AB = 3$



$$\Rightarrow \left(\frac{12}{3+4m}\right)^2 + \left(\frac{12}{3+4m}\right)^2 m^2 = 9$$

$$\Rightarrow m = \frac{7}{24}$$

So, the required line is $y - 2 = \frac{7}{24}(x - 1)$

Or $7x - 24y + 41 = 0$

107. What is the least value of k such that the function $x^2 + kx + 1$ is strictly increasing on (1, 2)

- 1) 1
- 2) -1
- 3) 2
- 4) -2

Solution : (Correct Answer: 4)

Let $f(x) = x^2 + kx + 1$

$f'(x) = 2x + k$

$f(x)$ is strictly increasing on (1, 2)

if $f'(x) > 0$ for $x \in (1, 2)$

$$\Rightarrow 2x + k > 0 \quad \text{for } x \in (1, 2)$$

$$\Rightarrow k > -2x \quad \text{for } x \in (1, 2)$$

$$\text{Now, } 1 < x < 2 \Rightarrow 2 < 2x < 4$$

$$\Rightarrow -2 > -2x > -4$$

$$\Rightarrow -4 < -2x < -2$$

$$\Rightarrow k \geq -2$$

Hence least value of $k = -2$.

108. Let the pairs $\vec{a}, \vec{b}$ and $\vec{c}, \vec{d}$ each determine a plane. Then the planes are parallel if

- 1) $(\vec{a} \times \vec{c}) \times (\vec{b} \times \vec{d}) = \vec{0}$
- 2) $(\vec{a} \times \vec{c}) \cdot (\vec{b} \times \vec{d}) = 0$
- 3) $(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d}) = \vec{0}$
- 4) $(\vec{a} \times \vec{b}) \cdot (\vec{c} \times \vec{d}) = 0$

Solution : (Correct Answer: 3)

Since $\vec{a}$ and $\vec{b}$ are coplanar, therefore $\vec{a} \times \vec{b}$ is a vector perpendicular to the plane containing $\vec{a}$ and $\vec{b}$. Similarly $\vec{c} \times \vec{d}$ is a vector perpendicular to the

plane containing $\vec{c}$ and $\vec{d}$. Thus, the two planes will be parallel if their normals i.e. $\vec{a} \times \vec{b}$ and $\vec{c} \times \vec{d}$ are parallel. $\Rightarrow (\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d}) = \vec{0}$

109. The differential equation that represents all parabolas each of which has a latus rectum $4a$ and whose axes are parallel to the x -axis is

- 1) $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} = 0$
- 2) $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^3 = 0$
- 3) $a\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^3 = 0$
- 4) $2a\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^3 = 0$

Solution : (Correct Answer: 4)

Equation of the family of such parabolas is

$$(y - k)^2 = 4a(x - h) \dots (1)$$

where h & k are arbitrary constants

Differentiating w.r.t. x , we get

$$(y - k)\frac{dy}{dx} = 2a \dots (2)$$

Differentiating again

$$(y - k)\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = 0 \dots (3)$$

Putting value of $(y - k)$ from (2) in (3), we get

$$2a\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^3 = 0, \text{ which is required equation.}$$

110. The perimeter of the triangle with vertices at (1, 0, 0), (0, 1, 0) and (0, 0, 1) is

- 1) 3
- 2) 2
- 3) $2\sqrt{2}$
- 4) $3\sqrt{2}$

Solution : (Correct Answer: 4)

Let $A = (1, 0, 0)$, $B = (0, 1, 0)$ and $C = (0, 0, 1)$

$$\text{So, } AB = \sqrt{(0-1)^2 + (1-0)^2 + 0^2} = \sqrt{2}$$

$$BC = \sqrt{0^2 + (0-1)^2 + (1-0)^2} = \sqrt{2} \text{ and } CA = \sqrt{(1-0)^2 + 0^2 + (0-1)^2} = \sqrt{2} \therefore \text{Perimeter of triangle}$$

$$\therefore \text{Perimeter of triangle} = AB + BC + CA = \sqrt{2} + \sqrt{2} + \sqrt{2} = 3\sqrt{2}$$

English - Section A (MCQ.)

111. Complete the sentence in the following questions with most appropriate choice.

I can write with _____ hand.

- 1) every
- 2) two
- 3) either
- 4) both

Solution : (Correct Answer: 3)

The sentence "I can write with hand." is a reference to the ability to use one of two hands, or possibly both hands, for writing. Thus, the most appropriate completion of the sentence should indicate the capability to use any one of the two hands (left or right) or both. The choices are analyzed as follows:

Option A - every: This option is not suitable because "every" is used to refer to all members of a group of three or more. Since the sentence is about writing with a hand, and individuals typically have two hands, "every" is not the right choice.

Option B - two: "Two" is also incorrect because it literally implies writing with two hands simultaneously, which, although possible, is not the common interpretation or intention behind the statement.

Option C - either: This is the most appropriate choice. "Either" correctly implies a choice between two distinct alternatives, in this case, the left hand or the right hand, without stating a preference for one over the other. It conveys the ability to write with one hand, with the choice being open.

Option D - both: "Both" indicates the use of two things together. While it's true some people might be able to write with both hands (ambidexterity), the statement aiming to be more general and inclusive of all individuals' abilities would best be served by indicating the potential to use one hand or the other.

Therefore, the correct completion for the sentence is Option C - either, which makes the complete sentence: "I can write with either hand."

112. Fill in the blank with the most suitable choice.

I _____ the job if you had paid me enough.

1) would have done 2) had done 3) will do 4) would do

Solution : (Correct Answer: 1)

The correct answer is:

would have done

Here's why:

The sentence "I _____ the job if you had paid me enough." is a counterfactual conditional sentence, meaning it refers to a situation that did not actually happen.

In such sentences, the typical structure is:

If-clause: Past perfect (e.g., "if you had paid me enough")

Main clause: "would have" + past participle (e.g., "would have done")

Therefore, the complete sentence reads:

"I would have done the job if you had paid me enough."

This structure correctly reflects a hypothetical situation in the past where the condition was not met.

113. Pick out the correct synonym of the word- 'Prerogative'.

1) Privilege 2) Obligation 3) Liability 4) Duty

Solution : (Correct Answer: 1)

The correct synonym for the word 'Prerogative' is 'Privilege', which makes Option A the correct choice.

The word 'Prerogative' typically refers to a special right or privilege that is granted to an individual or a group. In essence, it's a benefit or advantage that certain people have, usually due to their position, role, or status. The key feature of a prerogative is that

it's a discretionary power or privilege, exclusive to a person or group and not a universally applied standard.

Options B (Obligation), C (Liability), and D (Duty), on the other hand, all suggest some form of responsibility or burden that someone is required to perform or bear. These terms signify something that one must do, rather than a special or exclusive right they might enjoy, and hence do not align with the meaning of 'Prerogative'.

To sum up, 'Privilege' most accurately captures the essence of 'Prerogative', making Option A the right choice.

114. Select the antonym for the word 'Chaotic'.

1) Haphazard 2) Organised 3) Charming 4) Charismatic
Solution : (Correct Answer: 2)

The word 'chaotic' refers to a state of complete disorder and confusion. Therefore, when looking for an antonym, we are searching for a word that represents the opposite meaning, which would be a state of order, structure, and organization. With this in mind, let's evaluate the provided options:

Option A: Haphazard - This word means lacking any obvious principle of organization, which is actually very similar in meaning to 'chaotic'. Hence, it's not the antonym we're looking for.

Option B: Organised - Being organized implies that things are arranged in a systematic way, with order and planning. This is the direct opposite of chaotic, making it the correct antonym in this context.

Option C: Charming - This word pertains to the appeal or attractiveness of something or someone. It doesn't relate to the concept of order vs. disorder, so it is not suitable as an antonym for 'chaotic'.

Option D: Charismatic - Similar to charming, charismatic refers to a compelling attractiveness or charm that can inspire devotion in others. Like charming, it does not relate to orderliness or organization, and thus, it is not an appropriate antonym for 'chaotic'.

Thus, the antonym for 'chaotic' among the given options is Option B: Organised.

115. Select the most appropriate antonym of the underlined word in the following sentence. The woman in the crowd broke down in hysterics.

1) Aghast 2) Cray 3) Calm 4) Insanity

Solution : (Correct Answer: 3)

The underlined word is "hysterics", which means a state of **extreme emotion or uncontrolled laughter**

or crying. The antonym would therefore describe a state of **composure, peace, or self-control**.

Option A: — means shocked or filled with **Aghast** horror (not opposite).

Option B: — informal and not a proper **Cray** antonym.

Option C: — means peaceful, composed, and not **Calm** emotionally disturbed.

Option D: — means mental instability (not **Insanity** opposite).

Hence, the most appropriate antonym is: **Option C: Calm**

Aptitude - Section A (MCQ)

116. In a certain code language, 'HONEY' is coded as '65' and 'MONEY' is coded as '70'. How will 'SUNNY' be coded in the same language?

- 1) 97 2) 83 3) 93 4) 92

Solution : (Correct Answer: 4)

As,

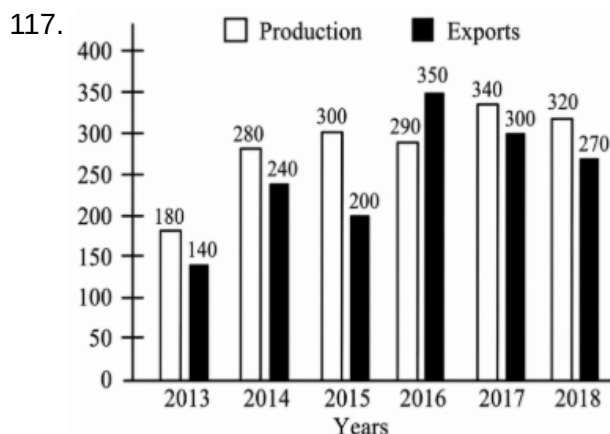
H O N E Y
↓ ↓ ↓ ↓ ↓
8 + 15 + 14 + 5 + 25 alphabetical positions
= 67 - 2 (Number of vowel)
= 65

And,

M O N E Y
↓ ↓ ↓ ↓ ↓
13 + 15 + 14 + 5 + 25 alphabetical positions
= 72 - 2 (Number of vowel)
= 70

Similarly

S U N N Y
↓ ↓ ↓ ↓ ↓
19 + 21 + 14 + 14 + 25 alphabetical positions
= 93 - 1 (Number of vowel)
= 92



By what per cent were the total exports of computers, by the company, in 2013, 2014 and 2018 less than the total production of computers in 2015 to 2017? (correct to one decimal place)

- 1) 30.1% 2) 43.1% 3) 32.6% 4) 28.8%

Solution : (Correct Answer: 1)

Total export during 2013, 2014 and 2018

$$= 140 + 240 + 270 = 650$$

Total production during 2015, 2016 and 2017

$$= 300 + 290 + 340 = 930$$

∴ Required percentage

$$= \frac{(930 - 650)}{930} \times 100 = \frac{280}{930} \times 100 = 30.1\%$$

118. Four letter-clusters have been given, out of which three are alike in some manner and one is different. Select the letter-cluster that is different.

- 1) BFJNR 2) YBFKT 3) VZDHL 4) DHLPT

Solution : (Correct Answer: 2)

From the options,

B F J N R
↓ ↓ ↓ ↓ ↓
+4 +4 +4 +4

Y B F K T
↓ ↓ ↓ ↓ ↓
+3 +4 +5 +9

V Z D H L
↓ ↓ ↓ ↓ ↓
+4 +4 +4 +4

D H L P T
↓ ↓ ↓ ↓ ↓
+4 +4 +4 +4

Hence, 'YBFKT' is odd, while all are follow the same pattern.

119. Select the option that is related to the fifth letter-cluster in the same way as the second letter-cluster is related to the first letter-cluster and the fourth letter-cluster is related to the third letter-cluster.

ABIDE : GFKDC :: CHARM : OTCJE :: BLOOM : ?

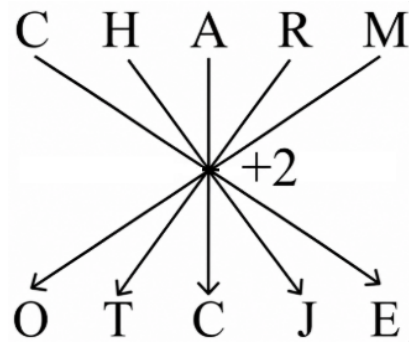
- 1) OQQND2) $\triangle PQNB$ 3) DNQQO4) $\triangle QQDN$

Solution : (Correct Answer: 1)

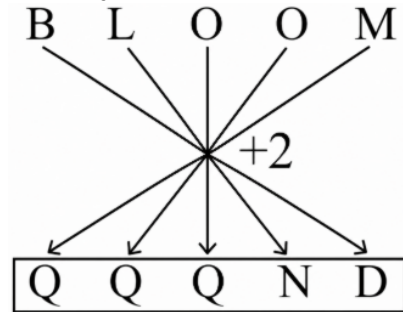
As,

A B I D E
↓ ↓ ↓ ↓ ↓
+2
G F K D C

and



Similarly,



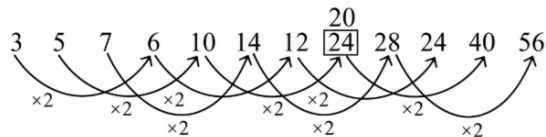
120. In the given series one number is incorrect. Identify the incorrect number from among the options given.

3, 5, 7, 6, 10, 14, 12, 24, 28, 24, 40, 56

- 1) 28 2) 24 3) 10 4) 12

Solution : (Correct Answer: 2)

The pattern of the series is as follows,



Hence, the wrong number is 24.

121. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements

1. Some chimpanzees are tigers.
2. All tigers are elephants.

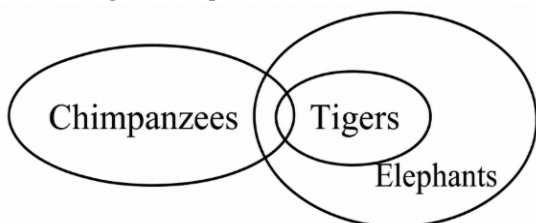
Conclusions

- I. Some elephants are tigers.
II. Some elephants are chimpanzees.

- 1) Only Conclusion I follows 2) Neither I nor II follows 3) Both I and II follow 4) Only Conclusion II follows

Solution : (Correct Answer: 3)

According to the question,



Conclusions I. (✓) II. (✓)

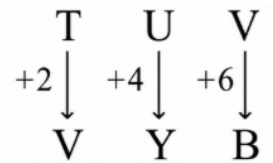
122. Select the letter that is related to the third letter in the same way as the second letter is related to the first letter.

TUV : VYB :: PRA : ?

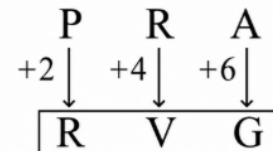
- 1) PRS 2) RVG 3) QVR 4) RVO

Solution : (Correct Answer: 2)

As,



Similarly,



123. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements

- Some plates are knives.
Some knives are bottles.
Many bottles are bowls.

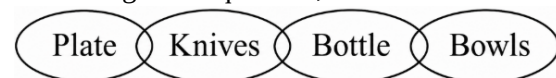
Conclusions

- I. Some plates are bowls.
II. Not a single plate is bowl.

- 1) If only I follow. 2) If only II follows. 3) If both the conclusions follow. 4) If either conclusion I or II follows.

Solution : (Correct Answer: 4)

According to the question,

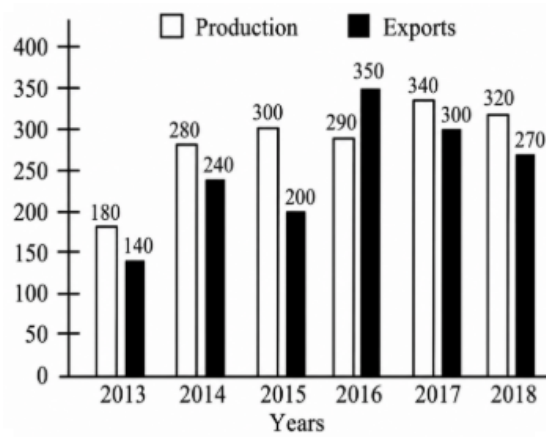


Conclusion

- I. × II. ×
(either I or II follows)

Conclusion I and II are complementary pair. Hence, option (d) is correct.

124.



The total production of computers in 2013, 2015 and 2018 is $x\%$ of the total exports of computers by the company during the 6 yr.

The value of x is

- 1) $53\frac{1}{3}\%$ 2) $49\frac{2}{3}\%$ 3) $52\frac{1}{3}\%$ 4) $46\frac{1}{3}\%$

Solution : (Correct Answer: 1)

Total production of computers in 2013, 2014 and 2015

$$= 180 + 300 + 320 = 800$$

Total export of computers

$$= 140 + 240 + 200 + 350 + 300 + 270 = 1500$$

$$\text{Now, } x = \frac{800}{1500} \times 100\% = 53\frac{1}{3}\%$$

125. In a certain code language, 'RUBBER' is coded as '102' and 'JELLY' is coded as '76'. How will 'LABEL' be coded in the same language?

- 1) 108 2) 132 3) 76 4) 98

Solution : (Correct Answer: 1)

As,

$$\begin{array}{cccccc}
 \text{R} & \text{U} & \text{B} & \text{B} & \text{E} & \text{R} \\
 \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\
 9 & + & 6 & + & 25 & + & 25 & + & 22 & + & 9 & = & 96
 \end{array}$$

(Opposite place value of letters)

$$\Rightarrow 96 + 6 \text{ (Total number of letters)} = 102$$

and

$$\begin{array}{ccccc}
 \text{J} & \text{E} & \text{L} & \text{L} & \text{Y} \\
 \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\
 \Rightarrow 17 & + & 22 & + & 15 & + & 15 & + & 2 & = & 71
 \end{array}$$

(Opposite place value of letters)

$$\Rightarrow 71 + 5 \text{ (Total number of letters)} = 76$$

Similarly,

$$\begin{array}{ccccc}
 \text{L} & \text{A} & \text{B} & \text{E} & \text{L} \\
 \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\
 15 & + & 26 & + & 25 & + & 22 & + & 15 & = & 103
 \end{array}$$

(Opposite place value of letters)

$$\Rightarrow 103 + 5 \text{ (Total number of letters)} = 108$$