CAREERS 360

PRACTICE Series

MHT-CET 2025

Sample Paper

MHT-CET 2025

Physics

Q. 1 An electric dipole in a uniform electric field experiences (When it is placed at an angle θ with the field)

Option 1:
Force and torque both

Option 2:
Force but no torque

Option 3:
Torque but no force

Option 4:
No force and no torque

Correct Answer:
Torque but no force

Solution:
As we have learned

Torque Experienced by the dipole -

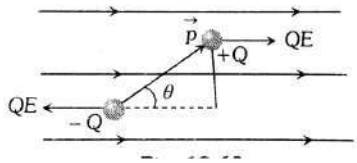
$$\vec{\tau} = \vec{P} \times \vec{E}$$

$$\vec{\tau} = PE\sin\Theta$$

$$\Theta = 0^\circ \quad \tau = 0$$

$$\Theta = \frac{\pi}{2} \qquad \tau = max^m$$

- wherein



In uniform electric field dipole experience only torque, but no force.

Q. 2 For a measurement of the radius of a ball following readings are taken:

3.26cm 3.28cm 3.31cm

absolute error for the first reading is :

Option 1:
0.01

Option 2:
0.02cm

Option 3:
0.00cm

Option 4:
0.04cm

Correct Answer:
0.02cm

Solution:
As we learn

$$a_m = \frac{a_1 + a_2 + a_3}{3}$$

$$a_m = \frac{3.26 + 3.28 + 3.31}{3} = 3.28$$

$$\Delta a_1 = 3.28 - 3.26 = 0.02cm$$

Q. 3 amplification is

Option 1:
the process which provide information

Option 2:
the process which reduced the strengh of signal

Option 3:
the process which increase the amplitude and hence increase the strength of message signal

Option 4:
a type of broadcasting

Correct Answer:
the process which increase the amplitude and hence increase the strength of message signal

Solution:
as we learn

Amplification -

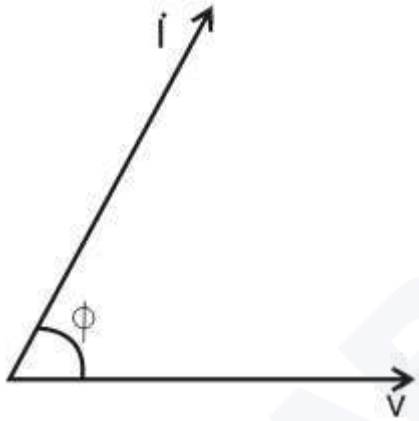
It is a process of increasing the amplitude of a signal.

- wherein

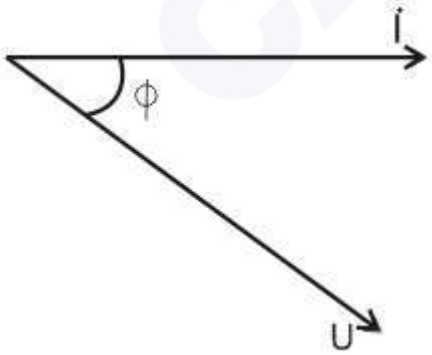
It is required in order to compensate for attenuation of signal.

Q. 4 In an alternative circuit the voltage is leading by phase angle ϕ then correct representation of phasor diagram is:

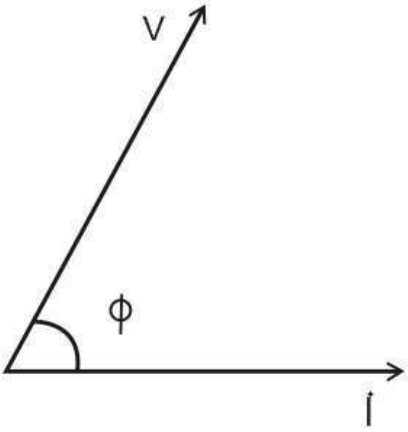
Option 1:



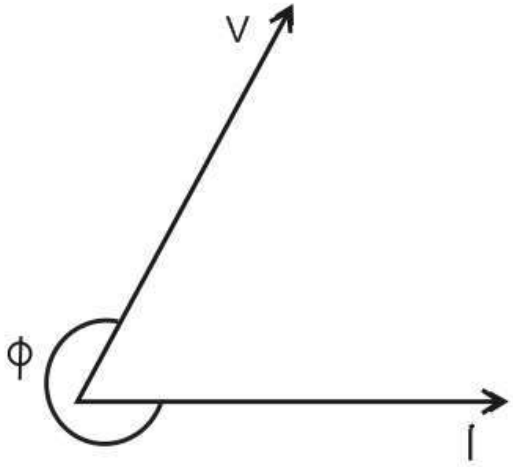
Option 2:



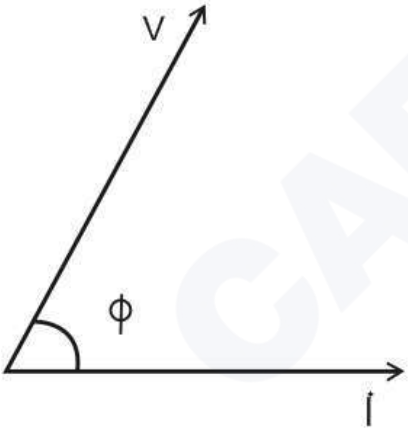
Option 3:



Option 4:



Correct Answer:



Solution:
As we learn

Phasor diagram -

A diagram representing alternating current and alternating voltage as vectors with the phase angle between them.

- wherein

i.e. R - L - and C - circuit

Q. 5 A charged particle enter in a magnetic feild perpendicullar to the direction of magnetic field then the path of particle will be -

Option 1:
Straight line

Option 2:
Parabola

Option 3:
Circle

Option 4:
Hyperbola

Correct Answer:
Circle

Solution:
As we learn

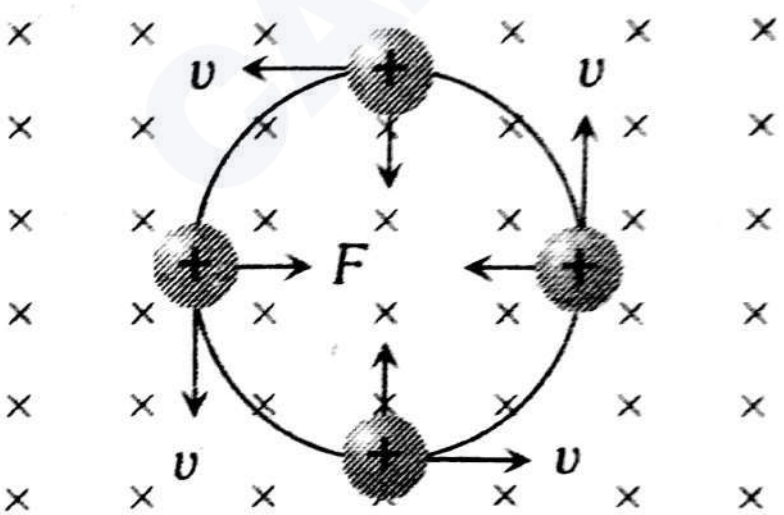
Path of charge particle If ? = 90° -

Trajectory of the particle is a circle

i.e. F=qVB

max

- wherein



For charged particle moving M magnetic field perpendicular to the field the force will be always perpendicular to the direction of motion so path will be circular.

Correct option is 3.

Q. 6 There are two metallic spheres of same radii but one is solid and the other is hollow, then

Option 1:
Solid sphere can be given more charge

Option 2:
Hollow sphere can be given more charge

Option 3:
They can be charged equally (maximum)

Option 4:
None of the above

Correct Answer:
They can be charged equally (maximum)

Solution:
If the surface is uniform the charge distributes uniformly.

Because in the case of a metallic sphere either solid or hollow, the charge will reside on the surface of the sphere. Since both spheres have the same surface area, they can hold an equal maximum charge.

Q. 7 If a person displaced a box inside the train through displacement $\vec{S}_1$ with the help of force $\vec{F}_1$,while during this time interval displacement of train was $\vec{S}_2$. Then find work done by force F_1.

Option 1:
$\vec{F}_1 \cdot \vec{S}_1$

Option 2:
$\vec{F}_1 \cdot \vec{S}_2$

Option 3:
$\vec{F}_1 \left(S_1 + \vec{S}_2 \right)$

Option 4:
$\vec{F}_1 \cdot \left(2\vec{S}_1 - \vec{S}_2 \right)$

Correct Answer:
$\vec{F}_1 \left(S_1 + \vec{S}_2 \right)$

Solution:
As we learned

Work done depends on the frame of refrence -

$$W = \vec{F} \cdot \left(\vec{S} + \vec{S_0} \right)$$

- wherein

i.e. A person is pushing a box inside a moving train with a force $\vec{F}$

Displacement inside train $\vec{S}$

Displacement of the train is $\vec{S_0}$

$$W = \vec{F} \cdot \left(\vec{S} + \vec{S_0} \right)$$

Because work done depends on the frame of referrance.

Q. 8 If size of electrode is doubled then internal resistance becomes

Option 1:
1/4 times original value

Option 2:
1/2 times original value

Option 3:
2 times original value

Option 4:
4 times original value

Correct Answer:
4 times original value

Solution:
As we learnt

The internal resistance of a cell -

Depends on the area of the electrodes

- wherein

$r \alpha A$

If the size is doubled area becomes 4 times

So, resistance becomes 4 times.

Q. 9 Conductivity depends on

Option 1:
drift speed

Option 2:
electric field

Option 3:
number of electron/volume

Option 4:
All of the above

Correct Answer:
All of the above

Solution:
As we learnt

Conductivity -

$$\sigma = \frac{1}{\rho}$$

- wherein

σ — Conductivity

ρ — Resistivity

$$\sigma = \frac{J}{E} = \frac{nV_d e}{E}$$

$\sigma \alpha n$

$\sigma \alpha v_d$

$\sigma \alpha \frac{1}{E}$

Q. 10 When the ideal monoatomic gas is heated at constant pressure. Then the ratio of 'change in interal energy of gas' to ' heat energy supply ' is equal to":

Option 1:
1

Option 2:
$\frac{3}{5}$

Option 3:
$\frac{5}{3}$

Option 4:
4

Correct Answer:
$\frac{3}{5}$

Solution:
As we learn

First law in isobaric process -

$\Delta U = n\, C_v \Delta T$

$= n \frac{R}{\gamma - 1} \Delta T$

- wherein

$\Delta Q = \Delta U + W$

$= n \frac{\gamma\, R}{\gamma - 1} \cdot \Delta T$

$\Delta Q = n C_p\, \Delta T$

When pressure is constant

$\Delta Q = heat supplied = nC_p\Delta T$

$\Delta u = nC_v\Delta T$ = Change in internal energy

So, $\frac{\Delta u}{\Delta Q} = \frac{nC_v\Delta T}{nC_p\Delta T} = \frac{C_v}{C_p} = \frac{1}{y}$

For monoatomic y = 5/3

so , $\frac{\Delta u}{\Delta Q} = \frac{3}{5}$

Q. 11

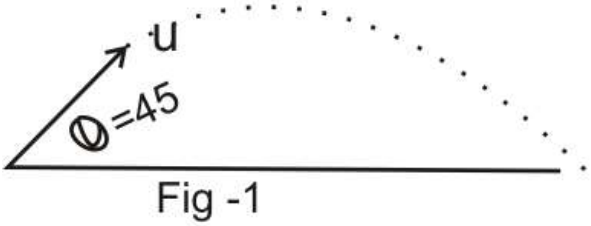


Fig -1

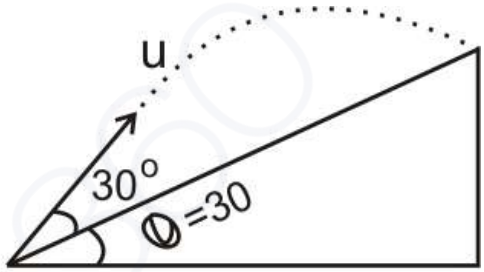


Fig-2

In the above figure R_1 is the range for the figure 1, while R_2 is the range along incline plane for figure 2. Then find $\frac{R_2}{R_1}$:

Option 1:

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

Option 2:

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

Option 3:

$\frac{1}{\sqrt{3}}$

Option 4:

$\sqrt{3}$

Correct Answer:

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

Solution:

$R_1 = \frac{u^2 \sin(2\theta)}{g} = \frac{u^2 \sin(90)}{g} = \frac{u^2}{g}$

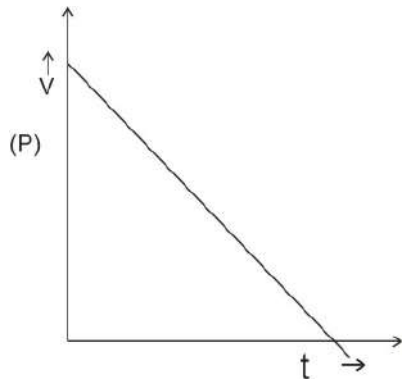
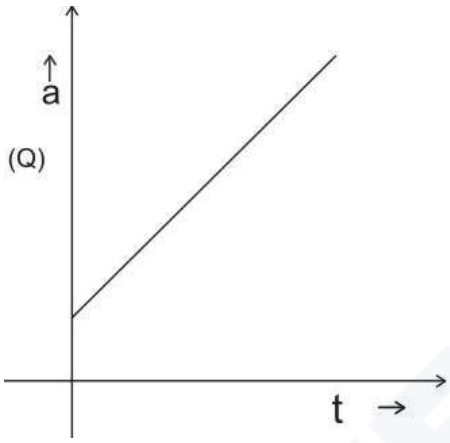
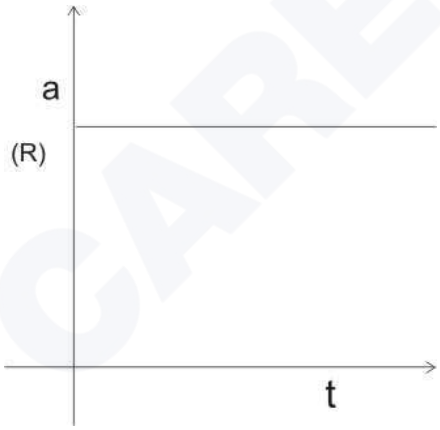
$$R_2 = \frac{2u^2 \sin(2\alpha - \beta)\cos\alpha}{g\cos^2\beta}$$

$\alpha = 30, \beta = 30$

$$R_2 = \frac{2u^2 \sin 30 \cos 30}{g \cos 30 \cos 30} = \frac{2u^2}{g}\tan 30 = [\frac{2u^2}{g} \times \frac{1}{\sqrt{3}}] = [\frac{2}{\sqrt{3}}\frac{u^2}{g}]$$

$$\frac{R_2}{R_1} = \frac{2}{\sqrt{3}}$$

Q. 12 Match the following cases for a moving object

	(1) Positive Acceleration
	(2) Negative Acceleration
	(3) Zero Acceleration

Option 1:
P - 1 , Q - 2 , R - 3

Option 2:
P-2 , Q - 1 , R - 1

Option 3:
P- 2 , Q - 1 , R - 3

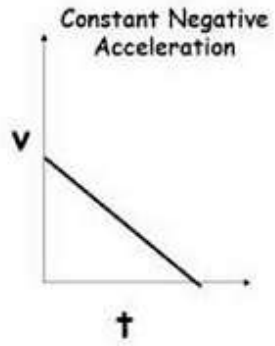
Option 4:
P - 3 , Q - 1 , R - 2

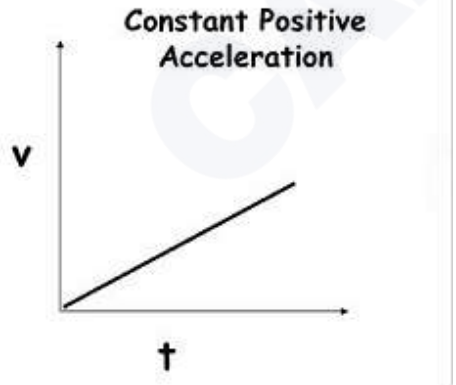
Correct Answer:
P- 2 , Q - 1 , R - 3

Solution:
As we have learned

Graphical Representation of positive, Negative and Zero Acceleration -

Three types of acceleration and their graphical representation a) position time graph and b) velocity time graph





-

for $\theta > 90$ acceleration is negative

for $\theta < 90$ acceleration is positive

Q. 13 The impedance of a certain ac circuit is 30 ohms. If the net resistance in the circuit is 15 ohms then the power factor of the circuit will be-

Option 1:
0.5

Option 2:
1

Option 3:
0.25

Option 4:
Zero

Correct Answer:
0.5

Solution:
As we have learnt

Power factor -

Ratio of resistance and impedance$(cos\phi)$.

Power factor $= \cos\phi = \frac{R}{Z} = \frac{15}{30} = \frac{1}{2} = 0.5$

Q. 14 The velocity of a particle is $v = v_0 + gt + Ft^2$. Its position is $x = 0$ at $t = 0$; then its displacement after time $(t = 1)$ is :

Option 1:
$v_0 + g + F$

Option 2:
$v_0 + \frac{g}{2} + \frac{F}{3}$

Option 3:
$v_0 + \frac{g}{2} + F$

Option 4:
$v_0 + 2g + 3F$

Correct Answer:

$v_0 + \frac{g}{2} + \frac{F}{3}$

Solution:

$$\mathrm{v} = \mathrm{v_0} + \mathrm{gt} + \mathrm{Ft}^2$$

$$\frac{\mathrm{ds}}{\mathrm{dt}} = \mathrm{v_0} + \mathrm{gt} + \mathrm{Ft}^2$$

$$\int_0^x \mathrm{ds} = \int_0^1 \left(v_0 + gt + \mathrm{Ft}^2\right) \mathrm{dt}$$

$$x = \left[v_0 t + \frac{gt^2}{2} + \frac{Ft^3}{3}\right]_0^1$$

$$x = v_0 + \frac{g}{2} + \frac{F}{3}$$

Q. 15 Which of the folllowing is true for the addition of the vectors?

Option 1:

$\vec{A} + \vec{B} = \vec{B} + \vec{A}$

Option 2:

$(\vec{A} + \vec{B}) + \vec{C} \neq \vec{A}(\vec{B} + \vec{C})$

Option 3:

$\vec{A} + \vec{B} = \left|\vec{A}\right| + \left|\vec{B}\right|$

Option 4:

Both A and B

Correct Answer:

$\vec{A} + \vec{B} = \vec{B} + \vec{A}$

Solution:

As we learn

Commutative law of vector addition -

Sum of vector remains the same in whatever order they may be added.

$\vec{P} + \vec{Q} = \vec{Q} + \vec{P}$

Commutative law

- wherein

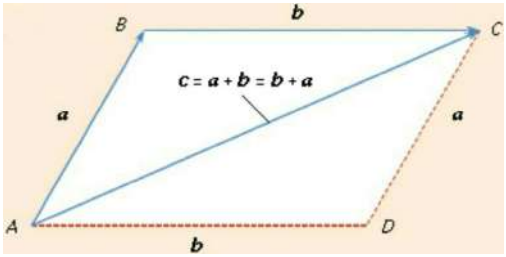


Fig. Shows Commutative law of vector addition.

Q. 16 The dimension of stafen's constant is

Option 1:
$[M^1L^1T^{-3}\Theta^{-4}]$

Option 2:
$[M^1T^{-3}\Theta^{-3}]$

Option 3:
$[M^2T^{-3}\Theta^{-3}]$

Option 4:
$[M^1T^{-3}\Theta^{-4}]$

Correct Answer:
$[M^1T^{-3}\Theta^{-4}]$

Solution:
As we learn

Stefan's Law -

$$E\ \alpha\ \theta^4$$

$$\Rightarrow\ E = \sigma\theta^4$$

- wherein

σ =Stefan's constant

$$\sigma = 5.67 \times 10^{-8} W/m^2K^4$$

According to Stefan's law

$$\Rightarrow\ E = \sigma T^4$$

$$\sigma = \frac{E}{T^4} \Rightarrow W/m^2K^4$$

$= [M^1T^{-3}\Theta^{-4}]$

Q. 17 According to Fleming's left hand rule first finger indicates:

Option 1:
The direction of force on a charged particle

Option 2:
The direction of magnetic feild

Option 3:
The direction of motion of charged particle.

Option 4:
The direction of electric feild.

Correct Answer:
The direction of magnetic feild

Solution:
As we learn

First finger -

Direction of magnetic field

As per the definition. First finger indicates the direction of magneti fields.

Correct option is 2.

Q. 18 When two lenses of focal length F1 and F2 respectively are are placed co-axiallly at adistance 'd' from each other the equivalent focal length is F then the value of 1/F is

Option 1:
$\frac{1}{f_1}+\frac{1}{f_2}$

Option 2:
$\frac{d}{f_1}+\frac{d}{f_2}$

Option 3:

$$\frac{1}{f_1}+\frac{1}{f_2}-\frac{d}{f_1 f_2}$$

Option 4:

$$\frac{1}{f_1}+\frac{1}{f_2}+\frac{d}{f_1 f_2}$$

Correct Answer:

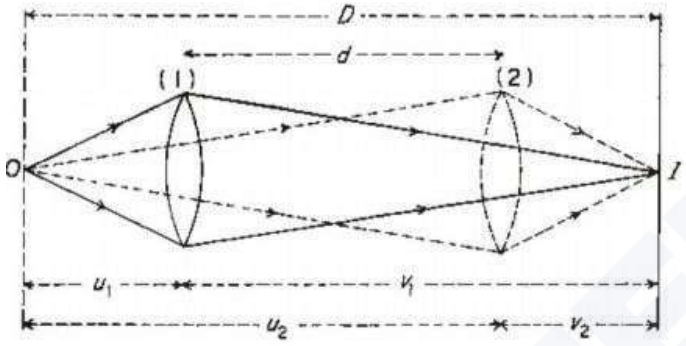
$$\frac{1}{f_1}+\frac{1}{f_2}-\frac{d}{f_1 f_2}$$

Solution:

As we learn

Lens displacement method -

$$d=\sqrt{D\left(D-4f\right)}$$



- wherein

$D=$ Distance between two position of a convex lens.

$D=$ Distance between object and screen

$$\frac{1}{f}=\frac{1}{f_1}+\frac{1}{f_2}-\frac{d}{f1f2}$$

Q. 19 Electron current will flow from

Option 1:

Higher potential to lower potential

Option 2:

Lower potential to Higher potential

Option 3:

It is defined along flow of electron

Option 4:
Both 2 and 3.

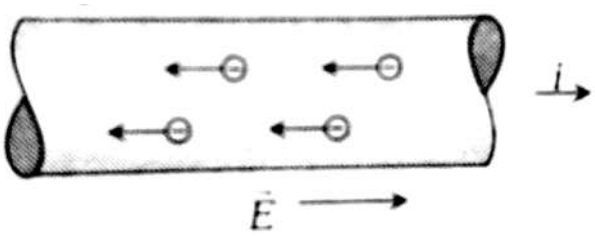
Correct Answer:
Both 2 and 3.

Solution:
As we learnt

Electron current -

Negative terminal to Positive terminal

- wherein



Electron current flow from lower potential to higher potential as its defined as flow of electron which is negative charge.

A negative charge experience force in the direction opposite of electric field which is from lower to higher potential.

Q. 20 Moment of inertia of a solid sphere of mass M and radius R about its diameter is

Option 1:
$\frac{1}{2}Mr^2$

Option 2:
$\frac{2}{3}MR^2$

Option 3:
$\frac{2}{5}Mr^2$

Option 4:

MR^2

Correct Answer:

$\frac{2}{5}Mr^2$

Solution:

As we learned

Moment of inertia for solid sphere -

$$I = \frac{2}{5}MR^2$$

About a diameter.

its moment of inertia about any diameter is $\frac{2}{5}Mr^2$

Q. 21 A charged particle enter in a magnetic field with velocity v at an angle 60 with the field . If the time period of helical path is 2 sec the pitch of the helical path is

Option 1:

2 v

Option 2:

v / 2

Option 3:

v

Option 4:

v/8

Correct Answer:

v

Solution:

As we have learned

Pitch of helix -

$$P = (V\cos\theta)T - \frac{2\pi m}{qB}(V\cos\theta)$$

$$= 2 \times v \times \cos 60 = v$$

Q. 22 In Bohr model of hydrogen atom, orbital frequency of the electron depends on the principal quantum number as :

Option 1:
$f \alpha n$

Option 2:
$f \alpha n^2$

Option 3:
$f \alpha \frac{1}{n^3}$

Option 4:
$f \alpha \frac{1}{n^2}$

Correct Answer:
$f \alpha \frac{1}{n^3}$

Solution:
As we learn

Orbital Frequency of electron -

$$f = \frac{mz^2e^4}{4\epsilon_0^2 n^3 h^3}$$

- wherein

$$f \alpha \frac{Z^2}{h^3}$$

Orbital Frequency of electron -

$$f = \frac{mz^2e^4}{4\epsilon_0^2 n^3 h^3} \rightarrow f \alpha \frac{Z^2}{h^3}$$

Q. 23 The coefficient of apperent expansion of liquid is

Option 1:
Depend upon initial volume of liquid

Option 2:
Independent of rise of temperature

Option 3:
Independent apperent increase in the volume of liquid

Option 4:
None of these

Correct Answer:
Depend upon initial volume of liquid

Solution:
As we learn

Co-efficient of Apparent Expansion -

$$\gamma_a = \frac{Apparent\ expansion\ in\ Volume}{Initial\ volume \times \Delta\theta}$$

$$\gamma_a = \frac{(\Delta v)_a}{V \times \Delta\theta}$$

$$\gamma_a = \frac{(\Delta v)_a}{V\Delta\theta}$$

It depends upon initial volume V.

Q. 24 The position of a particles as a function of time t , is given by

$$x(t) = at + bt^2 - ct^3$$

where a,b,and c are constants . When the particle attains zero acceleration , then its velocity will be :

Option 1:

$$a + \frac{b^2}{4c}$$

Option 2:

$a + \frac{b^2}{3c}$

Option 3:

$a + \frac{b^2}{c}$

Option 4:

$a + \frac{b^2}{2c}$

Correct Answer:

$a + \frac{b^2}{3c}$

Solution:

Given :

$$x(t) = at + bt^2 - ct^3$$

$$v = \frac{dx}{dt} = a + 2bt - 3ct^2$$

$$a = \frac{dv}{dt} = 2b - 6ct$$

$$a = 0 \Rightarrow t = \frac{2b}{6c} = \frac{b}{3c}$$

$$\text{So, Velocity at time } t = \frac{b}{3c}$$

$$V = a + 2b \times \frac{b}{3c} - 3c \times \frac{b^2}{9c^2}$$

$$V = a + \frac{b^2}{3c}$$

Q. 25 If angle between direction of magnetic field and plane of surface is 0^0 the value of net flux through the surface is:

[B - magnitude of magnetic flux and A - surface area magnitude]

Option 1:

BA

Option 2:
$\frac{BA}{2}$

Option 3:
2BA

Option 4:
Zero

Correct Answer:
Zero

Solution:

IF $\theta = \frac{\pi}{2}$ -

$\phi = 0$

- wherein

Flux will be zero

$\phi = BA\cos\theta$

$\theta = \frac{\pi}{2} between \vec{B} and \vec{A}$

so $\phi = 0$

Q. 26 The excess pressure on liquid surface is due to -

Option 1:
Pressure difference between two sides of liquids

Option 2:
Atmospheric pressure

Option 3:
Surface tension

Option 4:
Pressure due to wall of container

Correct Answer:
Pressure difference between two sides of liquids

Solution:

Excess Pressure -

Difference of pressure between two sides of the liquid surface.

- wherein

Excess pressure is provided by hydrostatic pressure

Pressure excess is due to pressure difference between two sides of liquids .

Q. 27 Whic of the following scale of temperature never has negative value-

Option 1:
Kelvin

Option 2:
celcius

Option 3:
Fahrenheit

Option 4:
Reaumur

Correct Answer:
Kelvin

Solution:
As we learn

Kelvin Scale -

The Kelvin temperature scale is also known as thermodynamic scale.

- wherein

Temperature measured on this scale are in Kelvin(K).

Kelvin scale never has negative value.

Q. 28 Aclinic lines are the lines

Option 1:
Joining places of zero dip

Option 2:
Joining places of equal declination

Option 3:
Joining points of equal dip

Option 4:
Which pass through places having zero declination

Correct Answer:
Joining places of zero dip

Solution:
As we have learned

Aclinic line -

A line which passes through places having zero dip

Q. 29 An electron (mass = $9.1 \times 10^{-31} kg$ and charge = $1.6 \times 10^{-19} C$) is sent in an electric field of intensity $1 \times 10^{6} V/m$ How long would it take for the electron, starting from rest, to attain one–tenth the velocity of light

Option 1:
$1.7 \times 10^{-12} sec$

Option 2:
$1.7 \times 10^{-6} sec$

Option 3:
$1.7 \times 10^{-8} sec$

Option 4:
$1.7 \times 10^{-10} sec$

Correct Answer:
$1.7 \times 10^{-10} sec$

Solution:
As we have learnt,

when Charged Particle at rest in uniform field -

Velocity -

$$v = \frac{QEt}{m} = \sqrt{\frac{2Q\Delta V}{m}}$$

$\Delta V =$ Potential difference.

By using

$$v = \frac{QEt}{m} \Rightarrow \frac{1}{10} \times 3 \times 10^8 = \frac{1.6 \times 10^{-19} \times 10^6 \times t}{9.1 \times 10^{-31}} \Rightarrow t = 1.7 \times 10^{-10} s$$

Q. 30 A particle is thrown with 10m/s at an angle of 60° with horizontal the time at which its velocity is perpendicular to the initial velocity is (g = 10 m/s)

Option 1:
$\sqrt{3}\ sec$

Option 2:
$2\sqrt{3}\ sec$

Option 3:
$\frac{2}{\sqrt{3}}\ sec$

Option 4:
$\frac{4}{\sqrt{3}}\ sec$

Correct Answer:
$\frac{2}{\sqrt{3}}\ sec$

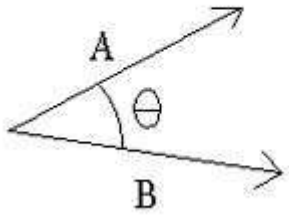
Solution:
As we learned

Scalar , Dot or Inner Product -

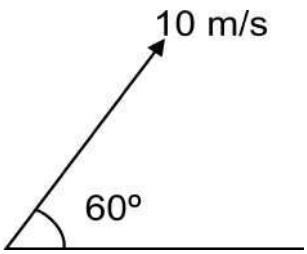
Scalar product of two vector $\vec{A}$ & $\vec{B}$ written as $\vec{A} \cdot \vec{B}$ is a scalar quantity given by the product of magnitude of $\vec{A}$ & $\vec{B}$ and the cosine of smaller angle between them.

$$\vec{A} \cdot \vec{B} = A\,B \cdot \cos\Theta$$

- wherein



showing representation of scalar products of vectors.



$u = 10\cos 60^\circ \hat{i} + 10\sin 60^\circ \hat{j}$

$= 5(\hat{i} + \sqrt{3}\hat{j})$

$V_y = u_y - gt = 5\sqrt{3} - 10t (here\ use\ g = 10)$

$\vec{V} = 5\hat{i} + (5\sqrt{3} - 10t)\hat{j}$

$since\ \vec{V}\ is\ perpendicular\ to\ \vec{u} hence\ \vec{u} \cdot \vec{V} = 0$

$\Rightarrow 5(\hat{i} + \sqrt{3}\hat{j}) \cdot 5(\hat{i} + (\sqrt{3} - 2t)\hat{j}) = 0$

$\Rightarrow 1 + \sqrt{3}(\sqrt{3} - 2t) = 0$

$or\ 1 + 3 - 2\sqrt{3}t = 0$

$\Rightarrow t = \frac{2}{\sqrt{3}} sec$

Q. 31 Which of the following is a scalar quantity ?

Option 1:
Current

Option 2:
Electric field

Option 3:
Force

Option 4:
Displacement

Correct Answer:
Current

Solution:

Scalar Quantity -

Scalar Quantity can be added or subtracted by the laws of addition or subtraction

- wherein

It does not specify the direction

Current is a scalar quantity because it does not follow the rules of vector.

Correct option is 1

Q. 32 Which of the following case motion is three dimensional motion

Option 1:
Motion of a flying kite

Option 2:
Motion of freely falling body

Option 3:
Motion of insect moving on horizontal surface

Option 4:
Motion of monkey climbing on vertical pole

Correct Answer:
Motion of a flying kite

Solution:
As we have learnt,

Three Dimension (3-D). -

When all the three coordinates are used to describe the motion of an object.

$\rightarrow$ Motion in space is 3-D.

- wherein

e.g: object moving in space.

Motion of a flying kite is three-dimensional motion.

Q. 33 Two vectors $\vec{A}\ and\ \vec{B}$ have equal magnitudes. The magnitudes of $\left(\vec{A}+\vec{B}\right)$ is 'n' times the magnitudes of $\left(\vec{A}-\vec{B}\right)$. The angle between $\vec{A}\ and\ \vec{B}$ is :

Option 1:

$\sin^{-1}\left[\frac{n-1}{n+1}\right]$

Option 2:

$\cos^{-1}\left[\frac{n^2-1}{n^2+1}\right]$

Option 3:

$\sin^{-1}\left[\frac{n^2-1}{n^2+1}\right]$

Option 4:

$\cos^{-1}\left[\frac{n-1}{n+1}\right]$

Correct Answer:

$\cos^{-1}\left[\frac{n^2-1}{n^2+1}\right]$

Solution:

Triangle law of vector addition -

$$A^2+B^2+2AB\cos\theta=n^2\left(A^2+B^2-2AB\cos\theta\right)$$

$$\because\left|\vec{A}\right|=\left|\vec{B}\right|$$

$$\therefore A^2+A^2+2A^2\cos\theta=n^2\left(A^2+A^2-2A^2\cos\theta\right)$$

$$2A^2\left(1+\cos\theta\right)=2A^2n^2\left(1-\cos\theta\right)$$

$$\cos\theta\left(1+n^2\right)=n^2-1$$

$$\cos\theta=\frac{n^2-1}{n^2+1}$$

$$\theta=\cos^{-1}\left(\frac{n^2-1}{n^2+1}\right)$$

Q. 34 Two slab of equal length and area of cross- section A and 2A have thermal conductivity K and 3K respectively. The equivalent thermal conductivity of the parallel combination is

Option 1:

$\frac{3K}{2}$

Option 2:

$\frac{5K}{3}$

Option 3:

$\frac{7K}{3}$

Option 4:

$\frac{4K}{3}$

Correct Answer:

$\frac{7K}{3}$

Solution:
As we learn

If l1 = l2 -

$$\theta=\frac{k_1\theta_1+k_2\theta_2}{k_1+k_2}$$

- wherein

θ =Also known as junction temperature.

$$K_p = \frac{K_1A_1 + K_2A_2}{A_1 + A_2}$$

$$= \frac{KA + (3K)(2A)}{3A}$$

$$= \frac{7K}{3}$$

Q. 35 An inductor of 5mH is connected in series to 220V, 50Hz supply. The susceptence of the circuit in Siemen's is:

Option 1:
0.2

Option 2:
$\frac{1}{\pi}$

Option 3:
$\frac{2}{\pi}$

Option 4:
0.5

Correct Answer:
$\frac{2}{\pi}$

Solution:
As we learn

Inductive susceptance (S_{L}) -

$$S_L = \frac{1}{X_L} = \frac{1}{2\pi\nu L}$$

Inductive susceptance

$$S_L = \frac{1}{X_L} = \frac{1}{2\pi fl} = \frac{1}{2\pi \times 50 \times 5 \times 10^{-3}} = \frac{2}{\pi}$$

Q. 36 The average binding energy por nuclean is maximum for the nucleus:

Option 1:
$_{92}U^{238}$

Option 2:
$_{26}Fe^{56}$

Option 3:
$_{2}He^{4}$

Option 4:
$_{8}O^{16}$

Correct Answer:
$_{26}Fe^{56}$

Solution:
As we learn

Binding energy per nuecleous increase with atomic number. The greater the binding energy per nucleous the more stable is the nueleus.

- The maximum binding energy per nucleon occurs at around mass number A = 50, and corresponds to the most stable nuclei. Iron nucleus Fe^{56} is located close to the peak with a binding energy per nucleon value of approximately 8.8 MeV. It's one of the most stable nuclides that exist.

Q. 37 The period of oscillation of a simple pendulum of length L is suspended from the roof of a vehicle which moves without friction down an inclined plane of inclination 'α ' is given by

Option 1:
$2\pi\sqrt{\frac{L}{g\cos\alpha}}$

Option 2:
$2\pi\sqrt{\frac{L}{g\sin\alpha}}$

Option 3:
$2\pi\sqrt{\frac{L}{g}}$

Option 4:

$2\pi\sqrt{\frac{L}{g\tan\alpha}}$

Correct Answer:

$2\pi\sqrt{\frac{L}{g\cos\alpha}}$

Solution:
As we learnt in

Time period of simple pendulum accelerating down an incline -

$$T=2\pi\sqrt{\frac{l}{g\cos\Theta}}$$

- wherein

$l=$ length of pendulum

$g=$ acceleration due to gravity.

$\theta=$ angle of inclination

$$T=2\pi\sqrt{\frac{L}{g_{eff}}}\Rightarrow 2\pi\sqrt{\frac{L}{g\cos\alpha}}$$

Q. 38 An electron moving with the speed 5×10^{6} m/s is shot parallel to the electric field of intensity $1\times10^{3}N/C$. The field is responsible for the retardation of the motion of electrons. Now evaluate the distance traveled by the electron before coming to rest for an instant (mass of $e=9\times10^{-31}kg$ charge $=1.6\times10^{-19}C$)

Option 1:
7m

Option 2:
0.7 mm

Option 3:
7cm

Option 4:
0.7 cm

Correct Answer:
7cm

Solution:
As we have learnt,

when Charged Particle at rest in uniform field -

Force and acceleration

$F = QE$

$a = \frac{QE}{m}$

m - mass

Q - charge

E - Electric field strength.

Electric force $qE = ma \Rightarrow a = \frac{QE}{m} \therefore a = \frac{1.6 \times 10^{-19} \times 1 \times 10^{3}}{9 \times 10^{-31}} = \frac{1.6}{9} \times 10^{15}$

$u = 5 \times 10^{6}$ and $v = 0 \therefore$ from $v^2 = u^2 - 2as \Rightarrow s = \frac{u^2}{2a}$

$\therefore Distance\ s = \frac{(5 \times 10^{6})^2 \times 9}{2 \times 1.6 \times 10^{15}} = 7cm(approx)$

Q. 39 For a inelastic collision value coefficient of restitution (e) can never be

Option 1:
2

Option 2:
-2

Option 3:
1

Option 4:
All of these

Correct Answer:
All of these

Solution:
Inelastic Collision -

$$e < 1$$

$$e \ : \ coeffecient\ of\ restitution$$

Also it cannot be less than or equal to zero

Q. 40 Paramagnetic substances are:

Option 1:
Feebly attracted by magnets

Option 2:
Strongly attracted by magnets

Option 3:
Feebly repelled by magnets

Option 4:
Strongly replled by magnets

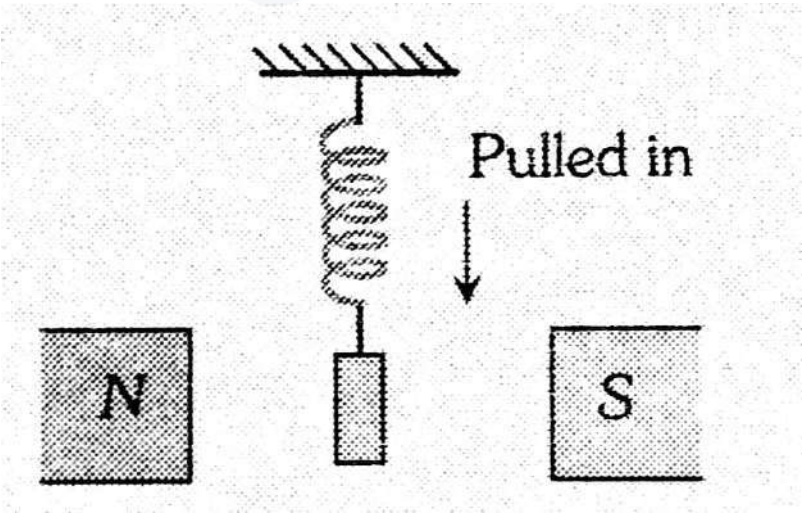
Correct Answer:
Feebly attracted by magnets

Solution:
As we learn

Behaviour in a non-uniform magnetic field -

These are feebly attracted in an external magnetic field (in paramagnetic substance)

- wherein



Property of paramagnetic substances.

Q. 41 Electric field between the two spheres of a charged spherical condenser

Option 1:
Is zero

Option 2:
Is constant

Option 3:
Increases with distance from the centre

Option 4:
Decreases with distance from the centre

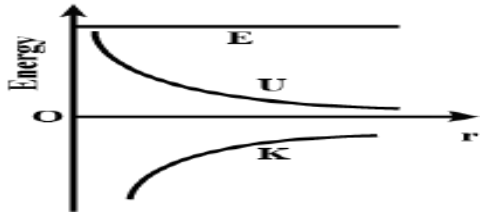
Correct Answer:
Decreases with distance from the centre

Solution:
Capacity of an Isolated Spherical Conductor -

$$C = 4\pi\epsilon_0 R = \frac{1}{9 \times 10^9} R$$

The electric field between the spheres of a charged capacitor is non-uniform and it decreases with distance from the centre as $E \propto 1/r^2$.

Q. 42 Two magnet of magnetic moment m_1 and m_2 are place as shown in diagram. The moment of inertia of system are I_1 and I_2 respectively then the frequency of system , if placed in earth's magnetic field B_H -



Option 1:

$$\frac{1}{2\pi}\sqrt{\frac{I_1+I_2}{(M_1+M_2)B_H}}$$

Option 2:

$$\frac{1}{2\pi}\sqrt{\frac{I_1+I_2}{(M_1-M_2)B_H}}$$

Option 3:

$$\frac{1}{2\pi}\sqrt{\frac{I_1-I_2}{(M_1-M_2)B_H}}$$

Option 4:

$$\frac{1}{2\pi}\sqrt{\frac{I_1-I_2}{(M_1+M_2)B_H}}$$

Correct Answer:

$$\frac{1}{2\pi}\sqrt{\frac{I_1+I_2}{(M_1+M_2)B_H}}$$

Solution:
As we learn

Frequency of sum position of magnetic moment -

$$\nu = \frac{I}{T_s} = \frac{1}{2\pi}\sqrt{\frac{(M_1+M_2)B_H}{I_s}}$$

Frequency $\nu = \frac{1}{2\pi}\sqrt{\frac{I_s}{M_s BH}} = \frac{1}{2\pi}\sqrt{\frac{I_1+I_2}{(M_1+M_2)BH}}$

Correct option is 1.

Q. 43 The condition for the thermal equilibrium of system (Note T=(Temperature), t=time)

Option 1:
$T\alpha t^0$

Option 2:
$T\alpha t^1$

Option 3:
$T\alpha t^2$

Option 4:
$T\alpha t^3$

Correct Answer:
$T\alpha t^0$

Solution:
As we learned

Thermal Equilibrium -

There is a uniform temperature in all parts of the system and is same as that of surrounding.

- wherein

T is independent of time.

Q. 44 Which of the following is true about normal stress :

Option 1:
It always increase the length

Option 2:
It always decrease the length

Option 3:
Force applied always normal to the surface

Option 4:
All of above

Correct Answer:
Force applied always normal to the surface

Solution:
As we learn

Normal Stress -

Force applied normal to the surface

Force applied is always normal to the surface.

Q. 45 At the centre of uniformly charged ring (+Q) electric field will be. (Cetre at O)

Option 1:
$\frac{kQ}{R^2}$

Option 2:
$\frac{kQ}{(x^2+y^2)^{\frac{3}{2}}}$

Option 3:
0

Option 4:
None

Correct Answer:
0

Solution:
As we have learned,

E at a point P that lies on the axis of the ring -

$$E_x = \frac{kQx}{(x^2 + R^2)^{\frac{3}{2}}}$$

And at centre, x = 0

So $E_c = 0$

Q. 46 A simple pendulum performs simple harmonic motion about $x = 0$ with an amplitude A and time period T. The speed of the pendulum at $x = \frac{A}{2}$ will be

Option 1:
$\frac{\pi A\sqrt{3}}{T}$

Option 2:
$\frac{\pi a}{T}$

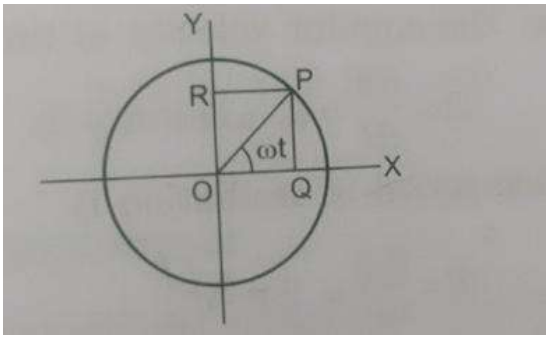
Option 3:
$\frac{\pi A\sqrt{3}}{2T}$

Option 4:
$\frac{3\pi^2 a}{T}$

Correct Answer:
$\frac{\pi A\sqrt{3}}{T}$

Solution:
As we learnt in

Simple harmonic as projection of circular motion -



- wherein

$x = A\cos\omega t$

$$y = A\sin wt$$

Velocity of a particle executing S.H.M is given by

$$v = \omega\sqrt{a^2 - x^2} = \frac{2\pi}{T}\sqrt{A^2 - \frac{A^2}{4}} = \frac{2\pi}{T}\sqrt{\frac{3A^2}{4}} = \frac{\pi A\sqrt{3}}{T}$$

Q. 47 In the absence of an applied electric field in non-polar materials , possess non zero net dipole moment , electric polarization vector in this

Option 1:
Elecrete

Option 2:
ferroelectrics

Option 3:
firrities

Option 4:
Dipole

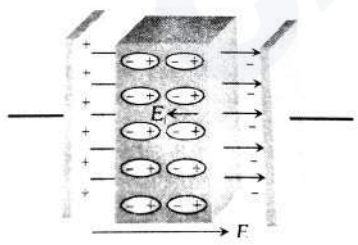
Correct Answer:
Elecrete

Solution:
As we learled

Polarisation of Dielectric slab -

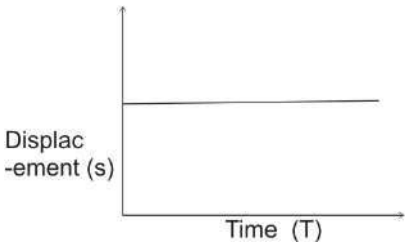
It is the process inducing equal and opposite charge on the two faces of the dielectric.

- wherein



Property

Q. 48 Which of the following case represent the graph correctly?



Option 1:
A moving bus with constant velocity

Option 2:
A book lying on the table

Option 3:
A train running with constant acceleration

Option 4:
A monkey climbing up on a tree with uniform speed

Correct Answer:
A book lying on the table

Solution:
As we have learnt,

Rest -

A body is said to be at rest if it does not change its position with respect to its surroundings with passage of time.

- wherein

e.g: A book lying on table.

Position of book is constant with respec to time

Q. 49 The value of the two resistor are $R_1 = (6 \pm 0.3)K\Omega$ and $R_2 = (10 \pm 0.2)K\Omega$ .The maximum absolute error in equivalent resistance when they are connected in series will be:

Option 1:
0.1

Option 2:
0.2

Option 3:
0.15

Option 4:
0.5

Correct Answer:
0.5

Solution:

Error in sum (x=a+b) -

$\Delta x = \pm (\Delta a + \Delta b)$ (minimum absolute error in x)

- wherein

Δa= absolute error in measurement of a

Δb= absolute error in measurement of b

Δx= absolute error in measurement of x

$R_{eq} = R_1 + R_2$ [series combination]

$$R_{eq} + \Delta R_{eq} = (R_1 + R_2) + (\Delta R_1 + \Delta R_2)$$

$$maximum\ error\ = (\Delta R1 + \Delta R2)$$

= 0.3+0.2 = 0.5Kω

Q. 50 A flat circular disc has a charge +Q uniformly distributed on the disc. A charge +q is thrown with kinetic energy E towards the disc along its normal axis. The charge q will

Option 1:
Hit the disc at the centre

Option 2:
Return back along its path after touching the disc

Option 3:
Return back along its path without touching the disc

Option 4:
Any of the above three situations is possible depending on the magnitude of *E*

Correct Answer:
Any of the above three situations is possible depending on the magnitude of *E*

Solution:
The motion of charge depend upon the electric field

Chemistry

Q. 1 The maximum oxidation state shown by Nitrogen is

Option 1:
-3

Option 2:
+3

Option 3:
+4

Option 4:
+5

Correct Answer:
+5

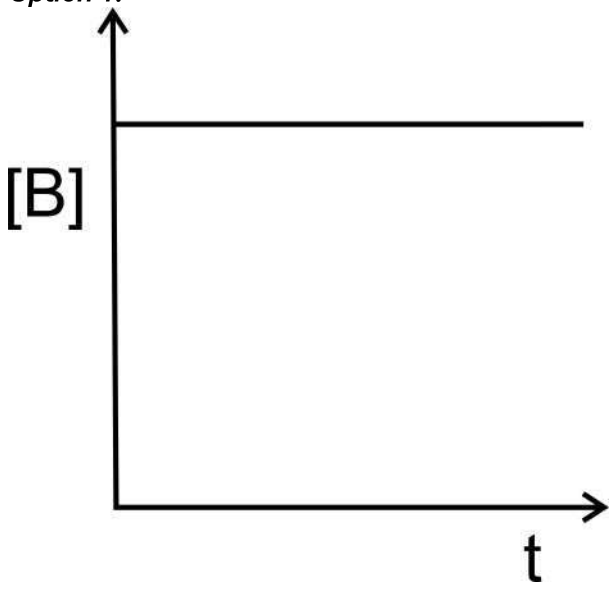
Solution:
The highest possible oxidation state for the non metals is equal to the total number of electrons present in the valence shell of the atom. As N has 5 electrons in its valence shell so its maximum oxidation state is +5.

It shows its +5 oxidation state in compounds like N_2O_5 and HNO_3.

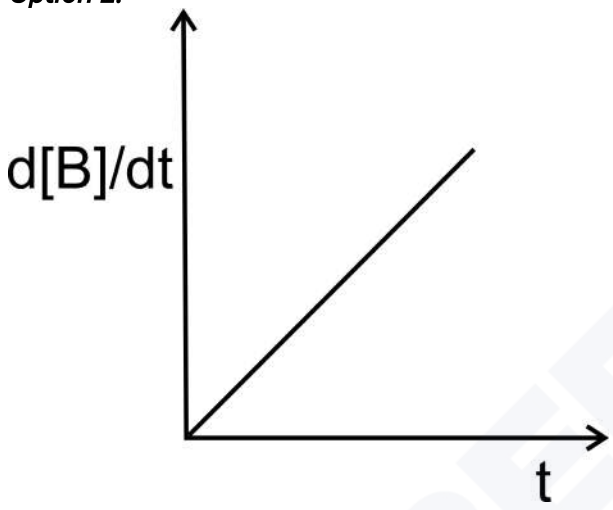
Therefore, **option (4) is correct.**

Q. 2 Which graph represents zero order reaction.

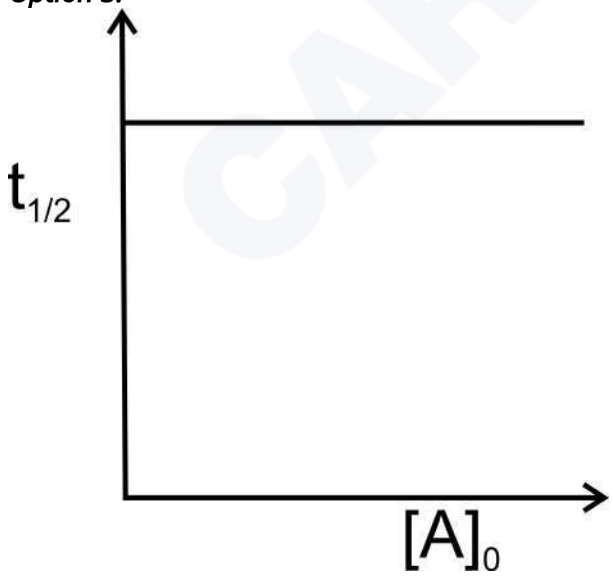
Option 1:



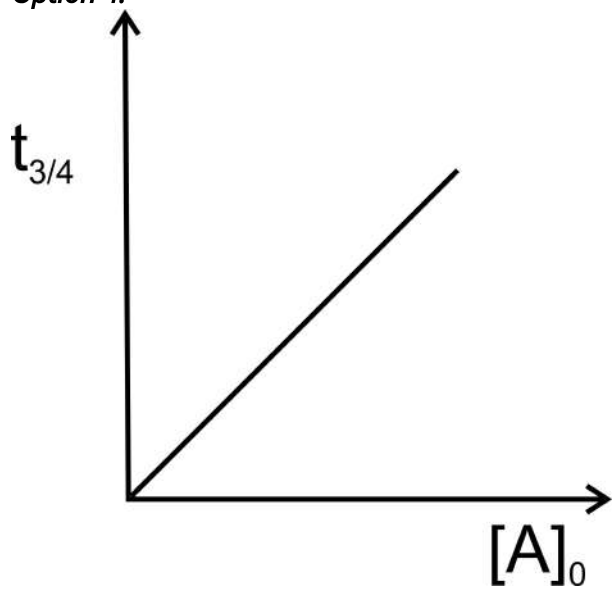
Option 2:



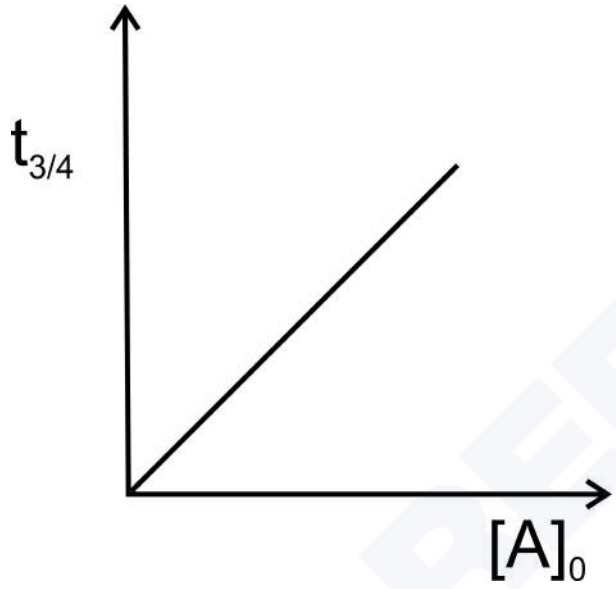
Option 3:



Option 4:



Correct Answer:



Solution:
For a zero-order reaction:

$$[\mathrm{A}] = [\mathrm{A}]_0 - \mathrm{kt}$$

Now, $\mathrm{t}_{\frac{3}{4}}$ represents the time taken for 75% completion of the reaction,

i.e. $[\mathrm{A}] = \frac{[\mathrm{A}]_0}{4}$

Putting these values in the integrated rate equation

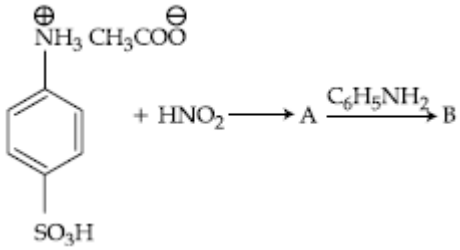
$$\frac{[\mathrm{A}]_0}{4} = [\mathrm{A}]_0 - \mathrm{kt}_{\frac{3}{4}}$$

$$\Rightarrow \mathrm{t}_{\frac{3}{4}} = \frac{3[\mathrm{A}]_0}{4}$$

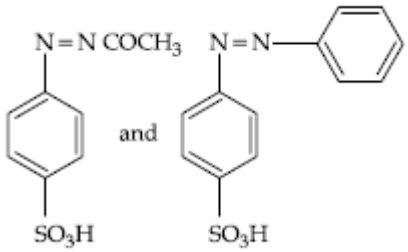
which represents a straight line passing through the origin and having a positive slope

Therefore, **option(4) is correct.**

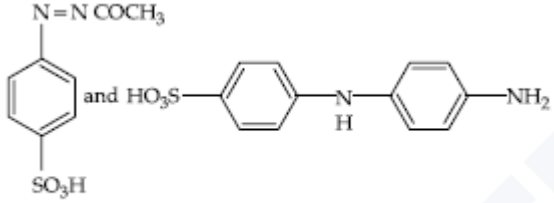
Q. 3 Products A and B formed in the following reactions are respectively :



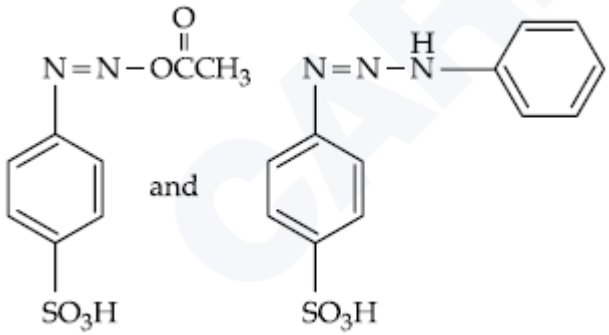
Option 1:



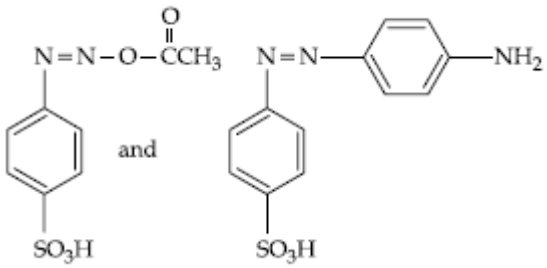
Option 2:



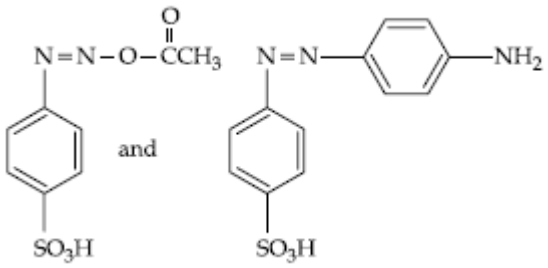
Option 3:



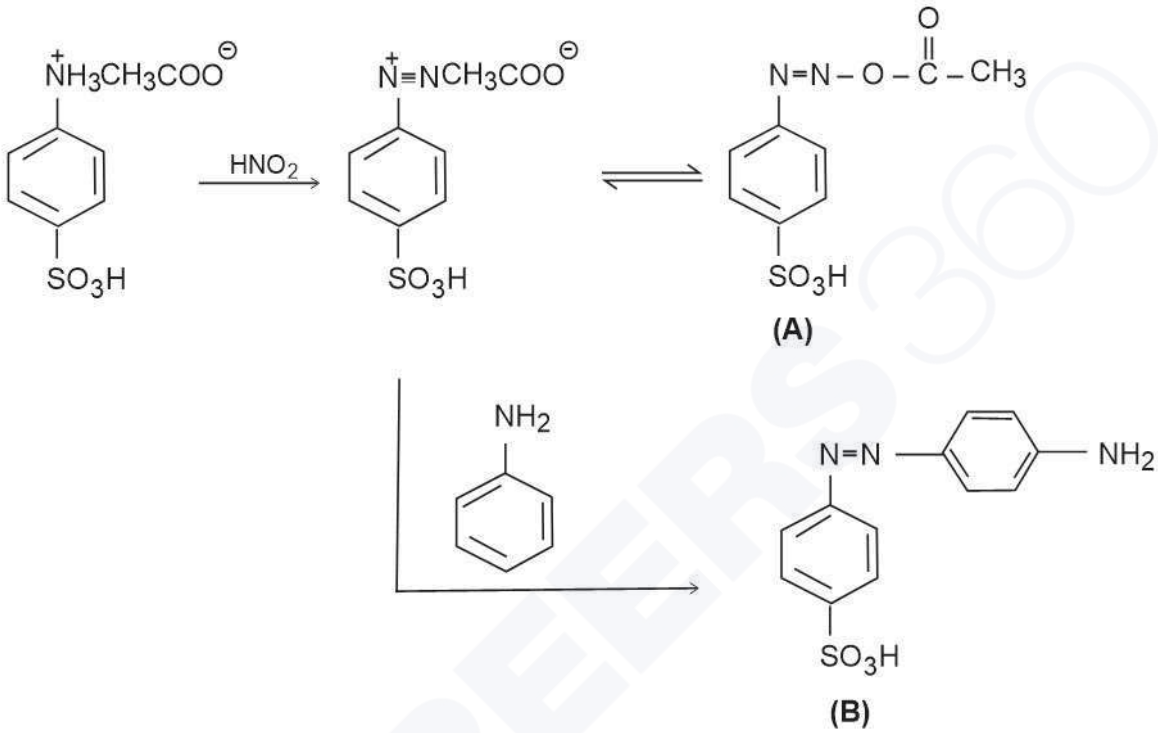
Option 4:



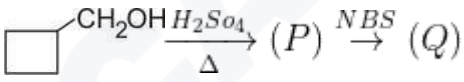
Correct Answer:



Solution:
The reaction will be -

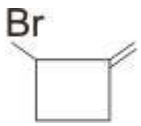


Hence, the correct answer is Option (4)

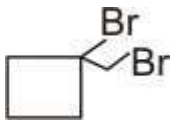
Q. 4 

(P) and (Q) is:

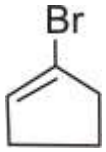
Option 1:



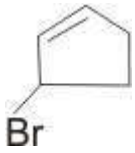
Option 2:



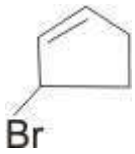
Option 3:



Option 4:



Correct Answer:

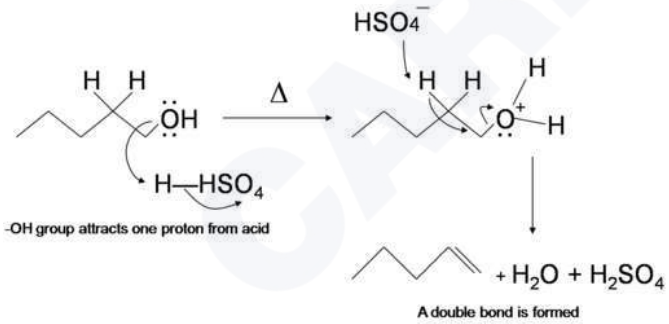


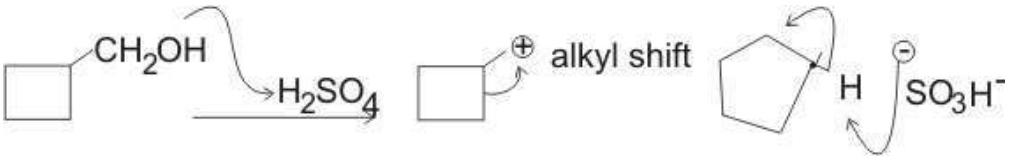
Solution:
As we learn

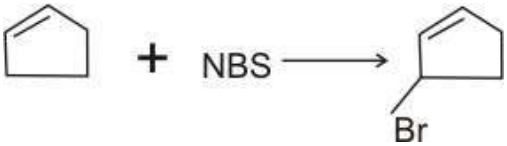
Acidic Dehydration alcohol -

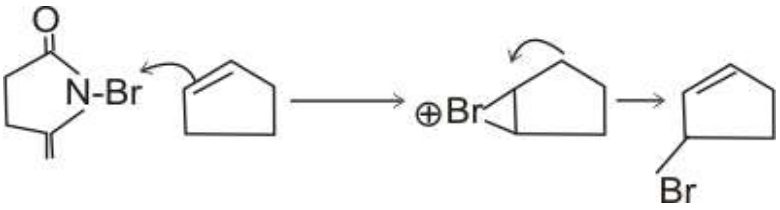
Alcohol on heating with concentrated H_2SO_4 form alkenes with the elimination of one water molecule.

- wherein









The correct option is 4.

Q. 5 Hybridisation state of carbon in $C^{\ominus}H_3$ is

Option 1:
sp^2

Option 2:
sp^3

Option 3:
sp^3d

Option 4:
SP

Correct Answer:
sp^3

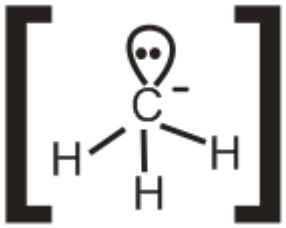
Solution:
As we learned

Carbanion -

Those chemical species in which carbon bearing negative charge is called carbanion

- wherein

$CH_3-CH_2^-$



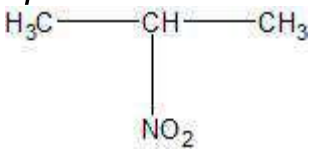
The hybridisation state of carbon is sp^3

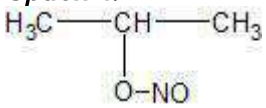
Q. 6 The product formed in the following reaction is :

$$CH_3 - CH_2 - CH_2 - Br + AgNO_2 \rightarrow$$

Option 1:
CH_3-CH_2-CH_2-NO_2

Option 2:
$CH_3 - CH_2 - CH_2 - O - N = O$

Option 3:


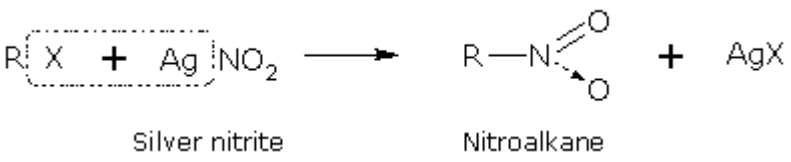
Option 4:


Correct Answer:
CH_3-CH_2-CH_2-NO_2

Solution:
The reaction of an alkyl halide with $AgNO_2$-

Alkyl halides when treated with $AgNO_2$, Nitroalkane is obtained as a product.

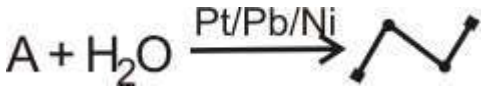
- wherein



$AgNO_2$ is covalent so 'N' is a nucleophilic site.

$$CH_3 - CH_2 - CH_2 - Br + AgNO_2 \rightarrow CH_3 - CH_2 - CH_2 - NO_2$$

Q. 7 What is the hydrocarbon (A) if



Option 1:

Option 2:

Option 3:

Option 4:
All of the above

Correct Answer:
All of the above

Solution:
As we learn

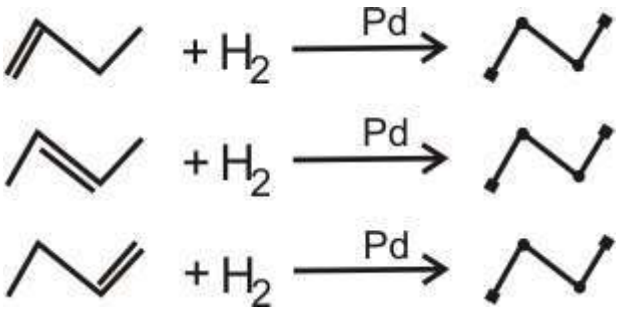
Addition of Hydrogen on alkyne -

Alkyne gives alkane when reacting with H_2 in presence of the metallic surface.

- wherein

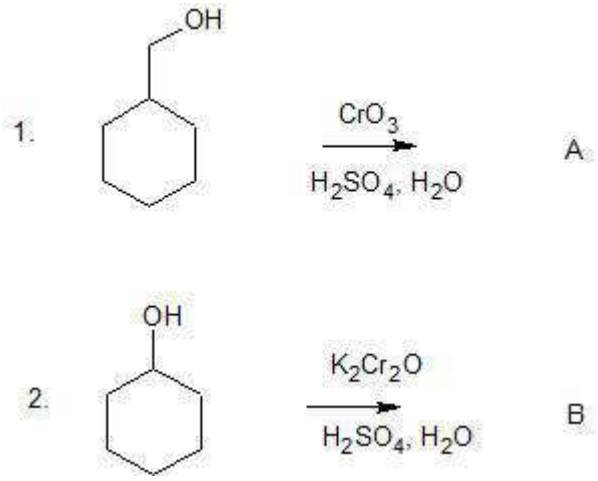
$$CH \equiv CH + 2H_2 \xrightarrow{pd} CH_3 - CH_3$$

The final product is $CH_3 - CH_2 - CH_2 - CH_3$ so, hydrocarbon (A) anyone of options:



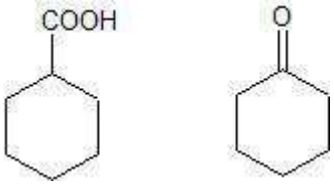
Correct option 4.

Q. 8

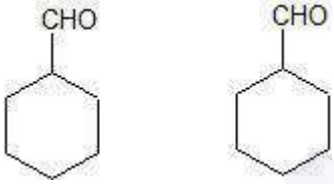


(A) and (B) are

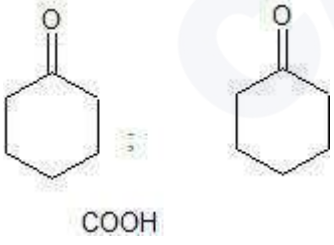
Option 1:



Option 2:



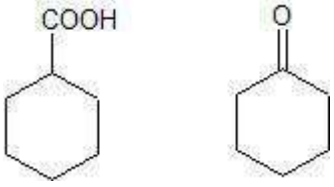
Option 3:



Option 4:

None of these

Correct Answer:

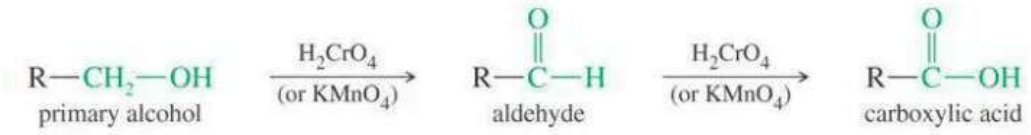


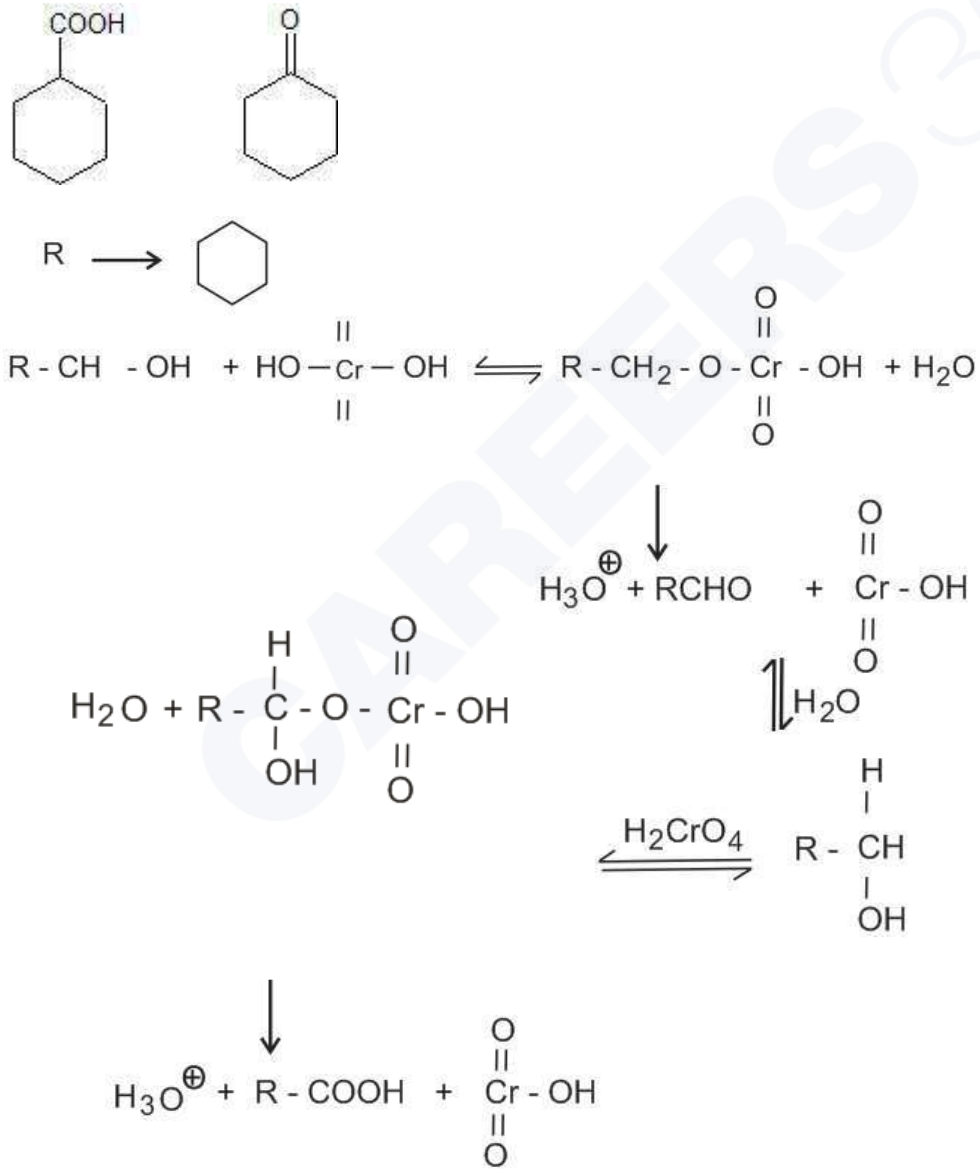
Solution:
As we learned

Oxidation of primary alcohol or an aldehyde -

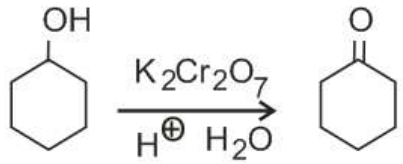
Primary alcohol oxidizes in the presence of oxidising agent to give aldehyde which further oxidises to give the carboxylic acid.

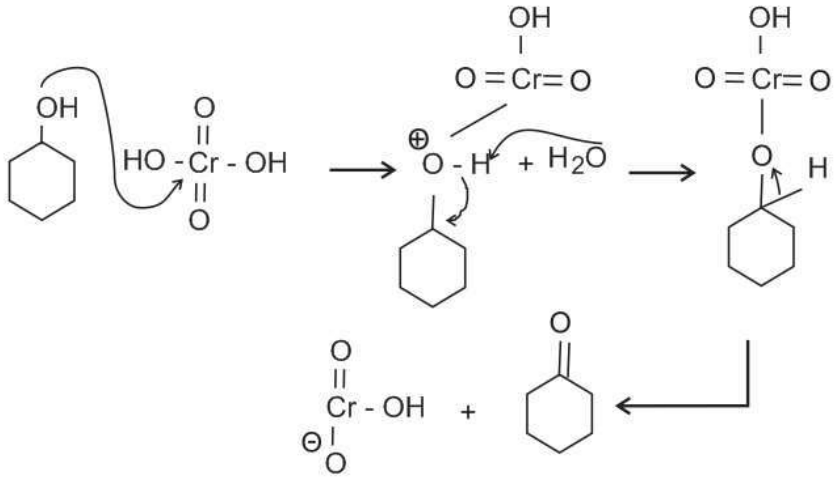
- wherein





2





Q. 9 Which of following has highest dipole moment

Option 1:
Co_2

Option 2:
NH_3

Option 3:
NF_3

Option 4:
H_2O

Correct Answer:
H_2O

Solution:
as we learn

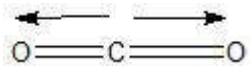
Resultant dipole moment -

Let XY and XZ are two polar bonds inclined at an angle θ their dipole moments are

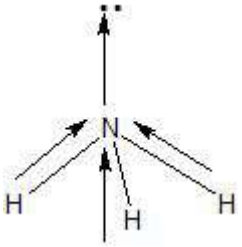
$\mu_1 \; and \; \mu_2$

- wherein

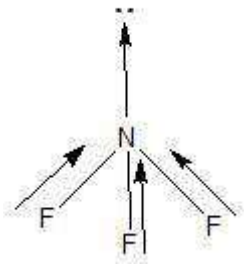
$$Resultant \; \mu_R = \sqrt{\mu_1^2 + \mu_2^2 + 2\mu_1\mu_2 cos\theta}$$



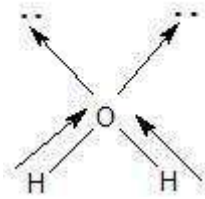
$\mu = 0$



$\mu = 1.46D$



$\mu = 0.24D$



$\mu = 1.84D$

Q. 10 The oxidation number of Cr in $[\mathrm{Cr}(\mathrm{NH_3})_6]\mathrm{Cl_3}$ is

Option 1:
8

Option 2:
6

Option 3:
4

Option 4:
3

Correct Answer:
3

Solution:
In $[\mathrm{Cr}(\mathrm{NH_3})_6]\mathrm{Cl_3}$,

Let the oxidation number of Cr be x

Charge balance gives us

$$x + 6(0) - 3(1) = 0$$

$$\Rightarrow x = 3$$

Thus, Oxidation number of Cr is +3

Therefore, **option (4) is correct.**

Q. 11 Effect of increases in temperature for solubilizing of a gas and K_H of a gas:

Option 1:
solubility of a gas increases , while K_H decreases

Option 2:
both solubility and K_H inreases

Option 3:
both solubility and K_H decreases

Option 4:
K_H of gas increases , while solubility decreases

Correct Answer:
K_H of gas increases , while solubility decreases

Solution:
As we learn

Factors affecting K_{h} -

Henry's const. depends on temp. and nature of gas. K_H increases on increasing temperature.

With increase in temperature K_H increases while solubility at gas decreases.

Q. 12 Poatsh alum is used in

Option 1:
Tanning of leather

Option 2:
purification of water

Option 3:
As antiseptic

Option 4:
All of these

Correct Answer:
All of these

Solution:
As we have learned

Use of Potash Alum -

1. For tanning of leather
2. As mordant in dyeing and calico printing
3. As antiseptic

Poatsh alum used in purificationof water , water proofing of textile , tanning of leather and alsoused as antiseptic

---

Q. 13 $NaCl \ and \ NH_4cl$ can be separated by

Option 1:
Distillation

Option 2:
Fractional distillation

Option 3:
Sublimation

Option 4:
None of these

Correct Answer:
Sublimation

Solution:
As we learned

Sublimation -

This method is used to separate the sublimable compounds.

- wherein

e.g. salicylic and $HgCl_2$, $AlCl_3$, $FeCl_3$

NH_4Cl is sublimable substance, so it can be separated by sublimation.

Q. 14 Which one of the following types of drugs reduces fever?

Option 1:
Analgesic

Option 2:
Antipyretic

Option 3:
Antibiotic

Option 4:
Tranquiliser

Correct Answer:
Antipyretic

Solution:
Chemical substances which are used to bring down the body temperature in high fevers are called antipyretics.

The correct option is 2.

Q. 15 The product obtained in the following reaction is :

$$CH_3 - Br + dry\ Ag_2O \rightarrow$$

Option 1:
$CH_3 - OH$

Option 2:
$CH_3COO\ Ag$

Option 3:
$CH_3 - O - CH_3$

Option 4:
CH_4

Correct Answer:
$CH_3 - O - CH_3$

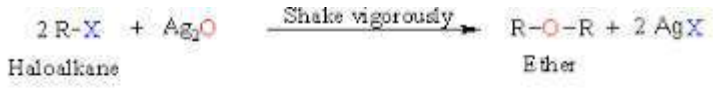
Solution:

As we learn

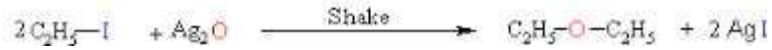
The reaction of an alkyl halide with dry Ag_2O -

Ether is obtained

- wherein



For example



Ether is formed if dry Ag_2O is taken in this reaction.

$$CH_3 - Br + dry Ag_2O \rightarrow CH_3 - O - CH_3$$

ether

Q. 16 The correct polarity of $C - X$ bond in haloalkanes is :

Option 1:

$\overset{\delta-}{C} - \overset{\delta+}{X}$

Option 2:

$\overset{\delta-}{C} - \overset{\delta-}{X}$

Option 3:

$\overset{\delta+}{C} - \overset{\delta+}{X}$

Option 4:

$\overset{\delta+}{C} - \overset{\delta-}{X}$

Correct Answer:

$\overset{\delta+}{C} - \overset{\delta-}{X}$

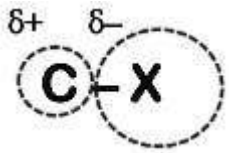
Solution:

As we learn

Nature of C-X bond -

Carbon atom bears partial positive charge and halogen atom bear a negative charge.

- wherein



X (halogen) is more electronegative than carbon so $C-X$ is correct polarity.

Q. 17 Which of the following metal hydroxide has most basic nature:

Option 1:
LiOH

Option 2:
$NaOH$

Option 3:
KOH

Option 4:
RbOH

Correct Answer:
RbOH

Solution:

Nature of hydroxides of alkali metals -

Alkali metal hydroxides are strongest of all bases, highly water soluble and not decomposed on heating (except LiOH). Basic character increases down the group

In Alkali metal hydroxides basic character increases down the group as : LioH<NaoH<KoH<RboH<CsoH

Q. 18 Paraldehyde is formed as a result of polymerisation of

Option 1:
CH_3CHO

Option 2:
$HCHO$

Option 3:
CH_3OH

Option 4:
CH_3CH_2CHO

Correct Answer:
CH_3CHO

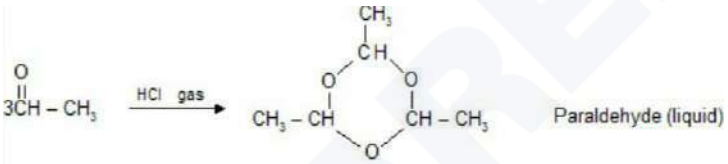
Solution:
As we learned

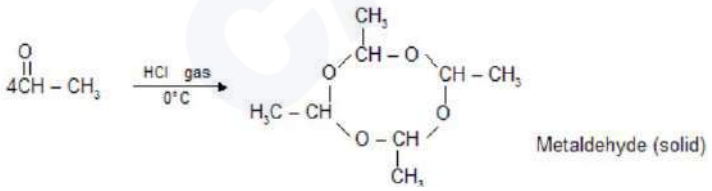
Polymerization of acetaldehyde -

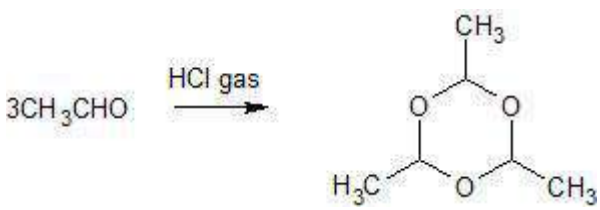
– Three molecules of acetaldehyde form paraldehyde used as hypnotic (sleep-inducing drug)

– Four molecules of acetaldehyde form metaldehyde used as fuels in lamps.

- wherein







Q. 19 the strength of hydrogen bonding depends

Option 1:
electon negativity

Option 2:
size

Option 3:
solution

Option 4:
all above

Correct Answer:
all above

Solution:
as we learn

Strength of Hydrogen bond -

Electrostatic force > covalent bond > H bond > Vander Wall's force

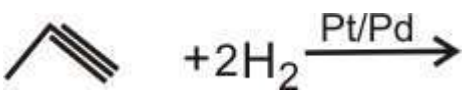
- wherein

H bond is a very weak bond and its strength is intermediate between the weak Vander wall force and strong covalent force.

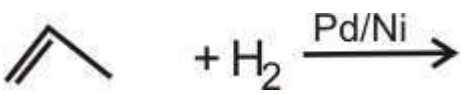
all above is correct electronegativity size and solution all factor affects H-bonding

Q. 20 By which of the following reaction we get propane?

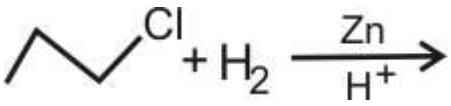
Option 1:



Option 2:



Option 3:



Option 4:
All of the above

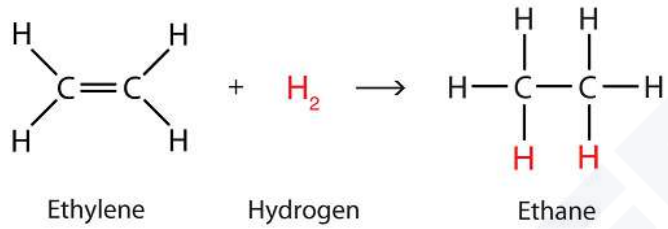
Correct Answer:
All of the above

Solution:
As we learn

Preparation of Alkane from Unsaturated Hydrocarbon -

Dihydrogen gas adds to alkenes and alkynes in the presence of a finely divided catalyst like Pt, Pd or Ni to form alkane.

- wherein



All of the above reaction will give propane.

The correct option is 4

Q. 21 Which of the following can be used to get 2° amine ?

Option 1:
Reduction of oximes

Option 2:
Reduction of amides

Option 3:
Reduction of nitriles by $LiAlH_4$

Option 4:
Reduction of isocyanide by $LiAlH_4$

Correct Answer:
Reduction of isocyanide by $LiAlH_4$

Solution:
As we have learnt,

Secondary amines can be prepared by reduction of isocyanide

Isocyanide group is reduced to $NHCH_3$ (2° Amine) group by LiAlH_4 or by catalytic hydrogenation.

$$\text{R} - \text{N}^{\oplus} \equiv \text{C}^{\ominus} \xrightarrow[\text{Ether}]{\text{LiAlH}_4} \text{R} - \text{NH} - \text{CH}_3$$

Oximes, amides and nitriles form primary amines as given below

$$\text{R} - \text{CH} = \text{N} - \text{OH} \xrightarrow{\text{LAH}} \text{R CH}_2\text{NH}_2$$

$$\text{R} - \overset{\overset{\text{O}}{\|}}{\text{C}} - \text{NH}_2 \xrightarrow{\text{LAH}} \text{R CH}_2\text{NH}_2$$

$$\text{R} - \text{C} \equiv \text{N} \xrightarrow{\text{LAH}} \text{R CH}_2\text{NH}_2$$

Hence, the correct answer is Option (4)

Q. 22 In hot concentrated $NaOH$ Cl_2 give

Option 1:
$NaCl \text{ and } NaOCl$

Option 2:
$NaCl \text{ and } NaClO_3$

Option 3:
$NaCl \text{ and } NaClO_4$

Option 4:
$NaOCl \text{ and } NaClO_3$

Correct Answer:
$NaCl \text{ and } NaClO_3$

Solution:
As we learnt

Reaction with Hot concentrated NaOH -

$3Cl_2+6NaOH \longrightarrow 5NaCl+NaClO_3+3H_2O$

- wherein

Cl_2 give disproportionation reaction

$$3Cl_2 + 6NaOH \xrightarrow[Conc]{Hot} 5NaCl + NaClO_3 + 3H_2O$$

Q. 23 If there is no interaction of mass and energy between system and surroundings, then system is know as:

Option 1:
Open system

Option 2:
Closed system

Option 3:
Isolated system

Option 4:
Surroundingd

Correct Answer:
Isolated system

Solution:

Isolated System -

The system which can not exchange energy and matter both with the surrounding.

- wherein

Water in thermos flask, Whole of the universe is a perfect isolated system.

For an isolated system, neither mass nor energy can transfer from system to surroundings.

Q. 24 In the pure state H_2O_2, what is the state of H_2O_2?

Option 1:
gas

Option 2:
liquid

Option 3:
solid

Option 4:
Both a and c

Correct Answer:
liquid

Solution:
As we learnt

Physical Properties -

I) It is almost colourless liquid.

II) It is miscible with H_2O

- wherein

It forms a hydrate H_2O_2 . H_2O

Pure H_2O_2 is at liquid state

Q. 25 Consider the following reaction $CH_3-CH=CH_2+H_2O \overset{H_2SO_4}{\rightarrow}$ product

which of the following product will be formed?

Option 1:
$CH_3-CH_2-CH_2-OH$

Option 2:
$$CH_3-\underset{\Big|}{\underset{OH}{CH}}-CH_3$$

Option 3:
Both (a) and (b)

Option 4:
None of these

Correct Answer:
$$CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3$$

Solution:
As we learned

Alcohol formation by hydration of alkenes -

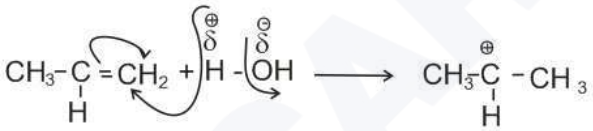
Follow electrophilic addition mechanism (Markownikoff)

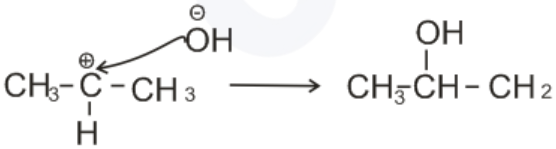
- wherein

$$RCH\equiv CH_2+H_2O\overset{H_2SO_4}{\rightarrow}RCH(OH)CH_3$$

$$CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3$$ is formal due to markownikoff's rule.

Here markownikoff's rule. is applied

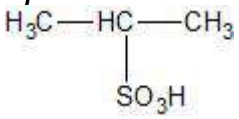




Q. 26 $H_3C-HC(OH)-CH_3+SOCl_2\rightarrow$

The product obtained in this reaction is :

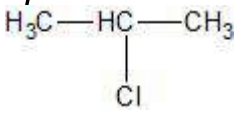
Option 1:



Option 2:

$CH_3 - CH_2 - O - CH_3$

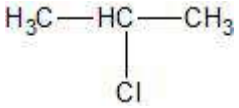
Option 3:



Option 4:

$CH_3 - CH_2 - CH_2 - Cl$

Correct Answer:



Solution:

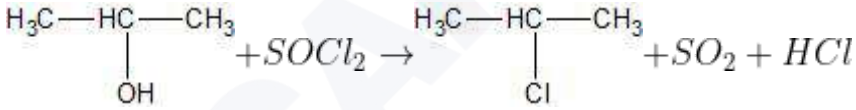
As we learn

The general method of preparation of alkyl and aryl halides -

When treated with $SOCl_2$, OH is replaced by Cl.

- wherein

$ROH + SOCl_2 \rightarrow RCl + SO_2 + HCl$



Q. 27 Dimer formation can takes place with

Option 1:

BH_3

Option 2:

$AlCl_3$

Option 3:

NO_2

Option 4:
All of these

Correct Answer:
All of these

Solution:
As we have learned

Aluminium chloride preparation -

Prepared by passing dry chroline over alumina and carbon. It exists as dimer Al_2Cl_6

- wherein

$$Al_2O_3 + 3C + 3Cl_2 \rightarrow 2AlCl_3 + 3CO$$

$$2BH_3 \rightarrow B_2H_6$$
$$2AlCl_3 \rightarrow Al_2Cl_6$$
$$2NO_2 \rightleftharpoons N_2O_4$$

Q. 28 Hyper conjugationn effect is possible in

Option 1:
Alkyl carbocation

Option 2:
Alkenes

Option 3:
Alkyl free radicals

Option 4:
All of these

Correct Answer:
All of these

Solution:
As we learned

Hyperconjugation or ?-? resonance or Baker and Nathan effect -

The conjugation between $\alpha C-H$ sigma bond and adjacent multiple bond or carbocation is called Hyperconjugation.

- wherein

It is permanent effect.

Hyperconjugation is a stabilising effect . It is possible in alkyl carbocation, alkenes, alkyl arenes and alkyl free radicals, which involves delocalisation of 6 C-H electrons.

Q. 29 Which of the following can form an azeotrope?

Option 1:
benzene + tolune

Option 2:
n - hexane + n - heptane

Option 3:
ethyl bromide + ethyl iodide

Option 4:
ethanol + water

Correct Answer:
ethanol + water

Solution:
As we learn

Azeotropes -

Constant boiling mixtures which can't be separated by the method of distillation are known as Azeotropes.

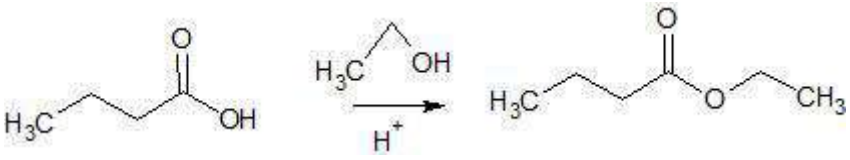
- wherein

Azeotropes have fixed boiling point.

-

An ideal solution can never form azeotrope ethanol + water is a non - ideal solution.

Q. 30



Te above reaction is

Option 1:
Fischer Speir Esterification

Option 2:
Darzen's Reaction

Option 3:
Phocol Rection

Option 4:
None of these

Correct Answer:
Fischer Speir Esterification

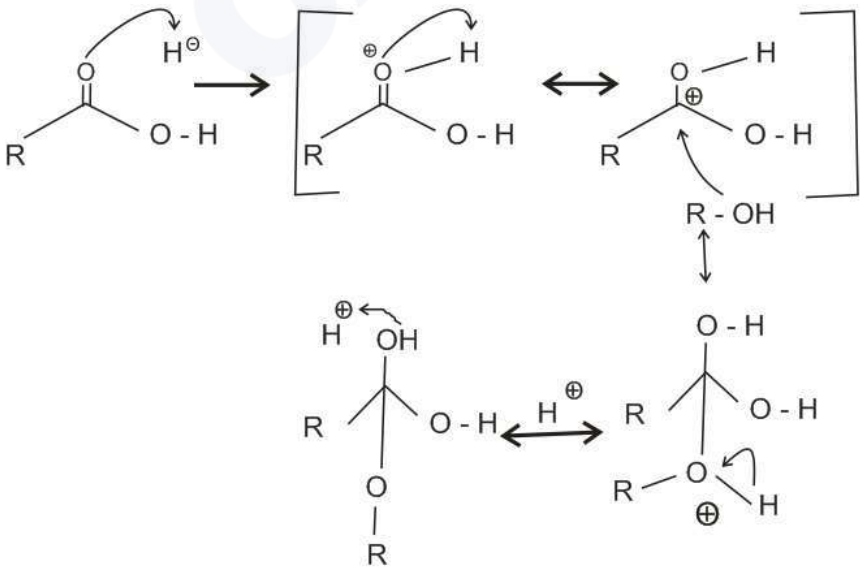
Solution:
As we learned

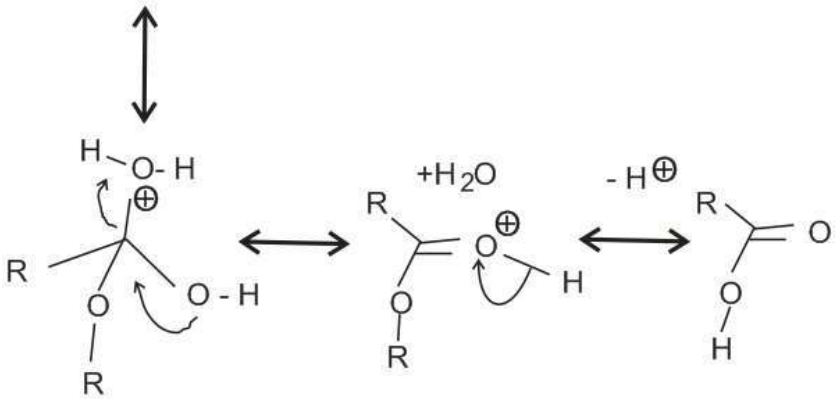
Fischer - Speier Esterification -

Reaction of alcohols with carboxylic acid.

- wherein

$$ROH + R'COOH + H_2SO_4/HCl \rightarrow R'COOR + H_2O$$





Q. 31 Unit of resistivity and conductance are respectively will be

Option 1:

$\Omega \ and \ \Omega^{-1}$

Option 2:

$\Omega - m \ and \ \Omega^{-1}$

Option 3:

$\Omega^{-1} \ and \ \Omega - m$

Option 4:

$\Omega^{-1} \ and \ \Omega$

Correct Answer:

$\Omega - m \ and \ \Omega^{-1}$

Solution:

As we learned

SI Units -

Resistivity = $\Omega - m$

Resistance = ω (ohm)

Conductance = siemens or Ω^{-1}

$Unit \ of \ \ resistivity \rightarrow \Omega - m$

$and \ Unit \ of \ \ conductance \rightarrow \Omega^{-1}$

Q. 32 Which of following molecule is not soluble in water

Option 1:
CH_3-OH

Option 2:
AgBr

Option 3:
NaOH

Option 4:
HCl

Correct Answer:
AgBr

Solution:
as we learn

The consequence of Intermolecular H Bonding -

Solubility in water.

- wherein

The compound which can form H bonds with H_2O are more soluble

e.g. lower alcohol ROH, NH_3

Agbr is insoluble in water it's structure is too hard to break in the water

Q. 33 When air is passed over hot coke it produces:

Option 1:
Water gas

Option 2:
Producer gas

Option 3:
Syn gas

Option 4:
Coal gas

Correct Answer:
Producer gas

Solution:
As we learn

Producer Gas is a mixture of CO and N_2 . It is produced when air is passed over hot coke

$$2C + O_2 + 4N_2 \xrightarrow{1273K} 2CO + 4N_2$$

Therefore, **option (2) is correct.**

Q. 34 A chemical reaction in which compound (A) reacts with compound (R) in the presence of pyridine to neutralize HCl and Ester is formed as products ; (A) and (B) are

Option 1:
Carboxylic Acid and PCl_3

Option 2:
Alcohol and acid Chloride

Option 3:
Alcohol and Carboxylic Acid

Option 4:
None of these

Correct Answer:
Alcohol and acid Chloride

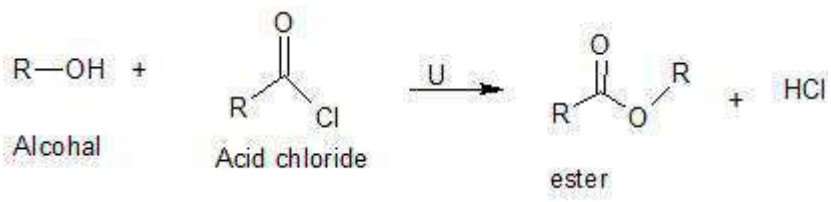
Solution:
As we learned

Alcohols reaction with acid chloride -

Carried out in the presence of pyricline (base) to neutralize HCl.

- wherein

$$ROH + R'COCl \rightarrow R'COOR + HCl$$



Q. 35 Potassium carbonate cannot be prepared by solvay process because

Option 1:
Its raw materials are expensive

Option 2:
K_2CO_3 is stronger base than Na_2CO_3.

Option 3:
It cannot be recovered from by products of the solvay process.

Option 4:
$KHCO_3$ is too soluble to be precipitated by the addition of NH_4HCO_3 to KCl solution.

Correct Answer:
$KHCO_3$ is too soluble to be precipitated by the addition of NH_4HCO_3 to KCl solution.

Solution:
Aswe learned

Manufacture of Na2 CO3 by solvay process -

Brime (NaCl) ammonia and carbon di oxide are the raw materials calcium chloride is a by-product

- wherein

$$NH_3 + CO_2 + H_2O \rightarrow NH_4HCO_3$$
$$NH_4HCO_3 + NaCl \overset{30^{\circ}c}{\rightarrow} NaHCO_3 \downarrow + NH_4Cl$$
$$NaHCO_3 \overset{250^{\circ}C}{\rightarrow} Na_2CO_3 + H_2O + CO_2$$
$$2NH_4Cl + Ca(OH)_2 \rightarrow CaCl_2 + 2H_2O + 2NH_3$$

$$NH_4HCO_3 + Nacl \rightarrow NH_4cl + NaHCO_3$$

$$NH_4HCO_3 + Kcl \rightarrow NH_4cl + KHCO_3(Soluble)$$

$KHCO_3$ is very much soluble so it is not separated out as crystals $NaHCO_3$. So solvay process is not used in the preparation of K_2CO_3. but Na_2CO_3 prepared by this process.

Q. 36 Hydrolysis of P_4O_{10} followed by boiling produces -

Option 1:
HPO_3

Option 2:
H_3PO_4

Option 3:
H_3PO_2

Option 4:
H_3PO_3

Correct Answer:
H_3PO_4

Solution:
As we have learnt,

Reaction of phosphorus pentaoxide with water -

Form meta-phosphoric acid which on boiling gives othophosphoric acid

- wherein

$$P_4O_{10} + 2H_2O \rightarrow 4HPO_3$$

$$HPO_3 + H_2O \rightarrow H_3PO_4$$

$$P_4O_{10} + 2H_2O \rightarrow 4HPO_3$$

$$HPO_3 + H_2O \overset{Boiling}{\rightarrow} H_3PO_4$$

Q. 37 Selection of temperature to carry out a reduction process depends so as to make:

Option 1:
$\Delta G\ Negative$

Option 2:
$\Delta G\ Positive$

Option 3:
$\Delta H\ Negative$

Option 4:
$\Delta H\ Positive$

Correct Answer:
$\Delta G\ Negative$

Solution:
As we learn

Thermodynamic principle of Metallurgy -

$$\triangle G = \triangle H - T \triangle S$$

also $\triangle G^{\circ} = -RTlnK$

- wherein

K is equilibrium constant.If $\triangle G$ for a reaction is negative reaction is fusible.

Thermodynamic principle of Metallurgy -

$$\triangle G = \triangle H - T \triangle S$$

also $\triangle G^{\circ} = -RTlnK$

For spontaneous process $\triangle G$ should be negative.

Q. 38 Which of the following is correct?

Option 1:
CO is Lewis acid

Option 2:
Aqueous solution of CO is acidic

Option 3:
CO is Lewis base

Option 4:
None of these

Correct Answer:
CO is Lewis base

Solution:

As we learn

Metal Carbonyls -

Compounds formed when CO reacts with metals when heated

- wherein

Due to the presence of lone pair, it acts as donor

CO has lone pair due to which it can donate it to metal and act as Lewis base to form metal carbonyls .

Therefore, **option (3) is correct.**

Q. 39 The average speed of gas molecule is 800m/sec calculate its arms speed at the same temperature

Option 1:
800m/sec

Option 2:
8600m/sec

Option 3:
868 m/sec

Option 4:
none of these

Correct Answer:
868 m/sec

Solution:
As we learn

RMS speed of gas molecules -

$$Vrms = \sqrt{(3RT/M)}$$

- wherein

M- Molecular Mass, R- Gas Constant, T- Temperature

$$U_{av} = \sqrt{\frac{8RT}{\pi M}} \, , \mu_{rms} = \sqrt{\frac{3RT}{M}}$$

$$U_{rms} = \mu_{av} \times \sqrt{\frac{3\pi}{8}} = 8000 \times \sqrt{\frac{3 \times 3.14}{8}}$$

$$= 868 m/sec$$

Q. 40 Oppenaur oxidation is the reverse process of

Option 1:
Wolf - Kishner

Option 2:
Rosenmund's Reductiion

Option 3:
Clemmensen Reduction

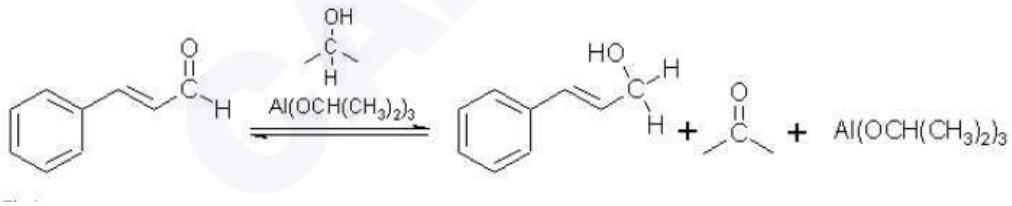
Option 4:
Meerwein - Pondarf verely reduction

Solution:
As we learned

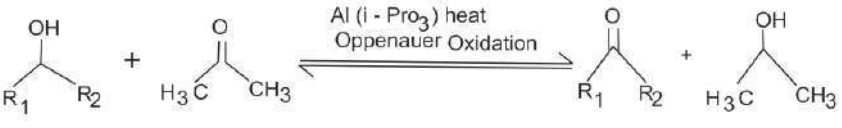
Meerwein-Ponndorf-Verley (MPV) Reduction -

Reduction of carbonyl compound with aluminium isopropoxide in excess of isopropyl alcohol.

- wherein



Meerwein-Ponndorf-Verley (MPV) Reduction -



Q. 41 In metallurgical process which of the following used to remove impurity?

Option 1:
CO

Option 2:
H_2

Option 3:
Cu

Option 4:
O_2

Correct Answer:
O_2

Solution:
As we learnt

The metallurgical process to remove the impurities of metal by oxidation
Therefore, **option (4) is correct.**

Q. 42 The maximum covalency of Beryllium is four in its compound because:

Option 1:
It's size is exceptionally small

Option 2:
It's ionisation energy is high

Option 3:
It has no vacnt d-orbital so octet cannot expand

Option 4:
Be^{+2} has high hydration energy

Correct Answer:
It has no vacnt d-orbital so octet cannot expand

Solution:
As we learn-

Anomalous behavious beryllium -

1) Due to small atomic and ionic size

2) High ionisation energy

3) No vacant d-orbitals

4) High hydration energy

Maximum covalency of 'Be' is four. It shows anomalous behavior

Be: $Is^2\ 2s^2$

It has no-vacant d-orbital so its octet cannot expand.

Q. 43 why ice has lower density than water

Option 1:
tetrahedral structure

Option 2:
cage structure

Option 3:
hydrogen bonding

Option 4:
all of them

Correct Answer:
tetrahedral structure

Solution:
as we learn

Why ice floats on water -

Ice has a lower density than H_2O. Due to H bonding in solid ice, it forms a cage-like structure of H_2O molecules in which each H_2O molecules is linked tetrahedrally to four H_2O molecule.The molecule of H_2O are not so closely packed in solid ice. For the same mass of water the volume decreases and hence density increases.

Q. 44 Oxidation Number of S in H_2SO_5 is

Option 1:
+6

Option 2:
+8

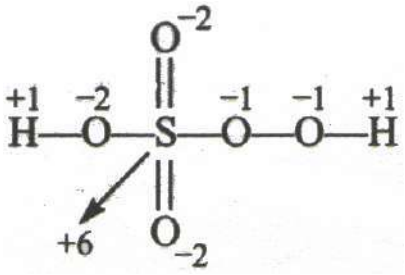
Option 3:
+4

Option 4:
+2

Correct Answer:
+6

Solution:
As we have learnt,

The structure of Peroxomonosulphuric acid is given below:



From the structure of H_2SO_5 we can say S has +6 oxidation state.

Therefore, **option (1) is correct.**

Q. 45 What is the EAN of nickel in $Ni(CO)_4$?

Option 1:
34

Option 2:
35

Option 3:
32

Option 4:
36

Correct Answer:
36

Solution:
As we have learnt,

Effective Atomic Number (EAN) is given as

$$EAN = (Z - x) + 2 \times C.N.$$

$Z =$ Atomic Number of Central Atom

$x =$ Oxidation Number

$C.N. =$ Coordination Number

Hence, EAN of Ni in $Ni(CO)_4$ is

$= 28 - 0 + 2 \times 4 = 36$

Therefore, **option (4) is correct.**

Q. 46 Which of the following statement is true?

Option 1:
Due to the high difference of electronegativity in C-H they possess weak van der Wall's forces.

Option 2:
C_1 to C_3 are gases at room temperature.

Option 3:
Hydrocarbon does not exist in a solid state at room temperature ?

Option 4:
None of these

Correct Answer:
C_1 to C_3 are gases at room temperature.

Solution:
As we learn

Physical Property of Alkane -

Due to weak Vander Waal force, the first four members, C_1 to C_4 are gases, C_5 to C_{17} are liquid and C_{18} to higher alkanes are solid.

- wherein

CH_4 To C_4H_{10} gas

C_5H_{12} to $C_{17}H_{36}$ liquid

$C_{18}H_{38}$ to higher are solid.

There is very little difference of electronegative between C-H bond.

C_1 to C_4 are gases at room temp. Hydrocarbon containing is or more are carbon are solid at 25^0c.

The correct option is 2.

Q. 47 Which of the following has least ionisation energy?

Option 1:
Si

Option 2:
Ge

Option 3:
Sn

Option 4:
Pb

Correct Answer:
Sn

Solution:
As we have learnt,

Ionisation energy of carbon family decreases down the group but Pb has more I.E. than Sn. This is because of the poor shielding of the f electrons.

Order of ionisation energy

$$\mathrm{C} > \mathrm{Si} > \mathrm{Ge} > \mathrm{Pb} > \mathrm{Sn}$$

Therefore, **option (3) is correct.**

Q. 48 Assertion: H_2O_2 is stored in tinted glass bottles

Reason: H_2O_2 decomposes on exposure to light

Option 1:
A and R are correct and R explains A correctly

Option 2:
A and R are correct but R doesn't explain A correctly

Option 3:
A is correct but R is not

Option 4:
A is incorrcet but R is correct

Correct Answer:
A is incorrcet but R is correct

Solution:
As we have learned

H_2O_2 is sensitive to light but it cannot be stored in glass bottles as trace metals present in glass catalyze its decomposition

H_2O_2 must be stored in Wax Lined colored bottles

Therefore, **option(4) is correct.**

Q. 49 The correct order of boiling point

Option 1:
H_2o > NH3 > HF

Option 2:
HN_3 > HF > H_2O

Option 3:
H_2O > HF > NH_3

Option 4:
none of above

Correct Answer:
H_2O > HF > NH_3

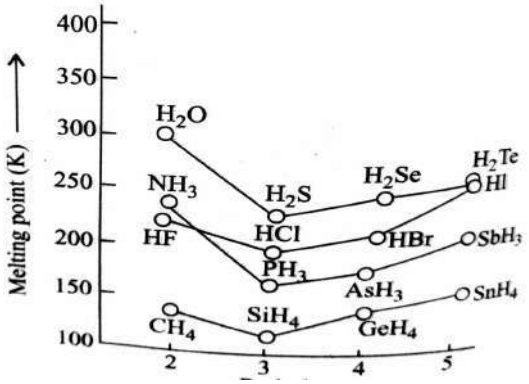
Solution:
as we learn

The consequence of Intermolecular H Bonding -

High melting and boiling point.

- wherein

The compound having H bond show abnormally high melting and boiling point.



H_2O has 2 hydrogen bonds per molecule and has a much stronger bond network HF has only hydrogen bond per molecule but strong H_3n has two hydrogen bonds per molecule but weak than HF

Q. 50 In Reduction process

Option 1:
Oxidation number increases

Option 2:
Number of electron increases

Option 3:
Oxygen content increases

Option 4:
Number of ions increases

Correct Answer:
Number of electron increases

Solution:
As we learned

Redox Reaction -

Redox reaction as a class of reactions in which oxidation and reduction reactions occur simultaneously.

Oxidation number decreases and the number of electrons increases in the reduction process.

Maths

Q. 1 P (x = 5) for n = 6 , p = 1/3 is

Option 1:
6 /128

Option 2:
4/243

Option 3:
4/81

Option 4:
1/81

Correct Answer:
4/243

Solution:
As we learned from

Binomial Distribution -

In a series of n independent trials if the probability of success P in each trial is same, then the probapility of r success is

$$P(X=r)=\begin{cases}\binom{n}{r}\, q^{n-r}\cdot P^{r} & q=1-P \\ \binom{n}{r}\,\frac{1}{2^n} & P=\frac{1}{2}\end{cases}$$

- wherein

Where $\sum$ is probability of failure.

$$P\left(x=5\right)={}^{6}C_{5}\left(\frac{1}{3}\right)^{5}\left(\frac{2}{3}\right)$$

$$6\times\frac{2}{3^{6}}$$

$$=\frac{4}{243}$$

Q. 2 Identify the symbol of conjuction

Option 1:
$\vee$

Option 2:
$\sqcap$

Option 3:
$\wedge$

Option 4:
$\sqcup$

Correct Answer:
$\wedge$

Solution:
As we have learned

Conjunction -

Symbol "λ" is used to denote conjunction.

Q. 3 If A and B are two sets such that $A' = B$ then the set $B' =$

Option 1:
$A \cup B$

Option 2:
$A \cap B$

Option 3:
B

Option 4:
A

Correct Answer:
A

Solution:
As we learnt

COMPLEMENT PROPERTY -

(A')' = A

Since $A' = B$

Thus $B' = (A')' = A$

Q. 4 If $A \cap B$ = {3, 4, 5, 6} and $A \cap C$= {5} then the value of set $A \cap (B - C)$ is ?

Option 1:
{3, 4, 5, 6}

Option 2:
{3}

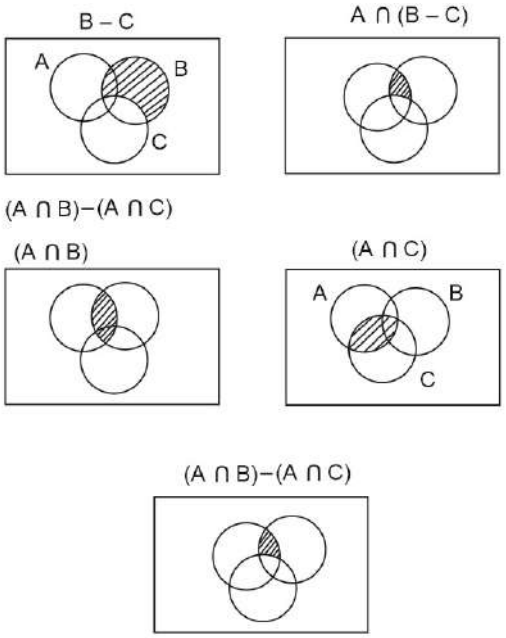
Option 3:
{3,4,6}

Option 4:
{3,5}

Correct Answer:
{3,4,6}

Solution:
Using Venn diagram one can see that

A ∩ (B - C) = (A ∩ B) - (A ∩ C)



So, $A \cap (B - C) = (A \cap B) - (A \cap C) = \{3, 4, 5, 6\} - \{5\} = \{3, 4, 6\}$

Q. 5 If $f(x) = e^x$, $F(x) = \int f(x)\ dx$ and $F(1) = 0$, then $F(x) =$?

Option 1:
$e^x + e$

Option 2:
e^x

Option 3:
$e^x - e$

Option 4:
$e^x + 1$

Correct Answer:

$e^x - e$

Solution:

as we learned

Constant of integration: -

$$\frac{\mathrm{d}}{\mathrm{d}x}\left(F\left(x\right)+C\right)=\frac{\mathrm{d}}{\mathrm{d}x}F\left(x\right)+0=f\left(x\right)$$

Hence $\int f\left(x\right)dx=F\left(x\right)+C$

- wherein

Where C is the constant of integration .

$$F(x)=\int e^x dx$$
$$F(x)=e^x+c$$
$$F(1)=e^1+c=0\Rightarrow c=-e$$

Q. 6 Find the area enclosed by the curve $f(x)=e^x\ ;\ x=0\ ;\ x=5$ and the x-axis.

Option 1:

e^5

Option 2:

e^4

Option 3:

e^5-1

Option 4:

$\ln 5$

Correct Answer:

e^5-1

Solution:

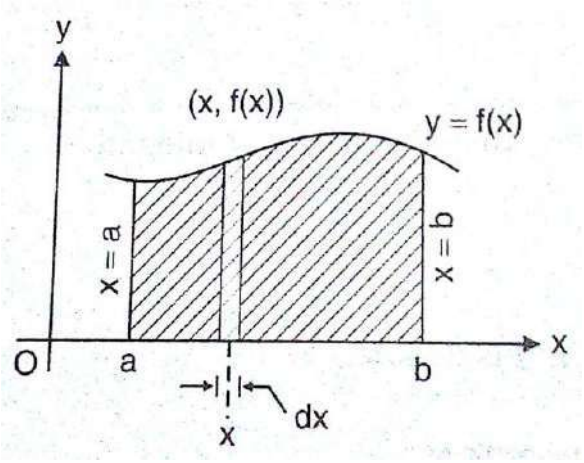
As we have learnt,

Introduction of area under the curve -

The area between the curve $y = f(x), x$ axis and two ordinates at the point $x = a \, and \, x = b \, (b > a)$ is given by

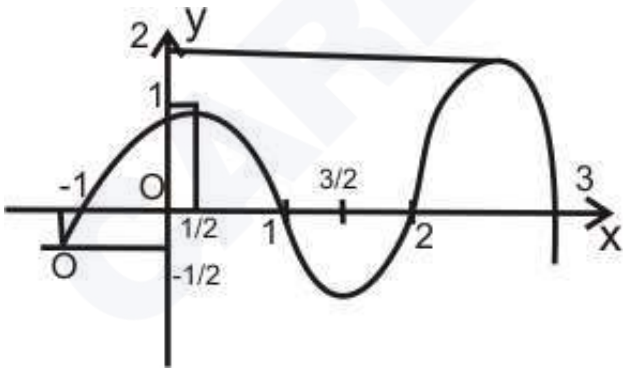
$$A = \int_a^b f(x)dx = \int_a^b ydx$$

- wherein



Area = $\int_0^5 e^x dx = [e^x]_0^5 = e^5 - 1$

Q. 7 For the figure given below, find absolute maximum (A.M.) and Absolute minimum (a.m.) between (-1,3]



Option 1:

A.M =2, a.m = not defined

Option 2:

A.M. = 2 , a. m. = $-\frac{1}{2}$

Option 3:
A.M. = 2 , a.m = 0

Option 4:
A.M. = 1, a.m = not defind

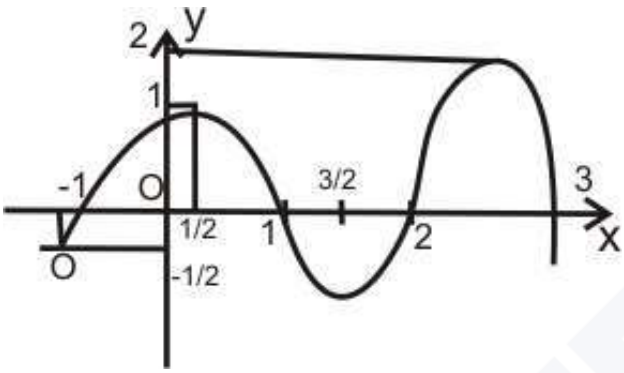
Correct Answer:
A.M =2, a.m = not defined

Solution:
As we learn

Absolute maximum and Absolute minimum values of a function -

The largest value of a function f(x) in an interval [a, b] and it is maximum (absolute value) and the smallest value of a function is minimum (absolute value)

-



Q. 8 If $A' = X$. Then simplify $(A \cup X')'$

Option 1:
$A \cap X$

Option 2:
A

Option 3:
$A \cup X$

Option 4:
X

Correct Answer:
X

Solution:
$(A \cup X')' = (A \cup (A')')' = (A \cup A)' = (A)' = X$

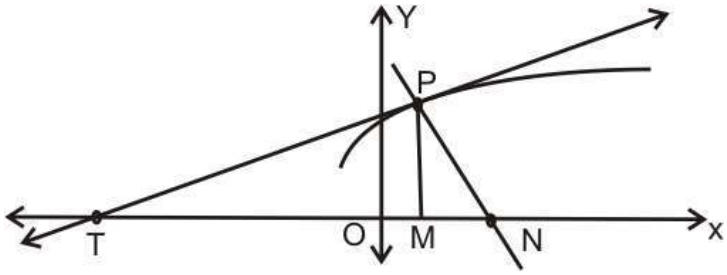
Q. 9 Match the column for the following figure

(i) PT (p) Subnormal

(ii) TM (q) tangent

(iii) PN (r) Normal

(iv) MN (r) Subtangent



Option 1:
(i) - (p) ; (ii) - (q) ; (iii) - (r) ; (iv) - (s)

Option 2:
(i) - (q) ; (ii) - (p) ; (iii) - (s) ; (iv) - (r)

Option 3:
(i) - (q) ; (ii) - (s) ; (iii) - (r) ; (iv) - (p)

Option 4:
(i) - (s) ; (ii) - (r) ; (iii) - (q) ; (iv) - (p)

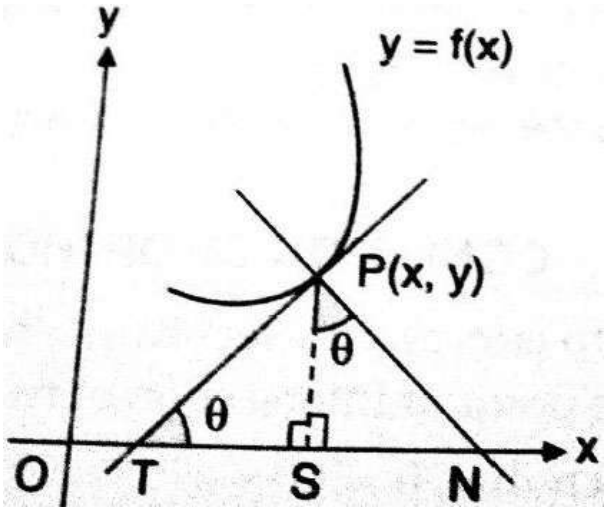
Correct Answer:
(i) - (q) ; (ii) - (s) ; (iii) - (r) ; (iv) - (p)

Solution:
As we learned

Concept of sub Tangent and sub Normal -

When Tangent and Normal cuts the x-axis at a point and perpendicular from point of contact to x-axis.Then this is sub Normal & Tangent.From fig TS and SN are known as sub tangent and sub normal.

- wherein



Q. 10 What is the ways of selecting atleast one fruit from 5 identical mangoes, 3 identical guavas and 7 identical bananas?

Option 1:
192

Option 2:
15

Option 3:
191

Option 4:
None of these

Correct Answer:
191

Solution:

The theorem of Combinations -

The number of ways of selecting at least one item from a collection of m objects of one kind, n objects of another kind and p other kind is (m + 1) (n + 1) (p + 1) -1.

-

(5 + 1) (3 + 1) (7 + 1) -1=191

Q. 11 In cartesian coordinate system point A = (3,5) and B = (2,7) , if point 'C' divides AB in ratio 3:5 point 'C' is :

Option 1:
(21/8,50/8)

Option 2:
(19/8,50/8)

Option 3:
(21/8,46/8)

Option 4:
(19/8,46/8)

Correct Answer:
(21/8,46/8)

Solution:
As we have learned

Section formula -

$$x = \frac{mx_2 + nx_1}{m+n}$$

$$y = \frac{my_2 + ny_1}{m+n}$$

- wherein

If P(x,y) divides the line joining A(x_1,y_1) and B(x_2,y_2) in ration $m : n$

3:5

A B

C

$$x_c = \frac{3x_B + 5x_A}{3+5} = \frac{3 \times 2 + 5 \times 3}{3+5} = 21/8$$

$$y_c = \frac{3y_B + 5y_A}{3+5} = \frac{3 \times 7 + 5 \times 5}{3+5} = \frac{46}{8}$$

Q. 12 What is the no. of ways of selecting 5 fruits such that there are bags of identical apples, oranges, papayas and bananas?

Option 1:
$8P_5$

Option 2:
5^4

Option 3:
5!

Option 4:
$^8C_5$

Correct Answer:
$^8C_5$

Solution:

Theorem of Combinations -

The number of combinations of n distinct objects taken r at a time when any object may be repeated any number of times is $^{n+r-1}C_r$.

- wherein

Coefficient of x^r in $(1-x)^{-n}$.

Coefficient of x^5 in $\left(1+x+x^2+x^3+...\right)^4$ = . Coefficient of x^5 in $(1-x)^{-4}$

$=^{5+4-1}C_5 =^8 C_5$

Q. 13 Matrix A and B are orthogonal matrix . Then (adjA) (adjB)=

Option 1:
Identity matrix

Option 2:
Inverse matrix doesn't exist.

Option 3:
Singular matrix

Option 4:
Both (b) and (c)

Correct Answer:
Identity matrix

Solution:
As we have learnt

Property of adjoint of A -

$$adj\,(AB) = (adjB)\,(adjA)$$

- wherein

$adjA$ denotes adjoint of A

$(adjA)(adjB) = adj(BA)$

and orthogonal matrix is

AB = I = BA

So, $(adjA)(adjB) = adj(I)$

$adj(I_n) = I_n$

correct option a

Q. 14 Constant function is differentiable:

Option 1:
at each $x \in \mathbb{R}$

Option 2:
at $x \in [-1, 1]$

Option 3:
at $x \in \mathbb{R} - \{0\}$

Option 4:
None of the above

Correct Answer:
at each $x \in \mathbb{R}$

Solution:
As we have learnt,

Properties of differentiable functions -

Every constant function is differentiable at each $x \epsilon R$

Q. 15 If $f(x) = x^2 + 2;$ then find g(x) such that it is the inverse of f(x)

Option 1:
$\sqrt{x-2}, x \geq 0$

Option 2:
$\sqrt{x-2}; x \geq 2$

Option 3:
$\sqrt{x-2}; x \geq 3$

Option 4:
$\sqrt{x-2}; x \geq 1$

Correct Answer:
$\sqrt{x-2}; x \geq 2$

Solution:
As we have learned

Property of Inverse -

The inverse of a bijection is also a bijection.

$y = x^2 + 2$

$x^2 = y - 2$

$x = \sqrt{y-2}$

so inverse $g(x) = \sqrt{x-2}; x \geq 2$

Because g(x) is only defined when $x \geq 2$

Q. 16 Find the domain of the function $f(x) = \frac{1}{x+1}$

Option 1:
$R - \{1\}$

Option 2:
$R - \{-1\}$

Option 3:
$\{-1, 1\}$

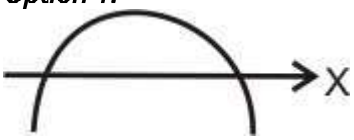
Option 4:
r

Correct Answer:
$R - \{-1\}$

Solution:
The function is not defined when $x + 1 = 0 \; or \; x = -1.$

Hence the domain is R - {-1}

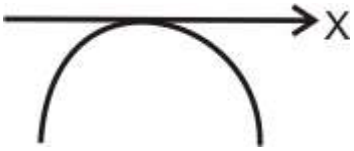
Q. 17 For which of the following graphs; $-3x^2 + 7x - \frac{49}{12}$ is the correct expression

Option 1:


Option 2:


Option 3:


Option 4:
None of these

Correct Answer:


Solution:
As we learned

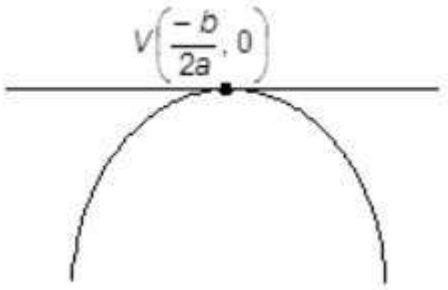
Quadratic Expression Graph when a< 0 & D = 0 -

Real and equal roots of

$f(x) = ax^2 + bx + c$

& $D = b^2 - 4ac$

- wherein



$a = -3 < 0$

$D = 49 - 49 = 0$

Q. 18 Find the no. of ways to answer 5 questions, with alternative in each question, such that atleast one question is answered.

Option 1:
3^5

Option 2:
$2^5 - 1$

Option 3:
$3^5 - 1$

Option 4:
None of these

Correct Answer:
$3^5 - 1$

Solution:

Rule for answering of n different questions -

The number of ways of answering one or more of n questions when each question has an alternative $= 3^n - 1$.

Here n=5.

So, required no. of ways = $3^5 - 1$

Q. 19 Which of these can be a diagonal element of square matrix of order 5?

Option 1:
x_{43}

Option 2:
x_{44}

Option 3:
x_{66}

Option 4:
x_{23}

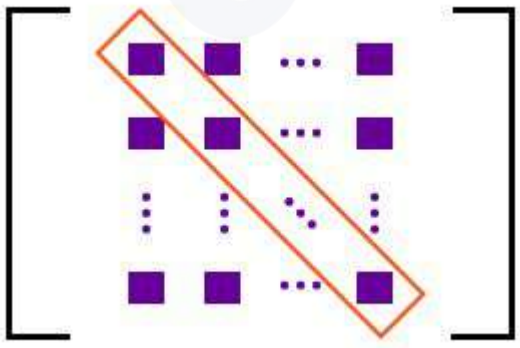
Correct Answer:
x_{44}

Solution:
As we have learnt

Leading / principal diagonal of a matrix -

Diagonal from left hand side upper corner to the lower most element.

- wherein



x_{ij} is a digonal element if i=j and $i, j \leq n$ where n is order of the matrix.

Q. 20 Let x be a random variable such that the probability function of a distribution is given by $\mathrm{P(X=0)=\frac{1}{2}, P(X=j)=\frac{1}{3^j}(j=1,2,3,\ldots,\infty)}$
Then the mean of the distribution and $\mathrm{P(X}$ is positive and even) respectively are

Option 1:
$\frac{3}{8}\ and\ \frac{1}{8}$

Option 2:
$\frac{3}{4}\ and\ \frac{1}{8}$

Option 3:
$\frac{3}{4}\ and\ \frac{1}{9}$

Option 4:
$\frac{3}{4}\ and\ \frac{1}{16}$

Correct Answer:
$\frac{3}{4}\ and\ \frac{1}{8}$

Solution:
$Mean\ of\ distribution = \sum xi\ pi$
$= 0\cdot\left(\frac{1}{2}\right)+1\left(\frac{1}{3}\right)+2\left(\frac{1}{3}\right)^2+\cdots$
$Let\ S=\frac{1}{3}+\frac{2}{3^2}+\frac{3}{3^3}+\frac{4}{3^4}+\cdots$
$\frac{S}{3}=\frac{1}{3^2}+\frac{2}{3^3}+\frac{3}{3^4}+\cdots$

Subtracting
$\frac{2S}{3}=\frac{1}{3}+\frac{1}{3^2}+\frac{1}{3^3}+\cdots$
$\frac{2S}{3}=\frac{1}{2}\Rightarrow S=\frac{3}{4}$

Now, $P\left(x\ is\ even\right)=P\left(x=2\right)+P\left(x=4\right)+\cdots$
$=\frac{1}{3^2}+\frac{1}{3^4}+\frac{1}{3^6}+\cdots$
$=\frac{1}{8}$

Q. 21 Let C_1 be the curve obtained by the solution of differential equation $2xy\frac{dy}{dx} = y^2 - x^2, x > 0$. Let C_2 be the solution of $\frac{2xy}{x^2 - y^2} = \frac{dy}{dx}$. If both the curve pass along (1,1) then the area enclosed by the curves C_1 and C_2 is equal to:

Option 1:
$\pi + 1$

Option 2:
$\frac{\pi}{2} - 1$

Option 3:
$\frac{\pi}{4} + 1$

Option 4:
$\pi - 1$

Correct Answer:
$\frac{\pi}{2} - 1$

Solution:

$$\frac{dy}{dx} = \frac{y^2 - x^2}{2xy}, \quad x \in (0, \infty)$$

$$\text{put } y = vx$$

$$x\frac{dv}{dx} + v = \frac{v^2 - 1}{2v}$$

$$\frac{2v}{v^2 + 1}dv = -\frac{dx}{x}$$

$$\text{Integrate,}$$

$$\ln\left(v^2 + 1\right) = -\ln x + C$$

$$\ln\left(\frac{y^2}{x^2} + 1\right) = -\ln x + C$$

$$\text{put } x = 1, y = 1, C = \ln 2$$

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

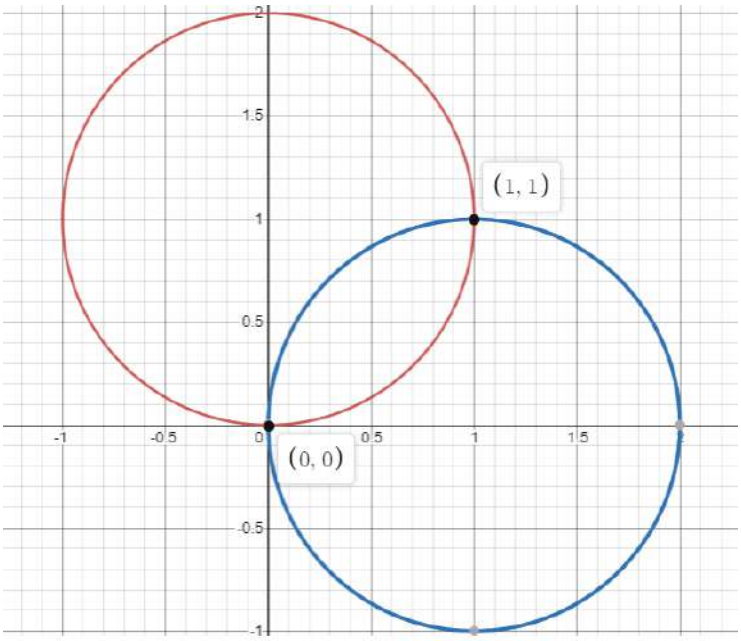
$$\Rightarrow x^2 + y^2 - 2x = 0 \quad (\text{ Curve } C_1)$$

Similarly

$$\frac{dy}{dx} = \frac{2xy}{x^2 - y^2}$$

Put $y = vx$

$$x^2 + y^2 - 2y = 0$$



$$\text{Required area } = 2\int_0^1 \left(\sqrt{2x - x^2} - x\right) dx = \frac{\pi}{2} - 1$$

Q. 22 Find the angle of intersection of curve $y^2 = x \ and \ x^2 = y$.

Option 1:

$\theta = 90°, tan^{-1}\left(\frac{3}{4}\right)$

Option 2:

$\theta = 90°, \frac{\pi}{4}$

Option 3:

$\theta = 0°, 90°$

Option 4:

$\theta = tan^{-1}\left(\frac{3}{4}\right), tan^{-1}\left(\frac{1}{4}\right)$

Correct Answer:

$\theta = 90°, tan^{-1}\left(\frac{3}{4}\right)$

Solution:

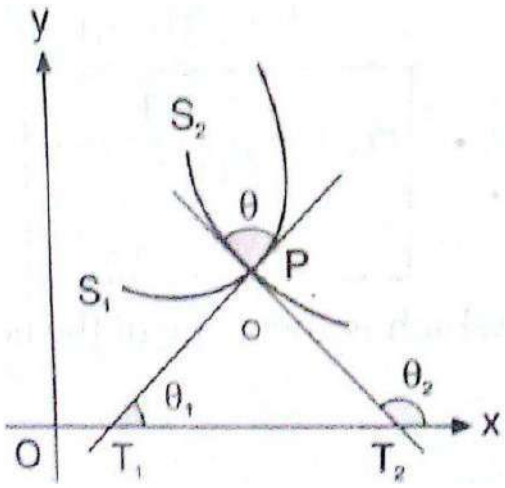
As we learned

Angle of intersection of two curves -

The angle of intersection of two curves is the angle subtended between the tangents at their point of intersection.Let m_1 & m_2 are two slope of tangents at intersection point of two curves then

$$tan\theta = \frac{[m_1 - m_2]}{1 + m_1 m_2}$$

- wherein



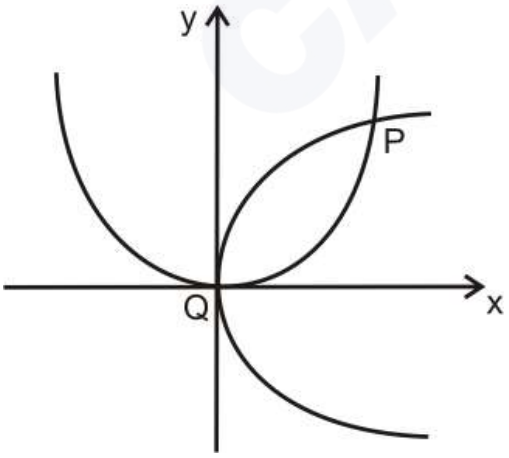
where θ is angle between two curves tangents.

We have

$$2y\ y^1 = 1.....(I)$$

$$y^1 = 2x.....(II)$$

For point of intersection,



$x^4 = x \Rightarrow x = 0, 1$

$At\ \ Q,\ \theta = 90^\circ$

$At\ \ P,\ m_1 = \frac{1}{2}\ (from(I))\ \ ,\ \ m_2 = 2(from(II))$

$So,\ \ tan\theta = \left|\frac{2 - \frac{1}{2}}{1 + 1}\right| = \frac{3}{4}$

Q. 23 $\dfrac{\sin^2 A - \sin^2 B}{\sin A \cos A - \sin B \cos B} =$

Option 1:
$\tan(A - B)$

Option 2:
$\tan(A + B)$

Option 3:
$\cot(A - B)$

Option 4:
$\cot(A + B)$

Correct Answer:
$\tan(A + B)$

Solution:
As we learn

Results of Compound Angles -

$\sin(A + B)\sin(A - B) = \sin^2 A - \sin^2 B$

- wherein

A and B are two angles.

$$\frac{2(\sin^2 A - \sin^2 B)}{2\sin A\cos A - 2\sin B\cos B} = \frac{2\sin(A + B).\sin(A - B)}{\sin 2A - \sin 2B} = \frac{2\sin(A + B)\sin(A - B)}{2\sin(A - B)\cos(A + B)} = \tan(A + B)$$

Q. 24 Which of the following functions are one - one functions?

Option 1:
$f(x) = x^2$

Option 2:
$f(x) = x^4$

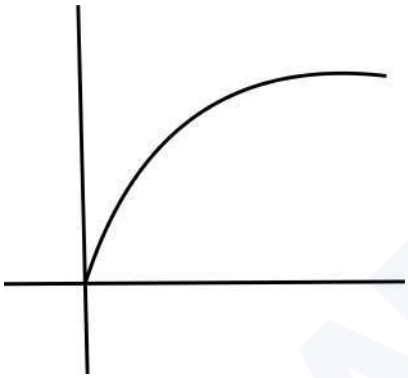
Option 3:
$f(x) = \cos x$

Option 4:
$f(x) = \sqrt{x}$

Correct Answer:
$f(x) = \sqrt{x}$

Solution:
A line parallel to x - axis cuts the curve of one-one function at at most one point.

$f(x) = \sqrt{x}$



Clearly, this function is one - one function.

Q. 25 Let R= {(3,3), (5,5), (9,9), (12,12), (5,12), (3,9), (3,12), (3,5)} be a relation on the set A= {3,5,9,12}. Then R is :

Option 1:
reflexive , symmetric but not transitive

Option 2:
symmetric, transitive but not reflexive

Option 3:
an equivalence relation.

Option 4:
reflexive, transitive but not symmetric

Correct Answer:
reflexive, transitive but not symmetric

Solution:
Let R= {(3,3), (5,5), (9,9), (12,12), (5,12), (3,9), (3,12), (3,5)} be a relation on the set

A= {3,5,9,12}

Clearly, every element of A is related to itself. Therefore, it is reflexive.

Now, R is not symmetric because 3 is related to 5 but 5 is not related to 3 .

Also, R is transitive relation because it satisfies the property that if aRb and bRc then aRc.

Q. 26 If $y = y(x)$ is the solution of the differential equation, $\frac{dy}{dx} + 2y\tan x = \sin x$, $y\left(\frac{\pi}{3}\right) = 0$, then the maximum value of the function $y(x)$ over R is equal to :

Option 1:
$-\frac{15}{4}$

Option 2:
$\frac{1}{2}$

Option 3:
$\frac{1}{8}$

Option 4:
8

Correct Answer:
$\frac{1}{8}$

Solution:

Given equation is linear differential equation

$$\frac{\mathrm{dy}}{\mathrm{dx}} + 2\mathrm{y}\tan\mathrm{x} = \sin\mathrm{x}$$
$$\mathrm{I.F.} = \mathrm{e}^{\int 2\tan\mathrm{x}\mathrm{dx}} = \mathrm{e}^{2\ln\sec x}$$
$$\mathrm{I.F.} = \sec^2\mathrm{x}$$

$$y \cdot \left(\sec^2 x\right) = \int \sin x \cdot \sec^2 x dx$$

$$y \cdot \left(\sec^2 x\right) = \int \sec x \tan x dx$$

$$y \cdot \left(\sec^2 x\right) = \sec x + C$$

Now

$$\mathrm{x} = \frac{\pi}{3}; \mathrm{y} = 0$$

$$\Rightarrow \mathrm{C} = -2$$

$$\Rightarrow \quad y = \frac{\sec x - 2}{\sec^2 x} = \cos x - 2\cos^2 x$$

$$y = t - 2t^2 \Rightarrow \frac{dy}{dt} = 1 - 4t = 0 \Rightarrow t = \frac{1}{4}$$

$$\therefore \quad \max = \frac{1}{4} - \frac{1}{8} = \frac{2-1}{8} = \frac{1}{8}$$

Q. 27 How do we express: The probability of occurring B when C has already occurred?

Option 1:
$P\left(B \cap C'\right)$

Option 2:
$P\left(B/C\right)$

Option 3:
$P\left(C/B\right)$

Option 4:
$P\left(B/C'\right)$

Correct Answer:
$P\left(B/C\right)$

Solution:
As we learned from

Conditional Probability -

Let A and B be any two events such that $B \neq \phi$ or

n(B) = 0 or P(B) = 0 then $P\left(\frac{A}{B}\right)$ denotes the conditional probability of occurrence of event A when B has already occured

Q. 28 $\int \sqrt{e^x}dx$

Option 1:
$\frac{1}{\sqrt{e^x}}+C$

Option 2:
$2\sqrt{e^x}+C$

Option 3:
$\frac{2}{\sqrt{e^x}}+C$

Option 4:
$2\left(e^x\right)^{\frac{3}{2}}+C$

Correct Answer:
$2\sqrt{e^x}+C$

Solution:
As we learned,

Type of integration by substitution -

$$\int \frac{f'(x)dx}{\sqrt{f(x)}}=2\sqrt{f(x)}+c$$

- wherein

Let $f(x)=t$

$\therefore f'(x)dx=dt$

$$\int \sqrt{e^x}dx=\int \frac{e^x}{\sqrt{e^x}}dx$$

Put $e^x=t$;

$$\int \frac{dt}{\sqrt{t}}=2\sqrt{t}=2\sqrt{e^x}+C$$

Q. 29 If A and B are invertible matrices. Then which one of the following statement is not correct.

Option 1:
$AdjA = |A|\, A^{-1}$

Option 2:
$\left|A^{-1}\right| = |A|^{-1}$

Option 3:
$(A+B)^{-1} = B^{-1} + A^{-1}$

Option 4:
$(AB)^{-1} = B^{-1}A^{-1}$

Correct Answer:
$(A+B)^{-1} = B^{-1} + A^{-1}$

Solution:
As we have learnt

Inverse of a matrix -

A non-singular square matrix of order n is invertible if there exists a square matrix B of the same order such that $AB = I = BA$

$AA^{-1} = I$

$|A| = 1/|A^{-1}|$

$(A+B)^{-1} \neq A^{-1} + B^{-1}$

Q. 30 If the mean of the data : 7, 8, 9, 7, 8, 7, λ, 8 is 8, then the variance of this data is :

Option 1:
$\frac{7}{8}$

Option 2:
1

Option 3:
$\frac{9}{8}$

Option 4:
2

Correct Answer:
1

Solution:
As we learned,

ARITHMETIC Mean -

For the values x_1, x_2, ...x_n of the variant x the arithmetic mean is given by

$$\bar{x} = \frac{x_1 + x_2 + x_3 + \cdots + x_n}{n}$$

in case of discrete data.

Standard Deviation -

If x_1, x_2...x_n are n observations then square root of the arithmetic mean of

$$\sigma = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n}}$$

–

- wherein

where $\bar{x}$ is mean

mean of data = $\frac{7+8+9+7+8+7+7+8}{8} = 8$

$\Rightarrow \lambda = 10$

Variance

$$V^2 = \frac{(7-8)^2 + (8-8)^2 + (9-8)^2 + (7-8)^2 + 0^2 + (7-8)^2 + (10-8)^2 + (8-8)^2}{8}$$

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

Variance = 1

Q. 31 Let $R = \{(1,3), (4,2), (2,4), (2,3), (3,1)\}$

be a relation on the set $A = \{1,2,3,4\}$ The relation R is

Option 1:
Symmetric

Option 2:
Transitive

Option 3:
Reflexive

Option 4:
None of these

Correct Answer:
None of these

Solution:
A = {1, 2, 3, 4}

R = {(1, 3), (4, 2), (2, 4), (2, 3), (3, 1)}

Reflexive: (1,1) is missing, so not reflexive

Symmetric: (2,3) is there, but (3,2) is not, so not symmetric

Transitive: (1,3), (3,1) are present, but (1,1) is not, so not transitive

---

Q. 32 What is the euler form of complex number $z = 2\sqrt{3} - 2i$

Option 1:
$4e^{\frac{-i\pi}{6}}$

Option 2:
$4\sqrt{2}e^{\frac{-i\pi}{3}}$

Option 3:
$4e^{\frac{-i\pi}{3}}$

Option 4:
None of these

Correct Answer:
$4e^{\frac{-i\pi}{6}}$

Solution:
As we learned

Euler's Form of a Complex number -

$z = re^{i\theta}$

- wherein

r denotes modulus of z and θ denotes argument of z.

$[z] = 2 * 2 = 4$

Arg $(z) = \frac{-\pi}{6}$

$\left(tan\Theta = \frac{i}{\sqrt{3}} \text{ and } 4^{th} quadrant \right)$

So, $z = 4e^{\frac{-i\pi}{6}}$

Q. 33 For $x \in \mathbb{R} - \{0, 1\}$, let $f_1(x) = \frac{1}{x}, f_2(x) = 1 - x$ and $f_3(x) = \frac{1}{1-x}$ be three given functions. If a function, $J(x)$ satisfies $(f_2 \circ J \circ f_1)(x) = f_3(x)$ then $J(x)$ is equal to:

Option 1:
$f_3(x)$

Option 2:
$\frac{1}{x} f_3(x)$

Option 3:
$f_2(x)$

Option 4:
$f_1(x)$

Correct Answer:
$f_3(x)$

Solution:
Given that

$$f_1(x) = \frac{1}{x}, \quad f_2(x) = 1 - x \quad and \quad f_3(x) = \frac{1}{1-x}$$

Given

$$f_2 o\left(J\left(f_1(x)\right)\right) = f_3(x)$$

$$f_2 o\left(J\left(\frac{1}{x}\right)\right) = \frac{1}{1-x}$$

$$1-J\left(\frac{1}{x}\right)=\frac{1}{1-x}$$

$$J\left(\frac{1}{x}\right)=\frac{x}{x-1}$$

Now, $x \rightarrow \frac{1}{x}$

$$J(x)=\frac{\frac{1}{x}}{\frac{1}{x}-1}=\frac{1}{1-x}=f_3(x)$$

Q. 34 $\vec{a} \times \vec{b}=\vec{c}$, then $\vec{a} \cdot \vec{c}=$

Option 1:
0

Option 2:
1

Option 3:
$\left|\vec{b}\right|$

Option 4:
$\vec{B}$

Correct Answer:
0

Solution:
As we learned

Properties of Vector Product -

$\vec{a} \times \vec{b}$ is perpendicular to $\vec{a}\ and\ \vec{b}$

- wherein

$If\ \vec{a} \times \vec{b}=\vec{c}$

$\vec{c}.\vec{a}=\vec{c}.\vec{b}=0$

Q. 35 The negation of $p \vee (\sim p \wedge q)$

Option 1:
$\sim p \wedge \sim q$

Option 2:
$p \wedge \sim q$

Option 3:
$\sim p \vee q$

Option 4:
$\sim p \vee \sim q$

Correct Answer:
$\sim p \wedge \sim q$

Solution:

$\mathbf{p}$	$\mathbf{q}$	$\neg(\mathbf{p} \vee (\neg\mathbf{p} \wedge \mathbf{q}))$
F	F	$\mathbf{T}$
F	T	F
T	F	F
T	T	F

$\mathbf{p}$	$\mathbf{q}$	$(\neg\mathbf{p} \wedge \neg\mathbf{q})$
F	F	$\mathbf{T}$
F	T	F
T	F	F
T	T	F

Correct Answer: Option A

Q. 36 Which one of the following is the factor of the determinant. $\begin{vmatrix} x & 7 & 3 \\ x^2 & 11 & 9 \\ x^3 & 13 & 27 \end{vmatrix}$

Option 1:
x-3

Option 2:
x+3

Option 3:
x-4

Option 4:
both (a) and (c)

Correct Answer:
x-3

Solution:
As we have learnt

Property of determinant -

If a determinant d become 0 for $x = a$, then $(x - a)$ is a factor of d, in other words if two rows (or two columns) becomes identical for $x = a$, Then $(x - a)$ is a factor of d

If you put x = 3 then C_1 and C_3 will be same.

So, $\Delta = 0$

Hence (x-3) is a factor.

correct option a.

Q. 37 How many words can be formed with the letters of the word 'ENTRANCE CORNER '

Option 1:
14!/(3! 3! 2!)

Option 2:
$14!/(3!3!3!2!)$

Option 3:
14 !/ (3! 3! 6)

Option 4:
none of these

Correct Answer:
$14!/(3!3!3!2!)$

Solution:
As we have learned

Number of arrangement of like and alike objects -

The number of arrangements that can be formed using n objects out of which r, q and p are identical objects then total number of arrangements$= \frac{n!}{p!\ q!\ r!}$

Ex. ALLAHABAD

$A \to 4$

$L \to 2$

$\therefore \quad \frac{9!}{4!\ 2!}$

Total no. of letters 14 . in which 3E's , 3N's , 3R's , 2 C's and rest are different

Then no. of word formed

$14!/(3!3!3!2!)$

Q. 38 The integral $\int \frac{dx}{(x+1)^{\frac{3}{4}}(x-2)^{\frac{5}{4}}}$

is equal to:

Option 1:

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

Option 2:

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

Option 3:

$-\frac{4}{3}\left(\frac{x+1}{x-2}\right)^{\frac{1}{4}}+C$

Option 4:

$-\frac{4}{3}\left(\frac{x-2}{x+1}\right)^{\frac{1}{4}}+C$

Correct Answer:

$-\frac{4}{3}\left(\frac{x+1}{x-2}\right)^{\frac{1}{4}}+C$

Solution:

Integration by substitution -

The functions when on substitution of the variable of integration to some quantity gives any one of standard formulas.

Since $\int f(x)dx = \int f(t)dt = \int f(\theta)d\theta$ all variables must be converted into single variable , $(t \; or \; \theta)$

$$I = \frac{dx}{(x+1)^{\frac{3}{4}}(x-2)^{\frac{5}{4}}}$$

$$I = \int \frac{dx}{(x+1)^{\frac{3}{4}}(x-2)^{\frac{5}{4}}} \frac{(x-2)^{\frac{3}{4}}}{(x-2)^{\frac{3}{4}}}$$

$$= \int \frac{dx}{\left(\frac{x+1}{x-2}\right)^{\frac{3}{4}}(x-2)^2}$$

Let $\frac{x+1}{x-2} = t$

$$\frac{(x-2)-(x+1)}{(x-2)^2}dx$$

$$\Rightarrow \frac{dx}{(x-2)^2} = -\frac{dt}{3}$$

Thus I= $\int \frac{-dt}{3t^{\frac{3}{4}}}$

$$= \frac{-1}{3} \times \frac{1}{\frac{1}{4}} t^{\frac{1}{4}} + c$$

$$= -\frac{4}{3}t^{\frac{1}{4}} + c$$

$$I = -\frac{4}{3}\left(\frac{x+1}{x-2}\right)^{\frac{1}{4}} + c$$

Q. 39 In triangle ABC , C is right angle , point D lies on hypoteneus AB such that CD is perpendicular to AB , if CD = 6 and BD = 9 then area of triangle is

Option 1:
36

Option 2:
39

Option 3:
32

Option 4:
54

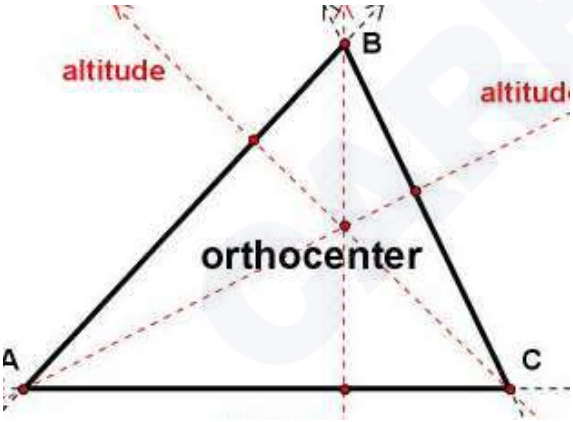
Correct Answer:
39

Solution:
As we have learned

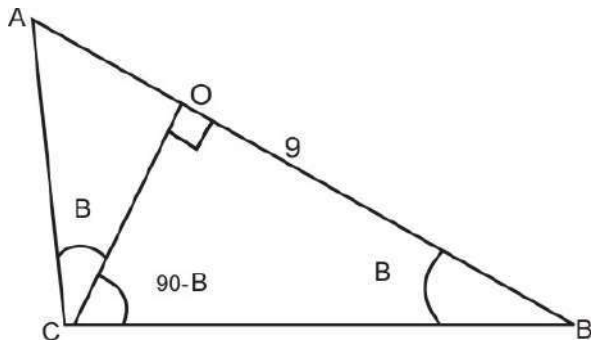
Orthocentre -

The point of intersection of the altitude of a triangle.

- wherein



In triangle CDB



$\tan B = CD/BD$

IN triangle ACD

$\angle DCA = \angle ABC$

$\tan B = AD/CD$

so we have

CD /BD = AD/CD

$CD^2 = (BD) \times (AD)$

$6^2 = 9 * AD$

$AD = 4$

$area\ \ of\ \ triangle\ \ = 1/2 * AB * CD = 1/2(4+9) * 6$

$= 13 * 3$

39

Q. 40 General solution of D.E $cosec^2(x)\cot ydx + cosec^2(y)\cot xdy = 0$

Option 1:
$|\cot x - \cot y| = c$

Option 2:
$|\cot x . \cot y| = c$

Option 3:
$|\cot x + \cot y| = c$

Option 4:
None of these

Correct Answer:
$|\cot x . \cot y| = c$

Solution:
As we learnt

The general form of Variable Separation -

$d(xy) = ydx + xdy$

-

Dividing the given eq by $\cot(x)\cot(y)$

$$\frac{cosec^2(x)}{\cot(x)}dx + \frac{cosec^2(y)}{\cot(y)}dy = 0$$

Integrate both sides

$$\int \frac{cosec^2(x)}{\cot(x)}dx + \int \frac{cosec^2(y)}{\cot(y)}dy = 0$$

$$-(\ln|\cot(x)| + \ln|\cot(y)|) = \ln|C|$$

$$|\cot(x).\cot(y)| = C$$

Q. 41 The roots of the equation $x^4 - 1 = 0$, are

Option 1:
$1, 1, i, -i$

Option 2:
$1, -1, i, -i$

Option 3:
$1, -1, \omega, \omega^2$

Option 4:
None of these

Correct Answer:
$1, -1, i, -i$

Solution:
As we learn

nth roots of unity -

$$z = (1)^{\frac{1}{n}} \Rightarrow z = \cos\frac{2k\pi}{n} + i\sin\frac{2k\pi}{n}$$

Where k=0,1,2,.....,(n-1)

-

$$x^4 - 1 = 0 \Rightarrow (x^2-1)(x^2+1) = 0 \Rightarrow x^2 = 1 and x^2 = -1 \Rightarrow x = \pm 1, \pm i$$

Q. 42 $\lim_{x \to 0} \frac{|X|}{x} =$

Option 1:
1

Option 2:
-1

Option 3:
0

Option 4:
does not exist

Correct Answer:
does not exist

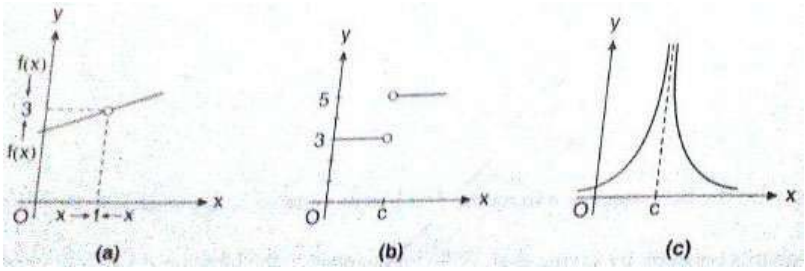
Solution:
As we learned

Condition for Geometrical Limit -

$$In\ fig(a),\ f(x)\ is\ not\ defined\ at\ x = 1,\ for\ f(x) = \frac{x^2+x-2}{x-1}.$$

Fig(b) & Fig(c) show the graphs of two functions that do not posses a limit as x approaches c.

- wherein



$\lim_{x \to 0-} \frac{|x|}{x} = 1$ hence limit does not exists

Q. 43 What is projection of $\vec{B}$ on $\vec{A}$ if $\vec{a} \cdot \vec{b} = 2$ and $|\vec{a}| = 3$?

Option 1:
6

Option 2:
$\frac{2}{3}$

Option 3:
$\frac{3}{2}$

Option 4:
1

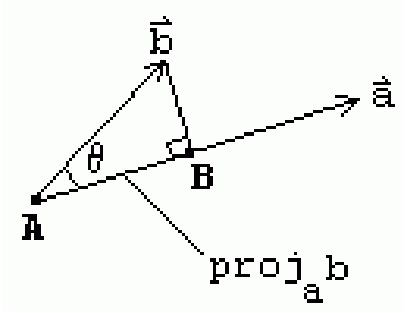
Correct Answer:
$\frac{2}{3}$

Solution:
As we have learnt

Projection of vector b on vector a -

$$\vec{b}\cos\Theta = \frac{\vec{a}.\vec{b}}{|\vec{a}|}$$

- wherein



$$\left|\vec{b}\right| \cos\theta = \frac{\vec{a}\cdot\vec{b}}{|\vec{a}|} = \frac{2}{3}$$

Q. 44 Consider the following statements :

$S_1 : x = \sqrt{log_{11}7}$ and $y = \sqrt{log_7 11}$, then $e^{y\ln 7 - x\ln 7}$ is equal to 1 .

$S_2 : \log_x 3 > \log_x 2$ is true for all value of $x\epsilon(0,1)\cup(1,\infty)$

$S_3 : |x-2| = [-\pi]$, then x is $6, -2$

$S_4 : \log_{25}(2+\tan^2\theta) = 0.5$, then θ may be $\frac{4\pi}{3}$ or $\frac{2\pi}{3}$

State, in order, whether S_1, S_2, S_3, S_4 are true or false

Option 1:
$T\ F\ F\ T$

Option 2:
$F\ F\ T\ T$

Option 3:
$F\ T\ F\ T$

Option 4:
$T\ T\ F\ T$

Correct Answer:
$T\ F\ F\ T$

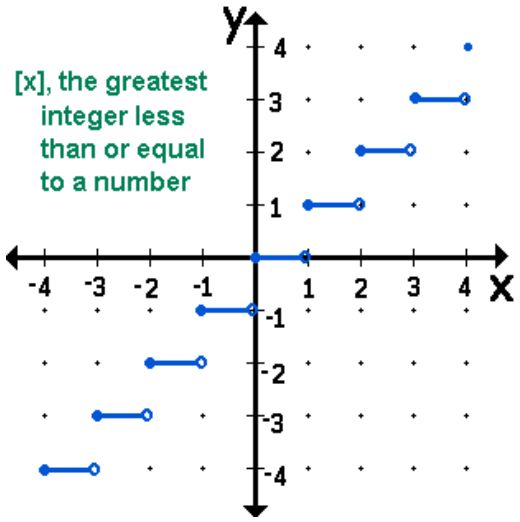
Solution:

Greatest Integer Function -

$[x]$ = Greatest integer less than or equal to x

$(for\ x\ \in\ R)$

- wherein



Range = Integers

$$S_1 : e^{y\,ln7 - x\,ln11} = e^{ln\frac{7^y}{11^x}} = \frac{7^y}{11^x} = \frac{7^{\sqrt{log_7 11}}}{11^{\sqrt{log_{11}7}}}$$

$$= \frac{7^{\frac{log_7 11}{\sqrt{log_7 11}}}}{11^{\sqrt{log_{11}7}}} = \frac{11^{\sqrt{log_{11}7}}}{11^{\sqrt{log_{11}7}}} = 1$$

$$S_2 : log_x 3 > log_x 2 \Rightarrow \quad x > 1$$

$$S_3 : |x-2| = [-\pi]$$

$$|x-2| = -4 \;\; no \;\; solution$$

$$S_4 : log_{25}(2 + \tan^2\theta) = \frac{1}{2} \Rightarrow 2 + \tan^2\theta = 5$$

$$\Rightarrow log_5(2 + \tan^2\theta) = \frac{1}{2} \Rightarrow 2 + \tan^2\theta = 5$$

$$\Rightarrow \tan^2\theta = 3 \Rightarrow \tan\theta = \pm\sqrt{3}$$

$$\Rightarrow \theta \; may \; take \; value \; \frac{2\pi}{3} \; or \; \frac{4\pi}{3}$$

Q. 45 The inverse of the function $y = \sin x$ is

Option 1:

$y = cosecx$

Option 2:
$y = \sin^{-1} x$

Option 3:
$y = \frac{1}{\sin x}$

Option 4:
None of these

Correct Answer:
$y = \sin^{-1} x$

Solution:
As we have learnt,

Property of Inverse -

The inverse of a bijection is also a bijection.

Inverse of $y = \sin x$, where $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$ is $y = sin^{-1}x; -1 \leq x \leq 1$. We need to specify value of x, so that it is a bijective function

---

Q. 46 What is the no. of sides of a polygon if it has 44 diagonals?

Option 1:
11

Option 2:
8

Option 3:
5

Option 4:
None of these

Correct Answer:
11

Solution:
As we learnt

Geometrical Permutations -

The number of diagonals of n sided convex polygon is ${}^{n}c_2 - n = \frac{n(n-3)}{2}$.

- wherein

Where n > 3

$${}^{n}C_2 - n = 44$$

$$\Rightarrow n(n-1) - 2n = 88$$

$$\Rightarrow n^2 - 3n - 88 = 0$$

$$\Rightarrow (n-11)(n+8) = 0$$

$$\Rightarrow n = 11, -8$$

Accepted value = 11

Q. 47 $If\ \alpha, \beta, \gamma\ and\ \delta$ are angles of quadrilateral such that $f(\alpha) = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}, Then\ the\ f(\alpha)f(\beta)f(\gamma)f(\delta)\ is:$

Option 1:
1

Option 2:
-1

Option 3:
0

Option 4:
None of these.

Correct Answer:
1

Solution:
As we have learnt

Multiplication of matrices -

$\begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \times \begin{pmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{pmatrix} =$

$\begin{pmatrix} a_{11}b_{11}+a_{12}b_{21}+a_{13}b_{31} & a_{11}b_{12}+a_{12}b_{22}+a_{13}b_{32} & a_{11}b_{13}+a_{12}b_{23}+a_{13}b_{33} \\ a_{21}b_{11}+a_{22}b_{21}+a_{23}b_{31} & a_{21}b_{12}+a_{22}b_{22}+a_{23}b_{32} & a_{21}b_{13}+a_{22}b_{23}+a_{23}b_{33} \\ a_{31}b_{11}+a_{32}b_{21}+a_{33}b_{31} & a_{31}b_{12}+a_{32}b_{22}+a_{33}b_{32} & a_{31}b_{13}+a_{32}b_{23}+a_{33}b_{33} \end{pmatrix}$

-

$$f(\alpha)f(\beta) = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix} \begin{bmatrix} \cos\beta & \sin\beta \\ -\sin\beta & \cos\beta \end{bmatrix}$$

$$= \begin{bmatrix} \cos(\alpha+\beta) & \sin(\alpha+\beta) \\ -\sin(\alpha+\beta) & \cos(\alpha+\beta) \end{bmatrix}$$

So, $f(\alpha)f(\beta)f(\gamma)f(\delta) = \begin{bmatrix} \cos(\alpha+\beta+\gamma+\delta) & \sin(\alpha+\beta+\gamma+\delta) \\ -\sin(\alpha+\beta+\gamma+\delta) & \cos(\alpha+\beta+\gamma+\delta) \end{bmatrix}$

As, $\alpha+\beta+\gamma+\delta = 360^\circ = 2\pi$

$$f(\alpha)f(\beta)f(\gamma)f(\delta) = \begin{bmatrix} \cos(2\pi) & \sin(2\pi) \\ -\sin(2\pi) & \cos(2\pi) \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

Q. 48 Find the values of α and β of the following system of linear equation having solution

$$x + y + z = 6$$

$$x + 2y + 3z = 10$$

$$x + 2y + \alpha z = \beta$$

Option 1:
$\alpha \epsilon R, \beta \epsilon R$

Option 2:
$\alpha \neq 3. \beta \epsilon R$

Option 3:
$\alpha = 3, \beta \epsilon R$

Option 4:

$\alpha \neq -3, \beta \epsilon R$

Correct Answer:

$\alpha \neq 3. \beta \epsilon R$

Solution:

As we have learnt

Property of determinant -

If each element in a row (or column) of a determinant is written as the sum of two or more terms then the determinant can be written as the sum of two or more determinants

- wherein

System of linear equation in matrix form,

$$\begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 2 & \alpha \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 6 \\ 10 \\ \beta \end{bmatrix}$$

$Ax = b, X = A^{-1}B$

$detA \neq 0$

$$\begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 2 & \alpha \end{bmatrix} = 0$$

$\alpha = 3.$ Then detA = 0

So, $\alpha \neq 3.$ and $\beta \epsilon R.$

correct option is b

Q. 49 If $A \times B = B \times A$; it is possible when

Option 1:

$A = \phi$

Option 2:

$B = \phi$

Option 3:

$A = B$

Option 4:

All of the above.

Correct Answer:
All of the above.

Solution:
As we have learnt,

Theorem of Cartesian Product -

AXB≠BXA

- wherein

Cartesian Product is not commutative.

Theorem of Cartesian Product -

AX(B-C)=(AXB)-(AXC)

-

$$A = \phi = BA \times B = \phi; if\ A = B; A \times B = B \times A$$

Q. 50 If A,B and C are non-empty sets then $(A \cup B) - (A \cap B)$

Option 1:
$(A \cup B) - B$

Option 2:
$A - (A \cap B)$

Option 3:
$(A - B) \cup (B - A)$

Option 4:
$(A \cap B) \cup (A \cup B)$

Correct Answer:
$(A - B) \cup (B - A)$

Solution:
Clearly, as the sets in the question and in third option, both equal the symmetric difference of A and B, so both these are equal.

$(A-B) \cup (B-A) = (A \cup B) - (A \cap B)$