CAREERS 360

PRACTICE Series

TS EAMCET 2025

Sample Paper

Physics

Q. 1 If the charge Q is given to a conductor then

Option 1:
Total charge resides on its centre

Option 2:
total charge distributes its infinite volume

Option 3:
total charge always resides on its outer surface

Option 4:
Charge will travel between centre and surface of conductor

Correct Answer:
total charge always resides on its outer surface

Solution:
As we learn

Charge on a conductor -

Charge given to a conductor always resides on it's outer surface.

-

Charge given to a conductor always resides on its outer surface.

Q. 2 The no.of turns and radius of cross section of the coil of tangeat galvanometer are doubled. The reaction factor k will be -

Option 1:
$4K$

Option 2:
$\frac{K}{4}$

Option 3:
$2K$

Option 4:
k

Correct Answer:
k

Solution:
As we learn

Tangent Galvanometer -

$$B = B_H tan\Theta B = \frac{\mu_o ni}{2r} = B_{\mu tan\Theta} = k\, tan\Theta$$

- wherein

$$K = \frac{2rB_H}{\mu_0 N}$$

r=radius of coil

θ =Angle made by needle

$$K = \frac{2rB_H}{\mu_0 N}$$

[R - Radius, N-no.of turns]

$$R' \rightarrow 2R,\ N' = 2N$$

$$K' \rightarrow K$$

Q. 3 If potential $V = -5x + 3y + \sqrt{15}z$, then electric field E(x, y, z) is:

Option 1:
10 unit

Option 2:
8 unit

Option 3:
7 unit

Option 4:
5 unit

Solution:
As we learn

Relation between field and potential -

$$E=\frac{-dv}{dr}$$

- wherein

$\frac{dv}{dr}\ is$ Potential gradient.

$$\overrightarrow{E}==-gradV$$

$$\overrightarrow{E}=-\left[\frac{\partial V}{\partial x}\widehat{i}+\frac{\partial V}{\partial y}\widehat{j}+\frac{\partial V}{\partial z}\widehat{k}\right]$$

$$\overrightarrow{E}=-\left[5\widehat{i}+3\widehat{j}+\sqrt{15}\widehat{k}\right]=\sqrt{25+9+15}=\sqrt{49}=7unit$$

Q. 4 The S.I unit of surface tension is -

Option 1:
N/m^2

Option 2:
$N-M$

Option 3:
$N-M^2$

Option 4:
N/M

Correct Answer:
N/M

Solution:
As we learn

Unit of Surface Tension -

$\frac{N}{m} - in\ \ S.I.\ Unit$

$\frac{dyne}{cm} - in\ \ c.g.s.\ Unit$

-

Unit of Surface Tension is $\frac{n}{m}$.

Q. 5 A drop of water of radius 0.0015 mm is falling in air. The coefficient of viscosity of air is $1.8 \times 10^5 kgm^{-1}s^{-1}$. If the density of the air is neglected, then what will be the terminal velocity of the drop-

Option 1:
$2.72 \times 10^{-5} m/sec$

Option 2:
$1.35 \times 10^{-5} m/sec$

Option 3:
$2.72 \times 10^{-4} m/sec$

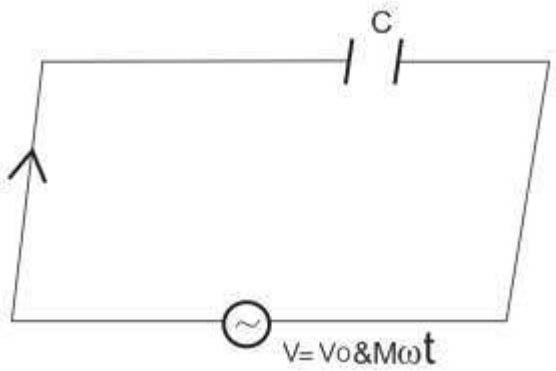
Option 4:
$3.45 \times 10^{-4} m/sec$

Correct Answer:
$2.72 \times 10^{-4} m/sec$

Solution:
$$v_t = \frac{2}{9}\frac{r^2\,(\rho - \sigma)}{\eta}g = \frac{2 \times [\frac{15 \times 10^{-4}}{1000}]^2 \times 10^3 \times 9.8}{9 \times 1.8 \times 10^{-5}}$$

$= 2.72 \times 10^{-4} m/s$

Q. 6 For the given circuit the value of peak current is equal to -



Option 1:
$\frac{V_o}{\omega C}$

Option 2:
$\frac{\omega C}{V_o}$

Option 3:
$V_o \omega C$

Option 4:
$\frac{\omega}{V_o C}$

Correct Answer:
$V_o \omega C$

Solution:
As we have learnt,

Peak current -

$$i_0' = \frac{V_0}{z} = \frac{V_0}{\sqrt{R^2 + X_c^2}} = \frac{V_0}{\sqrt{R^2 + \frac{1}{4\pi^2 \nu^2 c^2}}}$$

-

$$i_O = \frac{V_O}{X_C} = V_o \omega C$$

Q. 7 The thermo emf of a thermocouple varies with temperature as $E = A\theta + B\theta^2$. $\frac{A}{B} = 600^\circ C$. If the cold junction is kept at $0^\circ C$, the neutral temperature is

Option 1:
$0^\circ C$

Option 2:
$600^\circ C$

Option 3:
$150^\circ C$

Option 4:
No neutral temperature is possible

Correct Answer:
No neutral temperature is possible

Solution:
At neuttral temperature

$$\frac{dE}{d\theta} = 0$$

$$\Rightarrow A + 2B\theta_n = 0$$

$$\Rightarrow 2B\theta_n = -A$$

$$\theta_n = \frac{-A}{2B} = \frac{-1}{2}600 = -300^\circ C$$

Since $\theta_n = -300^\circ C$,

So, No neutral temperature is possible because Neutral temperature can never be negative hence no θ is possible.

Q. 8 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. 9 The unit of stress is-

Option 1:
$N - M$

Option 2:
$\frac{n}{m}$

Option 3:
$N - M^2$

Option 4:
$\frac{N}{M^2}$

Correct Answer:

$\frac{N}{M^2}$

Solution:
As we learn

Unit of stress -

Nm^{-2}

-

$$Stress = \frac{F}{A} = N/M^2$$

Q. 10 Ratio of average value of kinetic energy to that of potential energy for an SHM is.

Option 1:
2:1

Option 2:
1:1

Option 3:
1:2

Option 4:
1:4

Correct Answer:
1:1

Solution:
As we have learnt

Average value of kinetic energy -

Average of kinetic energy

$= \frac{\int (K.E.)\ dt}{\int dt}$

Average value of potential energy with respect to t -

$$U = \frac{Average\ of \int v\,dt}{\int dt}$$

- wherein

$$\because U = \frac{1}{2}Kx^2$$

average of U

$$= \frac{\int \frac{1}{2}m\omega^2 A^2 \sin^2 \omega t}{\int dt}$$

$$= \frac{1}{4}m\omega^2 A^2$$

- wherein

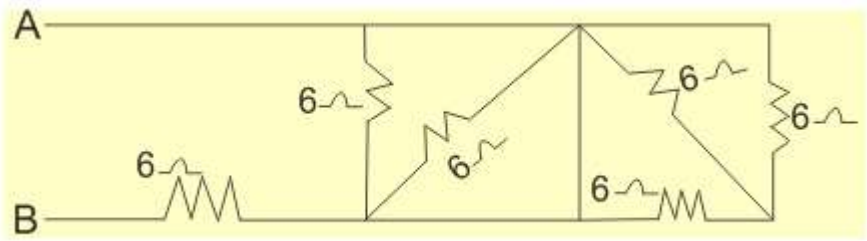
$$= \frac{\int \frac{1}{2}m\omega^2 A^2 \cos^2 (\omega t)}{\int dt}$$

$$= \frac{1}{4}m\omega^2 A^2$$

Average value of P.E.=Average value of K.E.

Ratio=1:1

Q. 11 The equivalent resistance across AB is



Option 1:
1.2Ω

Option 2:
12Ω

Option 3:
7.5Ω

Option 4:
6Ω

Correct Answer:
6Ω

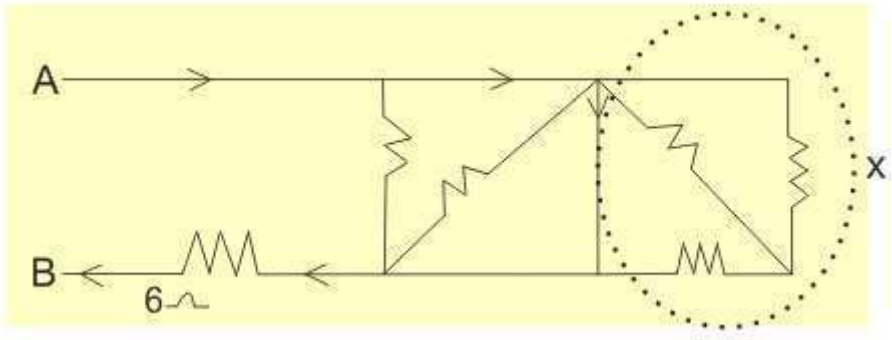
Solution:
As we learned

In series Grouping -

$$R_{eq} = R_1 + R_2 + R_3 + \cdots + R_n$$

- wherein

R_{eq} — Equivalent Resistance



$R_{AB} = 6\Omega$

Q. 12 If first excitation potential of a hydrogen like atom is V electron volt, then the ionization energy of this atom will be:

Option 1:
V electron volt

Option 2:
$\frac{3V}{4}$ electron volt

Option 3:
$\frac{4V}{3}$ electron volt

Option 4:
cannot be calculated

Correct Answer:
$\frac{4V}{3}$ electron volt

Solution:

Energy emitted due to transition of electron -

$$\Delta E = Rhcz^2\left(\frac{1}{{n_f}^2} - \frac{1}{{n_i}^2}\right)$$

$$\frac{1}{\lambda} = Rz^2\left(\frac{-1}{{n_i}^2} + \frac{1}{{n_f}^2}\right)$$

- wherein

$$R = Rhydberg\ constant$$

$n_i = initial\,state$

$n_f = final\ state$

First excitation energy = RhC $\left(\frac{1}{1^2} - \frac{1}{2^2}\right)$

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

$\therefore \frac{3}{4}RhC = Ve.v$

$\therefore RhC = \frac{4V}{3}e.v$

Q. 13 The Young's modulus of a wire of length L and radius R is $Y\,N/M^2$ if the length reduced to $L/2$ then it's Young's modulus will be-

Option 1:
y

Option 2:
$2Y$

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

Option 4:
$\frac{Y}{4}$

Correct Answer:
y

Solution:
As we learn

Young Modulus -

Ratio of normal stress to longitudnal strain

it denoted by Y

$$Y = \frac{Normal\ stress}{longitudnal\ strain}$$

- wherein

$$Y = \frac{F/A}{\Delta l/L}$$

F - applied force

A - Area

Δl - Change in length

l - original length

Young's modulus of wire does not vary with dimension of wire. It is property of given material.

Q. 14 A solid sphere of radius r made of a soft material of bulk modulus K is surrounded by a liquid in a cylindrical container. A massless piston of area a floats on the surface of the liquid, covering entire cross section of cylindrical container. When a mass m is placed on the surface of the piston to compress the liquid, the fractional decrement in the radius of the sphere,

$\left(\frac{dr}{r}\right)$, is:

Option 1:

$\frac{mg}{Ka}$

Option 2:

$\frac{Ka}{mg}$

Option 3:

$\frac{Ka}{3mg}$

Option 4:

$\frac{mg}{3Ka}$

Correct Answer:

$\frac{mg}{3Ka}$

Solution:

As we learnt that

Bulk Modulus -

Ratio of normal stress to volumetric strain.

$$K = \frac{f/A}{-\Delta v/v} = \frac{-Fv}{A\Delta v}$$

$$K = \frac{-Pv}{\Delta v}$$

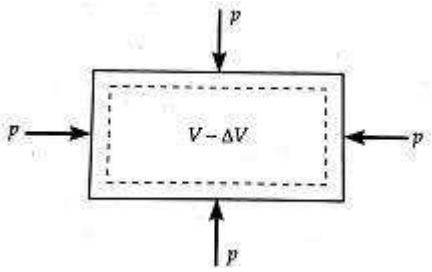
v = Original volume

ΔV = Change in volume

P = Increase in pressure

-ve(sign) shows volume (Δv) decrease.

- wherein



$$\Delta P = \frac{mg}{a} \qquad V = \frac{4\pi}{3}r^3$$

$$K = -\frac{\Delta P}{(\frac{\Delta V}{V})} \qquad \therefore \frac{dV}{V} = 3.\frac{dr}{r}$$

$$K = \frac{-\Delta P}{3.(\frac{dr}{r})}$$

$$or\ \frac{dr}{r} = \frac{-mg}{3Ka}$$

Q. 15 With rise in temperature of solid at a perticular temperature C_v becomes constant the temperature called as-

Option 1:
Dulong temperature

Option 2:
Debye temperature

Option 3:
Kelvin temperature

Option 4:
Petite temperature

Correct Answer:
Debye temperature

Solution:
As we learn

Debye's Temperature -

With rise in temperature C_V increases at a particular temperature.

- wherein

C_V = Specific heat capacity.

At Debye's temperature it becomes constant equal to 3R.

Q. 16 In the line of spectra of the hydrogen atom, the difference between the largest and the shortest wavelengths of the Lyman series is 304 $\dot{A}$. The corresponding difference for the Paschen is series in $\dot{A}$ is_____ (Give answer in closest integer)

Option 1:
10553

Option 2:
10567

Option 3:
9876

Option 4:
122234

Correct Answer:
10553

Solution:

$$\lambda = \frac{c}{\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)}$$

for Lyman series

$$\lambda_1 = \frac{c}{\frac{1}{1^2} - \frac{1}{\infty^2}} = c(n = \infty \text{ to } n = 1)$$

$$\lambda_2 = \frac{c}{\frac{1}{1^2} - \frac{1}{2^2}} = \frac{4c}{3}(n = 2 \text{ to } n = 1)$$

$$\Delta\lambda = \lambda_2 - \lambda_1 = \frac{c}{3} = 304\ A^0$$
$$\Rightarrow c = 912\ A^0$$

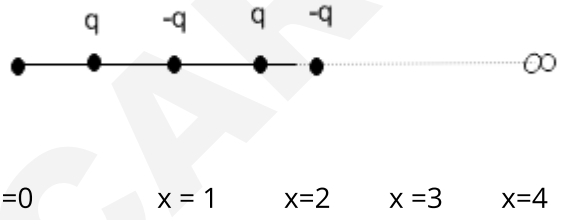
for Paschen series

$$\lambda_1 = \frac{c}{\frac{1}{3^2} - \frac{1}{\infty^2}} = 9c \quad (n = \infty \text{ to } n = 3)$$

$$\lambda_2 = \frac{c}{\frac{1}{3^2} - \frac{1}{4^2}} = \frac{144c}{7} \quad (n = 4 \text{ to } n = 3)$$

$$\Delta\lambda = \lambda_2 - \lambda_1 = \frac{144c}{7} - 9c = \frac{81c}{7}$$
$$\Delta\lambda = \frac{81 \times 912}{7} = 10553.14\ A^0 \approx 10553\ A^0$$

Q. 17 The potential at the origin charge distribution is : $\left[K = \frac{1}{4\pi\epsilon_0}\right]$



Option 1:
2 kq

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

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

Option 4:
kq (ln2)

Correct Answer:
kq (ln2)

Solution:
As we learn

Potential of a System of Charge -

$$V=\sum_{i=1}^{i=n}\frac{kQ_i}{r_i}$$

-

$$V_0=Kq\left[1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+.....\right]$$

$$V_0=Kq\,(ln2)$$

$$\left[ln(1+x)=x-\frac{x^2}{2}+\frac{x^3}{3}+.....\right]$$

Q. 18 If a conatiner of volume V contains 1 mole of H_2 gas with rms speed of the molecules of H_2 as 1500 m/s . If we change the gas in the container by 1 mole o f O_2 then we find rms speed for the molecules of H_2 as 2500 m/s . Then find the ratio of pressure due to gases $H_2\ and\ O_2$ respectively in container

Option 1:
3/40

Option 2:
40/3

Option 3:
20/6

Option 4:
6/20

Correct Answer:
3/40

Solution:

$$P = \frac{1}{3}\rho\, v^2$$

$$= \frac{1}{3}\left(\frac{M}{V}\right) \cdot\ v^2$$

$$H_2 \rightarrow M_H = 2g \quad V_{rms} = 1500m/s$$

$$O_2 \rightarrow M_{O2} = 16g \quad V_{rms} = 2500m/s$$

$$\frac{P_1}{P_2} = \left(\frac{M_{H2}}{M_{O2}}\right)\left(\frac{V_{rms}\, H_2}{V_{rms\, O2}}\right)^2 =$$

$$\frac{2}{16} \times \frac{1500}{2500} = 6/80 = 3/40$$

Q. 19 A body temperature T losses heat to the surrounding temperature to by radiation . If the difference in the temperature is small then , the rate of heat loss by body is propotional to

Option 1:
$(T - T_0)^4$

Option 2:
$\left(T^4 - T_0^4\right)^2$

Option 3:
$(T - T_0)$

Option 4:
$(T - T_0)^2$

Correct Answer:
$(T - T_0)$

Solution:
As we learn

Newton's Law of Cooling -

Rate of cooling is directly proportional to temperature difference between the body and its surrouding.

-

By Stefan's law $\frac{dQ}{dt} = \frac{A\epsilon\sigma}{mc}[T^4 - T_0^4]$

For small $T - T_0 = \Delta T$

$\frac{dQ}{dt} = \frac{A\epsilon\sigma}{mc} 4T_0^3 \Delta T$

$\frac{dQ}{dt} \alpha mc\,\Delta T \Rightarrow \frac{dQ}{dt}\ \alpha\ (T - T_0)$

Q. 20 Two large plates of surface charge density σ and $-\sigma$ are placed parallel to each other then the electric field at any point between the plate is:

Option 1:
$\frac{\sigma}{2\epsilon_0}$

Option 2:
$\frac{\sigma}{\epsilon_0}$

Option 3:
$\frac{2\sigma}{\epsilon_0}$

Option 4:
zero

Correct Answer:
$\frac{\sigma}{\epsilon_0}$

Solution:
As we learn

Infinite Plane parallel sheets of charge -

If

$\sigma_A = \sigma$ and $\sigma_B = -\sigma \rightarrow E_p = E_R = 0$

and

$$E_Q = \frac{\sigma}{\epsilon_0}$$

-

The electric field between point is:

$$E = \frac{1}{2\epsilon_0}\left[\sigma_1 - \sigma_2\right] = \frac{1}{2\epsilon_0}\left[\sigma - (-\sigma)\right] = \frac{\sigma}{\epsilon_0}$$

Q. 21 Choose the correct option

Option 1:
For isolated system total energy remain constant

Option 2:
For isolated system only total mechanical energy remains constant

Option 3:
For isolated system only heat energy is constant

Option 4:
For isolated system only kinetic energy is constant

Correct Answer:
For isolated system total energy remain constant

Solution:
As we learned

Conservation of Energy and Conservation of Mechanical Energy -

Accounting all forms of energy within isolated system

i.e. total energy remains constant.

- wherein

These all forms of energy includes mechanical energy,potential energy, heat ,sound ,light,electrical energy etc

Q. 22 The frequency of revolution of an electron in the n^{th} orbit is f_n. If the electron makes a transition from the n^{th} orbit to (n-1) th orbit then the relation between the frequency (ν) of emitted photon and f_n will be:

Option 1:
$\nu = f_n^2$

Option 2:
$\nu = \sqrt{fn}$

Option 3:
$\nu = \frac{1}{fn}$

Option 4:
$v = f_n$

Correct Answer:
$v = f_n$

Solution:
As we learn

Orbital Frequency of electron -

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

- wherein

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

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

$$f_n \ \alpha \frac{Z^2}{n^3}$$

For transition from n to (n-1)

$$E = h\nu = \frac{me^4z^2}{8\epsilon_0 h^2}\left(\frac{1}{(n-1)^2} - \frac{1}{n^2}\right)$$

$$= \frac{me^4z^2}{8\epsilon_0^2h^2}\left(\frac{n^2-(n-1)^2}{n^2(n-1)^2}\right)$$

$$\nu = \frac{me^4z^2}{8\epsilon_0^2h^2}\left(\frac{2n-1}{n^2(n-1)^2}\right)$$

If n is very large

$$\nu = \frac{me^4z^2}{8\epsilon_0^2h^2}\cdot\left(\frac{2n}{n^4}\right) = f_n$$

Q. 23 A galvanometer is converted to a voltmeter by connecting a high resistance R in series with galvanometer. If the voltage across galvanometer is $\frac{1}{100}$ of that of voltmeter, the value of R is (galvanometer resistance is 100Ω)

Option 1:
9900Ω

Option 2:
$100\,00\Omega$

Option 3:
$\frac{100}{99}\Omega$

Option 4:
1Ω

Correct Answer:
9900Ω

Solution:
As we learned

If V_{g} = V/n -

$$R = (n-1)G$$

- wherein

if n^{th} part of applied voltage across galvanometer

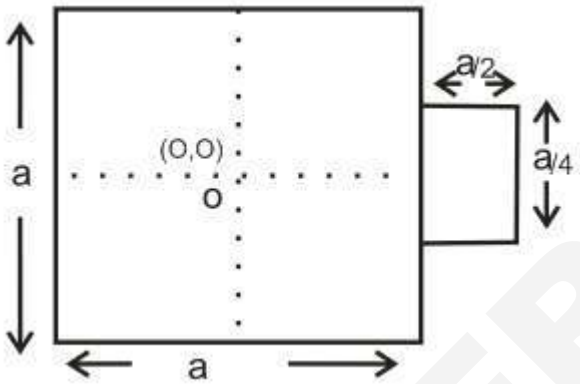
$$R = (n-1)\,G$$

$$V_g = \frac{v}{n}, n = 100 \text{ (given)}$$

$$R = (100-1)\,G \;\; Where\, G = 100\Omega$$

$$\because R = 99 \times 100 = 9900\Omega$$

Q. 24 A square plate of side a and mass M is shown in figure another plate of same material of given dimension is added as shown in the diagram the C.M of given system origin o is



Option 1:

$$\left[\frac{5a}{75}, 0\right]$$

Option 2:

$$\left[\frac{2a}{53}, \frac{2a}{53}\right]$$

Option 3:

$$\left[\frac{a}{12}, 0\right]$$

Option 4:

$\left[0, \frac{2a}{53}\right]$

Correct Answer:

$\left[\frac{a}{12}, 0\right]$

Solution:
As we learned

Centre of mass when some mass is added in the body -

$$\vec{r}_{CM} = \frac{m_1\vec{r}_1 + m_2\vec{r}_2}{m_1 + m_2}$$

- wherein

m_1 & $\vec{r_1}$ are mass and position of centre of mass for whole body. m_2 & $\vec{r_2}$ are mass and position of centre of mass of added mass.

$$X_{cri} = \frac{m_1x_1 + m_2x_2}{m_r + m_2} \qquad \begin{matrix} m_1 = M \\ m_2 = \frac{M}{8} \end{matrix}$$

$$X_{cm^2} = \frac{(M \times 0) + \frac{M}{8}(\frac{3a}{4})}{M + \frac{M}{8}} \qquad \begin{matrix} x_1 = 0 \\ x_2 = \frac{3a}{4} \end{matrix}$$

$$X_{cm} = \frac{a}{12}$$

$$y_{cm} = 0$$

Q. 25 A wave is represented by the equation $x = A\sin(\omega t + \delta)$. The phase constant of wave is

Option 1:

ωt

Option 2:

$\omega t + \delta$

Option 3:

ω

Option 4:
Δ

Correct Answer:
Δ

Solution:
As we have learnt

Phase constant -

The constant Δ appearing in eqation $x = A\sin\left(wt + \delta\right)$ is called phase constant. It describes initial state.

This constant depends on the choice of the instant t = 0. To describe the motion quantitatively, a particular instant should be called t = 0 and measurement of time should be made from this instant.

- wherein

This constant depends on the choice of the instant $t = 0$.

Q. 26 A magnet of length 0.1 m and pole strength 10^{-4} Am is kept in a magnetic field of 30 Wb/m^2 at angle 30^0. The torque acting on it is P *10^{-4} Nm. The value of P is -

Option 1:
6.0

Option 2:
3.0

Option 3:
1.5

Option 4:
7.5

Correct Answer:
1.5

Solution:
As we learn

Torque on a Magnetic Dipole -

$$\vec{\tau} = \vec{M} \times \vec{B}$$

$$\tau = MB \sin \Theta$$

$$\tau = MB \sin \Theta = m(2l) \times B \sin \Theta$$

$$= 10^{-4} \times 0.1 \times 30 \sin \Theta = 1.5 \times 10^{-4} Nm$$

P= 1.5

Q. 27 Magnetic field for an axial point due to short bar magnet of magnetic moment M is given by

Option 1:
$\frac{\mu_0}{4\pi}\frac{M}{d^3}$

Option 2:
$\frac{\mu_0}{4\pi}\frac{M}{d^2}$

Option 3:
$\frac{\mu_0}{2\pi}\frac{M}{d^3}$

Option 4:
$\frac{\mu_0}{2\pi}\frac{M}{d^2}$

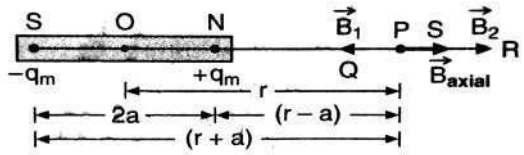
Correct Answer:
$\frac{\mu_0}{2\pi}\frac{M}{d^3}$

Solution:
As we learnt ,

Magnetic field on Axial Position of bar magnet -

$$B_{axial} = \frac{\mu_o \, 2M}{4\pi \, r^3}$$

- wherein



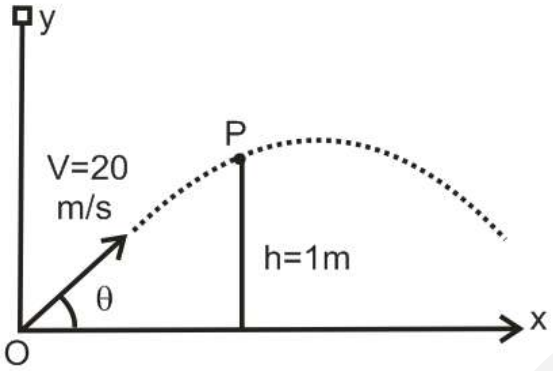
$$B_a = \frac{\mu_0}{4\pi}\frac{2Md}{(d^2l^2)^2}.$$

if l << d

then

$$B_a = \frac{\mu_0}{4\pi}\frac{2M}{d^3} \Rightarrow \frac{\mu_0}{2\pi}\frac{M}{d^3}$$

Q. 28 A body is projected as shown in figure. Then what is its velocity at point P.



Option 1:
$20m/s$

Option 2:
$19.5m/s$

Option 3:
$18m/s$

Option 4:
$15m/s$

Correct Answer:
$19.5m/s$

Solution:
$E_0 = K_0 + U_0 = (Total\ mechanical\ energy\ at\ 0)$

$E_P = K_P + U_P = (Total\ mechanical\ energy\ at\ P)$

But $E_0 = E_P = (Total\ mechanical\ energy\ is\ Constant)$

$K_0 + U_0 = K_P + U_P$

$\frac{1}{2} \times m \times 20 \times 20 + 0 = \frac{1}{2}mv^2 + m \times 10 \times 1$

$v^2 = 2\,(200 - 10)$

$v = \sqrt{2 \times 190} = \sqrt{380} = 19.5m/s$

Q. 29 P type semiconductor is -

Option 1:
A pure form of semiconductor

Option 2:
Obtained by adding tetra valent impurity

Option 3:
Obtained by adding trivalent impurity

Option 4:
Obtained by adding pentavalent impurity

Correct Answer:
Obtained by adding trivalent impurity

Solution:
As we learn

p - type semiconductor -

Here the base semiconductor (i.e.pure Si or Ge) is mixed with tetravalent doping material (e.g. Al)

- wherein

1) $n_h >> n_e$

2) There is an acceptor level just above the valence band .

Obtained by adding trivalent impurity.

Q. 30 10 identical cells of emf 1.5 and internal resistance 0.2Ω are connected in parallel. The equivalent resistance of the combination is

Option 1:
0.02Ω

Option 2:
0.2Ω

Option 3:
2Ω

Option 4:
0.5Ω

Correct Answer:
0.02Ω

Solution:
As we learned

Equivalent internal resistance -

$$R_{eq} = \frac{r}{n}$$

-

$$R_{eq} = \frac{r}{n} = \frac{0.2}{10} = 0.02\Omega$$

Q. 31 Which of the following is true about terminal velocity of a spherical of body in a viscouse fluid -

Option 1:
Greater the density of body greater will be the terminal velocity

Option 2:
Greater the density of fluid greater will be the terminal velocity

Option 3:
Greater the viscocity of fluid greater will be the terminal velocity

Option 4:
Terminal velocity does not depends upon radius of phere.

Correct Answer:
Greater the density of body greater will be the terminal velocity

Solution:
As we learn

Terminal Velocity -

When spherical body attains constant velocity in viscous fluid.

-

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

$$v\alpha\frac{1}{\eta}, v\alpha r^2, v\alpha\rho$$

$$and\ v\alpha(-6)$$

Q. 32 According to 'Fleming's left hand rule' direction of thumb indicates the direction of -

Option 1:
Magnetic field

Option 2:
Current

Option 3:
Motion of particle

Option 4:
Direction of force

Correct Answer:
Direction of force

Solution:
As we learn

Thumb -

Direction of force

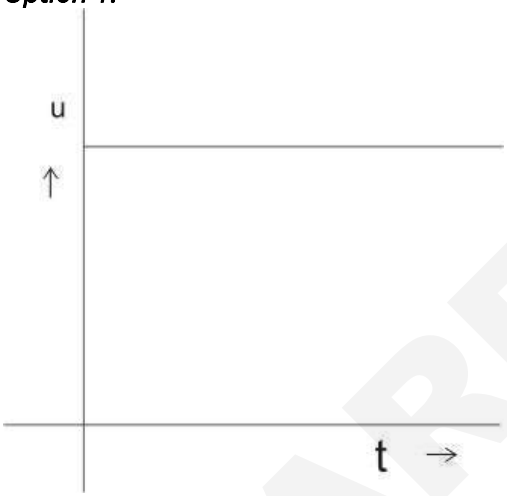
-

According to definition.

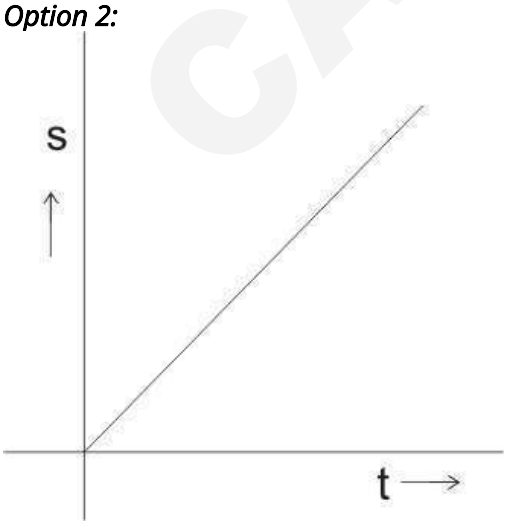
Correct option is 4.

Q. 33 Which of the following graph represents non-uniform motion

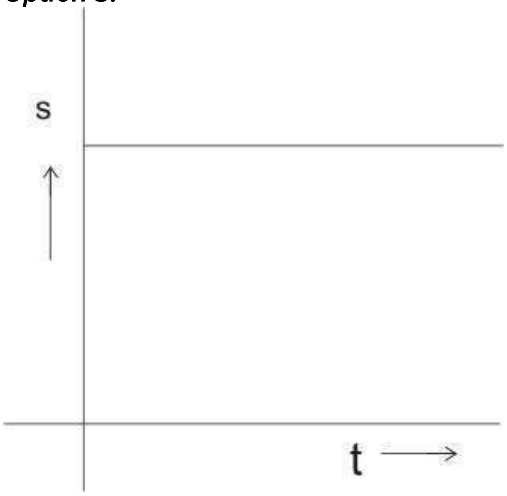
Option 1:



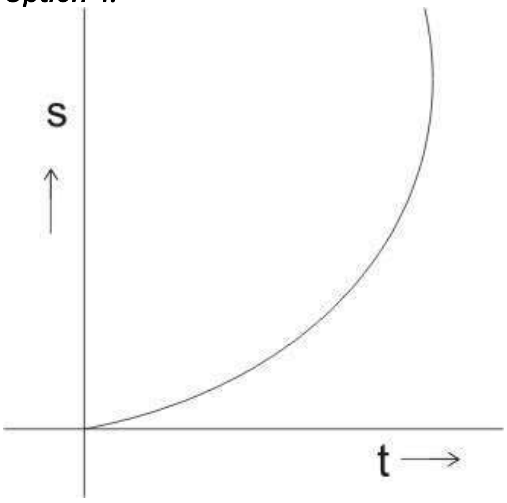
Option 2:



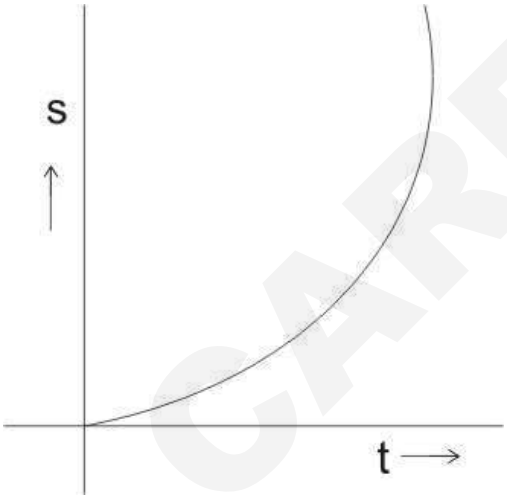
Option 3:



Option 4:



Correct Answer:

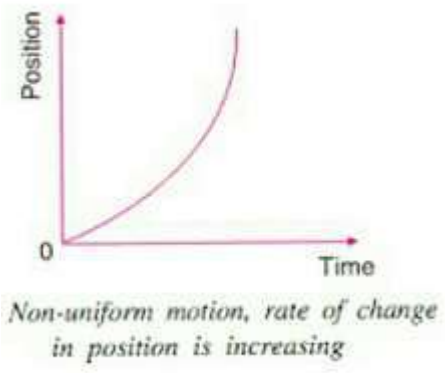


Solution:
As we have learned

Position – time graph For object in non-uniform motion -

When object moving along straight Line and covers equal distance in unequal time interval.

- wherein



Non-uniform motion, rate of change in position is increasing

Figure shows position – time graph for non uniform motion

Q. 34 For polytropic process $(PV^n = constant)$ n can take value as.

Option 1:
n = 0

Option 2:
n = 2

Option 3:
n = 4

Option 4:
All of these

Correct Answer:
All of these

Solution:
As we learned

Polytropic Process -

A process $PV^r = costant$

is called Polytropic Process

- wherein

Here $r \neq 1 \, or \, \gamma$

As polytropic process is define as

$PV^n = constant$

Q. 35 A generator produces a voltage that is given by $V = 240 \sin 120t$ where T is in seconds. the r.m.s voltage is -

Option 1:
240V

Option 2:
120V

Option 3:
170V

Option 4:
70V

Correct Answer:
170V

Solution:
As we have learnt,

Root mean square i_{rms} -

$$i_{rms} = \sqrt{\frac{i_1^2 + i_1^2 + - - - -}{\eta}} = \sqrt{\bar{i}^2}$$

$$\sqrt{\frac{\int_0^T i^2 dt}{\int_0^T dt}} = \frac{i_0'}{\sqrt{2}} = 0.707 \, i_0'$$

$$= 70.7 \, \% \, i_0'$$

- wherein

i_0' - Peak Current

$$V_{rms} = \frac{V_o}{\sqrt{2}} = \frac{240}{1.414} \approx 170V$$

Q. 36 In Young's Double slit experiment, the width of the one of the slit is three times the other slit. The amplitude of the light coming from a slit is proportional to the slit -width. Find the ratio of the maximum to minimum intensity in the interference pattern.

Option 1:
2:1

Option 2:
4:1

Option 3:
3:1

Option 4:
1:4

Correct Answer:
4:1

Solution:

$$\text{Amplitude} \propto \text{Width of slit}$$

$$\Rightarrow A_2 = 3\ A_1$$

$$\frac{I_{max}}{I_{min}} = \left(\frac{\sqrt{I_1}+\sqrt{I_2}}{|\sqrt{I_1}-\sqrt{I_2}|}\right)^2$$

$$\because \text{ Intensity } I \propto A^2$$

$$\Rightarrow \frac{I_{max}}{I_{min}} = \left(\frac{A_1 + A_2}{|A_1 - A_2|}\right)^2$$

$$\Rightarrow \frac{I_{max}}{I_{min}} = \left(\frac{A_1+3A_1}{|A_1-3A_1|}\right)^2 = \left(\frac{4A_1}{2A_1}\right)^2 = 4:1$$

Q. 37 A body of mass 0.3 kg is being pulled by a horizontal force P= 4 N. If body is just tending to move then what is the value of resultant force exerted by surface on block.

Option 1:
8 N

Option 2:
0

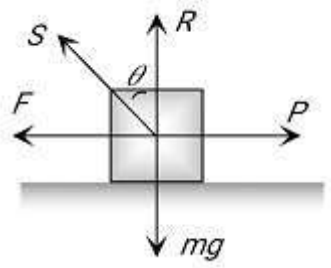
Option 3:
5 N

Option 4:
6 N

Correct Answer:
5 N

Solution:
As we learn

Resultant Force Exerted by Surface on block -



$$S = \sqrt{F^2 + R^2}$$

$$S = \sqrt{(\mu mg)^2 + (mg)^2}$$

$$S = mg\sqrt{\mu^2 + 1}$$

S = Resultant force

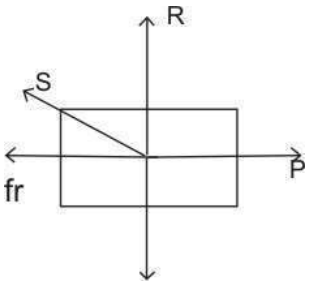
$\mu =$ Coefficient of friction

- wherein

If $\mu = 0$

S(will be minimum)

S = mg



In the given figure resultant force

$$S = \sqrt{F^2 + R^2}$$

for limiting case Fr = p

so $S = \sqrt{P^2 + R^2} = \sqrt{P^2 + (mg)^2}$

$= \sqrt{4^2 + (0.3 \times 10)^2} = 5N$

Q. 38 What is the shape of magnet used in moving coil galvanometer to make the magnetic field radial-

Option 1:
Concave

Option 2:
Convex

Option 3:
Hoese shoe magnet

Option 4:
None of these

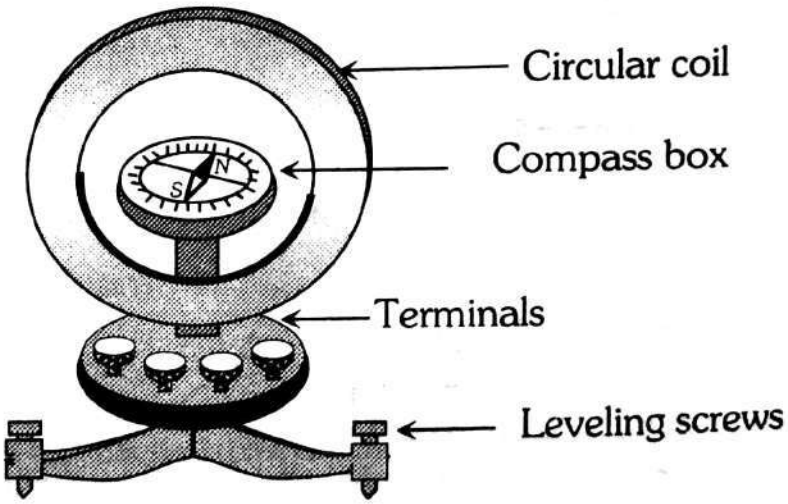
Correct Answer:
Concave

Solution:
As we learn

Tangent galvanometer -

It is an early measuring instrument for small electric currents. It consists of a coil of insulated copper wire wound on a circulator non-magnetic frame

- wherein



Theoritical.

Correct option 1.

Q. 39 Which of the following is true about EM wave.

(i) It can be used to carry information.

(ii) Its travel with speed of light in vacuum.

Option 1:
Only (i)

Option 2:
Only (ii)

Option 3:
Both (i) and (ii)

Option 4:
None of these

Correct Answer:
Both (i) and (ii)

Solution:
As we learned

Property of EM wave -

It can be used to carry information.

-

It can be used to carry information

Q. 40 Assuming M is the mass of earth and R is the radius then work done to take 1 kg mass from earth surface to infinity will be -

Option 1:
$\frac{GM}{R}$

Option 2:
$\frac{GM}{2R}$

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

Option 4:
$\sqrt{\frac{GM}{2R}}$

Correct Answer:
$\frac{GM}{R}$

Solution:
As we have learnt,

Work done against gravity -

$$W = \Delta U = GMm\left[\frac{1}{r_1} - \frac{1}{r_2}\right]$$

$W \rightarrow$ work done

$\Delta U \rightarrow$ change in Potential energy

$r_1, r_2 \rightarrow$ distances

- wherein

If body is moved from surface of earth to a point h above surface of earth then use the given formula

Potential energy at the earth surface

$$U_1 = -\frac{GMm}{R} = -\frac{GM}{R}$$

Potential energy at infinity

$$U_2 = -\frac{GMm}{\infty} = 0$$

Work done $\Delta U = U_2 - U_1 = \frac{GM}{R}$

Chemistry

Q. 1 EMF of a cell in terms of reduction potential of its left and right electrodes is :

Option 1:
$E = E_{left} - E_{right}$

Option 2:
$E = E_{left} + E_{right}$

Option 3:
$E = E_{right} - E_{left}$

Option 4:
$E = -(E_{right} + E_{left})$

Correct Answer:
$E = E_{right} - E_{left}$

Solution:
As we learn

Electrode Potential -

The potential associated with each electrode is known as electrode potential.

-

We know that E cell

= Reduction potential of cathode + oxidation potential of Anode

= Reduction potential of Cathode - Reduction potential of Anode

= $E_{right} - E_{left}$

Q. 2

The correct IUPAC nomenclature of the following compund is

$$CH \equiv C - CH = CH - CH = CH_2$$

Option 1:
$Hexa - 1,3 - dien - 5 - yne$

Option 2:
$Hexa - 3,5 - dien - 1 - yne$

Option 3:
$Hexa - 1,3,5 - triene$

Option 4:
$Hexa - 2,3 - dien - 5 - yne$

Correct Answer:
$Hexa - 1,3 - dien - 5 - yne$

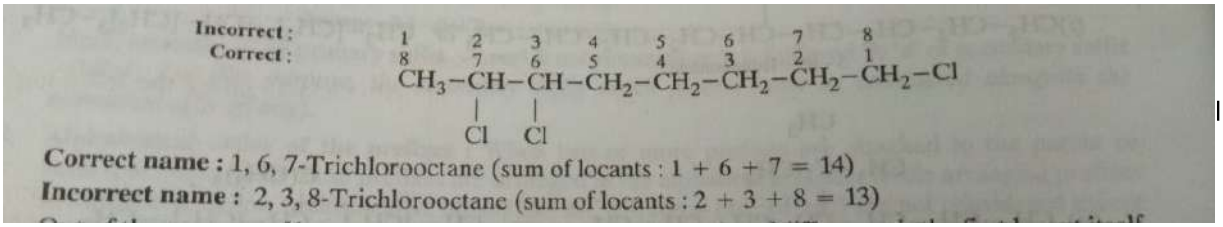
Solution:
As we learned

Nomenclature of organic compounds -

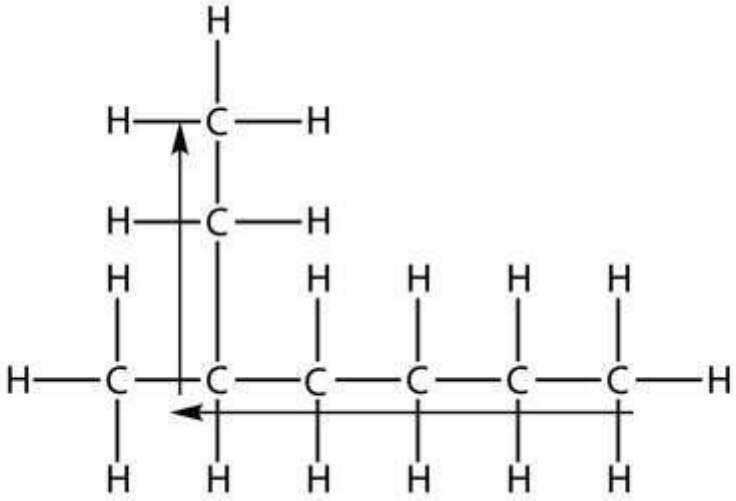
Longest chain is main chain, branched chain is substituent.

Locant value or position number should be minimum.

- wherein



IUPAC system of nomenclature



Alkene has higher priority than alkyne.

$$C^6H \equiv C^5 - C^4H = C^3H - C^2H = C^1H_2$$

IUPAC Name: $Hexa - 1,3 - dien - 5 - yne$

Q. 3 Dumas method is used in the quantitative estimation of

Option 1:
C

Option 2:
H

Option 3:
N

Option 4:
S

Correct Answer:
N

Solution:
As we learned

Dumas method- Quantitative analyze of nitrogen -

$$Volume\ of\ Nitrogen\ at\ STP\ = \frac{P_1V_1 * 273}{760 * T_1}$$

$$percentage\ of\ Nitrogen = \frac{28 \times vol\ of\ N_2\ at\ STP \times 100}{22400 \times m}$$

There are two methods for quantitative estimation of nitrogen. (i) Dumas Method (ii) Kjeldahl's method

Q. 4 In the Lassaigne's test for sulphur in an organic compound, the violet colour is obtained due to the formation of

Option 1:
$[Fe\,(CN)_5\,No]^{+2}$

Option 2:
PbS

Option 3:
$Fe_4\,[Fe\,(CN)_6\,No]_3$

Option 4:
$[Fe\,(CN)_5\,NOS]^{-4}$

Correct Answer:
$[Fe\,(CN)_5\,NOS]^{-4}$

Solution:
As we learned

Test for Sulphur -

The sodium fusion extract is acidified with acetic acid and bad acetate is added to sodium fusion.

- wherein

$$2Na + \underset{\text{(From organic compound)}}{S} \xrightarrow{\text{Fuse}} Na_2S$$

$$\underset{\text{(From sodium extract)}}{Na_2S} + \underset{\text{Sod. nitroprusside}}{Na_2[Fe(CN)_5NO]} \longrightarrow \underset{\text{Purple colouration}}{Na_4[Fe(CN)_5NOS]}$$

$$S^{-2} + [Fe\,(CN)_5\,NO]^{+2} \rightarrow [Fe\,(CN)_5\,NOS]^{-4}$$

Sodium nitroprusside Violet

Q. 5 Which of the following compound of 'Xe' does not exist

Option 1:
XeF_2

Option 2:
XeO_3

Option 3:
XeH_2

Option 4:
XeO_2F_2

Correct Answer:
XeH_2

Solution:
As we learned

Oxide of Xenon -

$$XeF_2 + H_2O \rightarrow X_e + 2HF + \frac{1}{2}O_2$$

$$2XeF_4 + 4H_2O \rightarrow X_eO_3 + 8HF + \frac{1}{2}O_2$$

- wherein

Due to high electronegativity of oxygen, it forms compound with Xe

Xe forms oxides and fluorides only.

due to high electronegativity of 'F' and 'O'

XeH_2 does not exist.

Q. 6 Lead chamber process is used in the manufacturing of -

Option 1:
HNO_3

Option 2:
H_2SO_4

Option 3:
H_3PO_3

Option 4:
$NaOH$

Correct Answer:
H_2SO_4

Solution:
As we learn

Lead chamber process -

In this process SO_2 is oxidised to SO_3 by the oxides of nitrogen and the SO_3 thus formed is dissolved in steam to form H_2So_4

-

The lead chamber process is an industrial method to produce sulphuric acid (H_2SO_4).4

Correct option is 2.

Q. 7 Deoxygenation of phenol can be achieved by distillation with:-

Option 1:
Ravey nickel

Option 2:
$LiAlH_4$

Option 3:
$NaBH_4$

Option 4:
Zinc Dust

Correct Answer:
Zinc Dust

Solution:
As we learned

Reaction of phenol with zinc dust -

Product form is benzene.

- wherein

$$C_6H_5OH + Zn \rightarrow C_6H_6 + ZnO$$

Q. 8 Statement : 1 The recation coordination is the collection of motions such as changes inter atomic distances and bond angles ,

Statement : 2 Endothermic reaction do not need Activation energy to proceed in forward direction

Option 1:
statement 1 is true and statement 2 is true and corrcet explanation for statement 1

Option 2:
statement 1 is true and statement 2 is true and not corrcet explanation for statement 1

Option 3:
statement 1 is true and statement 2 is false

Option 4:
statement 1 is false and statement 2 is true

Correct Answer:
statement 1 is true and statement 2 is false

Solution:
As we have learned

Reaction Coordinate -

The reaction coordinate is the collection of motions such as changes in inter-atomic distances and bond angles and distortions that are directly involved in product formation.

-

Q. 9 We have 200 mL of 6% $\left(\frac{w}{v}\right)$ urea solution at $27^{\circ}C$ osmoti pressure due to osmosis is:

(R = 0.0821 L atm mol^{-1} K^{-1})

Option 1:
24.63 atm

Option 2:
12.315 atm

Option 3:
4.926 atm

Option 4:
6.157 atm

Correct Answer:
12.315 atm

Solution:
As we learn

Osmotic Pressure -

Osmotic Pressure (π) is excess pressure developed on solution side due to osmosis.

-

$$\pi = CRT$$

$$C = \frac{\frac{6}{60}}{\frac{200}{1000}} = 0.5$$

$$\pi = 0.5 \times 0.0821 \times 300 = 12.315atm$$

Q. 10

here reagents used are :-

Option 1:
(1) $Hg(OAC)_2, CH_3OH$
(2) $NaBH_4$

Option 2:
(1) $Hg(OAC)_2, H_2O$
(2) $NaBH_4$

Option 3:
(1) BH_3
(2) H_2O, OH

Option 4:
None of these

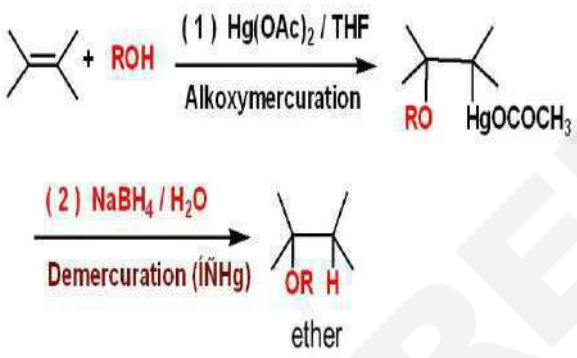
Correct Answer:
(1) $Hg(OAC)_2, CH_3OH$
(2) $NaBH_4$

Solution:
As we learned

Alkoxy mercuration demercuration -

Reaction between alkene and alcohol in the presence of trifluoroacetate.

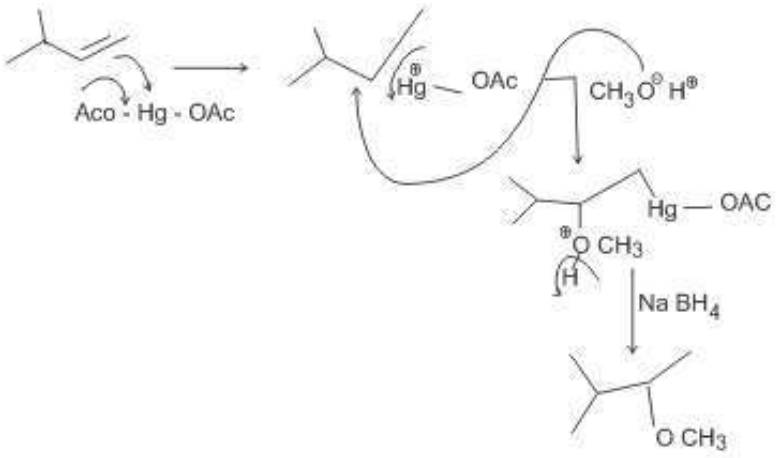
- wherein



$Hg(OAC)_2, CH_3OH$

$NaBH_4$

This is Alkoxymercuration - Demorcuration Mechanisium



Q. 11 P^H value of 0.1 M NH_4OH will be ($K_a = 4.0 \times 10^{-5}$)

Option 1:
2.7

Option 2:
11.3

Option 3:
12.3

Option 4:
1.7

Correct Answer:
11.3

Solution:
As we learned from

Direction of reaction -

Direction of reaction is predicted with the help of reaction quotient Q.

- wherein

The reaction quotient Q is defined in the same way as equilibrium constant K_c except that concentration are not necessarily equilibrium values.

Q. 12 Which of the following are true?

i. Carbohydrate is the energy source in the body.

ii. Gelatin is used in food particles.

iii. Carbohydrate is the constituent of cell walls.

Option 1:
i and ii

Option 2:
iii

Option 3:
i and iii

Option 4:
i

Correct Answer:
i and iii

Solution:
As we learn

Importance of carbohydrate -

- Energy source
- Constituent of cell walls
- Building furniture, clothes, papers.
- $D-ribose$ and $2-deoxy-D-ribose$ (aldopentoses) are constituents of nucleic acid.

-

- energy source

- Constituent of the cell wall

- Building furniture, clothes, papers.

Q. 13 which of the following is incorrect about teflon

Option 1:
it is chemically inert and resestant to attacks by corrosive reagents

Option 2:
it is used of making oil seals

Option 3:
it is homoploymer

Option 4:
polymerization takes place at lower pressure

Correct Answer:
polymerization takes place at lower pressure

Solution:
As we have learned

Polytetrafluoroethylene / Teflon -

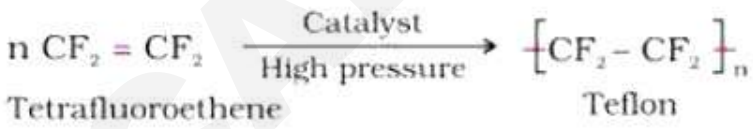
- Polymerization of tetrafluoroethylene ($F_2C = CF_2$) with free radical or persulphate at high pressure.

- Homopolymer.

- wherein

- Chemically inert and resistant to attack by corrosive reagents.

- Used in making oil seals, gaskets, non-stick surface



Polymerization of tetrafluoroethylene ($F_2C = CF_2$) with free radical or persulphate at high pressure.

Q. 14 Which of the following compound is amphoteric?

Option 1:
$Mg(OH)_2$

Option 2:
$Al(OH)_3$

Option 3:
$B(OH)_3$

Option 4:
$In(OH)_3$

Correct Answer:
$Al(OH)_3$

Solution:
As we have learnt,

Hydroxides of boron family -

General formula: $M(OH)_3$

Acidity decreases, basicity increases down the group

- wherein

Aluminium hydroxide is amphoteric

$Al(OH)_3$ is amphoteric in nature. It can react with acid as well as with alkali.

Q. 15 Plaster of Paris is:

Option 1:
$CaSO_4.2H_2O$

Option 2:
$CaSO_4.H_2O$

Option 3:
$CaSO_4.1/2H_2O$

Option 4:
$CaSO_4$

Correct Answer:
$CaSO_4.1/2H_2O$

Solution:

Plaster of paris -

It is hemihydrate of calcium sulphate

On mixing with water, it takes up the water of crystallisation and is converted into dihydrate which sets into hard mass

- wherein

formula:

$$CaSO_4.\frac{1}{2}H_2O \xrightarrow{H_2O(setting)} CaSO_4.2H_2O \xrightarrow{Orthorhombic} CaSO_4.2H_2O(Monoclinic\ gypsum)$$

Plaster of Paris is hemihydrate of calcium sulphate i.e. $CaSO_4.\frac{1}{2}H_2O$

Correct option is 3.

Q. 16 The energy required to break one mole of $Cl-Cl$ bonds in $Cl_2\ is\ 242\ kJmol^{-1}$. The longest wave-length of light capable of breaking a single $Cl-Cl$ bond is

$(c = 3 \times 10^8 m\ s^{-1}\ and\ N_A = 6.02 \times 10^{23} mol^{-1})$

Option 1:
494 nm

Option 2:
594 nm

Option 3:
640 nm

Option 4:
700 nm

Correct Answer:
494 nm

Solution:
As we learnt in

The energy (E) of a quantum of radiation -

$$E = hv$$

Where h is plank's constant and ν is frequency

-

$$Energy\ of\ one\ photon = \frac{242 \times 10^3}{6.02 \times 10^23} = E$$

$$E = \frac{hc}{\lambda}$$

$$\lambda = \frac{hc}{E} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8 \times 6.02 \times 10^23}{242 \times 10^3}$$

$$\lambda = 4.94 \times 10^{-7} = 494nm$$

Q. 17 The correct order of tendancy of absorption of noble gases on charcoal is

Option 1:
$He > Ne > Ar > Kr > Xe$

Option 2:
$He < Ne < Ar < Kr < Xe$

Option 3:
$He > Ne < Ar > Kr < Xe$

Option 4:
$He < Ne > Ar > Kr > Xe$

Correct Answer:
$He < Ne < Ar < Kr < Xe$

Solution:
As we learned

Ease of adsorption -

Increases down the group

- wherein

$$Xe > Kr > Ar > Ne > He$$

As atomic weight increases, tendency adsorption increases this method is used to separate inert gas.

order: $He < Ne < Ar < Kr < Xe$

Q. 18 (water + methanol) behave as :

Option 1:
ideal solution

Option 2:
maximum boiling azeotrope

Option 3:
minimum boiling azeotrope

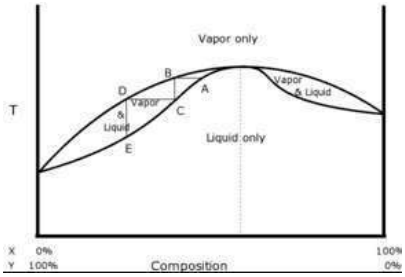
Option 4:
none of these

Correct Answer:
minimum boiling azeotrope

Solution:
As we learn

Maximum boiling Azeotrope -

The mixture having boiling point more than the boiling point of liquid A and liquid B.



- wherein

This type of azeotrope is formed by mixture showing -ve deviation.

Water + methanol shows positive deviation from Raoult's law, so it behaves as minimum boiling azeotrope.

Q. 19 The brownian motion is due to

Option 1:
Temperature fluctuation within the liquid phase

Option 2:
Attraction and repulsion between the charges of the colloidal particles

Option 3:
Impact of molecules and dispersion medium on the colloidal particles

Option 4:
ion negative currents

Correct Answer:
Impact of molecules and dispersion medium on the colloidal particles

Solution:
As we learned from from

Properties of Colloidal Solutions -

Brownian Movement

- wherein

When colloidal solutions are viewed under a powerful ultramicroscope, the colloidal particles appear to be in a state of continuous zig-zag motion all over the field of view. This is known as Brownian movement.

Q. 20 2^{nd} carbon of C fructose contains a:

Option 1:
Alcohol group

Option 2:
Aldehyde group

Option 3:
Ketonic group

Option 4:
None of these

Correct Answer:
Ketonic group

Solution:
as we learn

Fructose / fruit sugar -

Contain a ketonic functional group at carbon number 2

-

Fructose contain a ketonic functional group at carbon number 2.

Q. 21 Which of the following is false regarding laboratory preparation of hydrogen

Option 1:
dil. H_2SO_4 reacts with granular zinc

Option 2:
Woulfe bottle or Kipp's apparatus can be used for the process

Option 3:
Downward displacement of air occurs in the apparatus

Option 4:
None of these

Correct Answer:
None of these

Solution:
In the laboratory preparation of Hydrogen, dilute H_2SO_4 reacts with Zinc granules.

The reaction is given as

$$Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$$

The reaction may be carried out in a Kipp's Apparatus or Woulfe's bottle which the lighter gases rise up by downward displacement of air.

Hence, all given statements are correct.

So, none of these is false

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

Q. 22 Which of the following is the correct statement for chemisorption?

Option 1:
It is irreversible in nature

Option 2:
Multilayers are formed in this type of adsorption

Option 3:
Van der Waal's interaction play major role in this adsorption

Option 4:
With increase in temperature, chemisorption decreases.

Correct Answer:
It is irreversible in nature

Solution:
In chemisorption, actual chemical bonds formation takes place, so the process is irreversible.

Multilayers do not form in this type of adsorption due to one formed layer does not make bonds for another layer.

With the increase in temperature, chemisorption increases.

Hence, **the correct answer is Option (1)**

Q. 23 The chemical compounds used for the treatment of stress, and severe mental diseases are called

Option 1:
Narcotic analgesics

Option 2:
Antibiotics

Option 3:
Tranquilizers

Option 4:
Non- narcotic analgesic

Correct Answer:
Tranquilizers

Solution:

Tranquilizers -

Medicines used for the treatment of stress and mental diseases.

- wherein

They reduce mental tension and anxiety.

Tranquilizers are a class of compounds used for the treatment of stress, mild to severe mental disease.

Q. 24 The correct order of -I effect is

Option 1:
$F > Cl > Br > I$

Option 2:
$-NO_2 > -CN$

Option 3:
$-OCH_3 > -OH$

Option 4:
All of these

Correct Answer:
All of these

Solution:
As we learned

Inductive effect -

Presence of attacking reagent is not required

- wherein

Because It is a permanent effect

The correct order of - I effect is: $-NO_2 > -CN > -F > -Cl > -Br > -I > -OR > -OH$

Q. 25 Lack of vitamin B_1 causes:

Option 1:
Scurvy

Option 2:
Beri - Beri

Option 3:
Lips inflammation

Option 4:
Dermatitis

Correct Answer:
Beri - Beri

Solution:
As we learn

Vitamin deficiency associated diseases -

Vitamin A - Night blindness , Xeropthalmia

Vitamin (Thiamine) B_1 - Beriberi

Vitamin (Riboflavin) B_2 - Cheilosis

Vitamin (Niacin) B_3 - Pellagra

Vitamin (Pyridoxine) B_6 - Convulsions , Anaemia

Vitamin B_{12} - Pernicious anaemia

Vitamin C (Ascorbic acid) - Scurvy

Vitamin d - Rickets (in chilldrens)

Osteomalacia (in adults)

Vitamin E - Increased RBCs fragility , muscular weakness

Vitamin K - Poor blood clotting

-

Beri - Beri is a disease caused by a Vitamin B-1 deficiency.

Correct option is 2.

Q. 26 +1 oxidation state in Thallium is more stable than +3 oxidation state de to:

Option 1:
Lanthanoid contraction

Option 2:
inert pair effect

Option 3:
d-d transition

Option 4:
presence if a single electron in the valence shell

Correct Answer:
inert pair effect

Solution:
As we have learnt,

Inert pair effect -

The phenomenon in which outer shell s electrons (ns^2) penetrate to (n-1) d-electrons and thus become closer to the nucleus and are more effectively pulled by the nucleus

- wherein

This results in less availability of ns^2 electrons pair for bonding or ns^2 electron pair becomes inert.

In heavier p-block elements lower oxidation state is more stable than higher oxidation state due to inert pair effect.

Q. 27 The electron present (n-1) shell shield n'th shell of an element

Option 1:
Screening power

Option 2:
Stster's rule

Option 3:
ductility

Option 4:
none of these

Correct Answer:
Screening power

Solution:
As we learn

Comparison of screening power -

An electron present in the nth orbital is more effectively shielded by (n-1) th orbital while the same electron is not effectively shielded by the other electron present in the same orbital.

-

This property of an element is known as screening power

Q. 28 Van Arkel method is used for refining of

Option 1:
Ni

Option 2:
Zr

Option 3:
Si

Option 4:
Ge

Correct Answer:
Zr

Solution:

Vapour Phase Refining -

There are two main requirements of this method.The metal should form a volatile compound is collected and then decomposed to give a pure metal.

- wherein

Mond process $Ni+CO \longrightarrow Ni[CO]_{4\ Impure}$

$Ni\ [CO]_4 \longrightarrow Ni + 4CO\ Pure$

Van Arkel method is used for refining of Zr or Ti

$$Zr(Impure) + 2I_2 \rightarrow ZrI_4 \overset{\Delta}{\rightarrow} Zr(Pure) + 2I_2$$

Q. 29 Which of the following reactiver will not give alkene as a final product?

Option 1:
$CH_3CH_2Br - CH_2Br + Zn \rightarrow$

Option 2:
$CH_3CH_2OH \xrightarrow[\Delta]{Conc.H_2So_4}$

Option 3:

$CH_3CH_2OH \xrightarrow[\Delta]{alc.KaoH}$

Option 4:

$CH_3 - C \equiv CH + 2H_2 \overset{Pd/c}{\rightarrow}$

Correct Answer:

$CH_3 - C \equiv CH + 2H_2 \overset{Pd/c}{\rightarrow}$

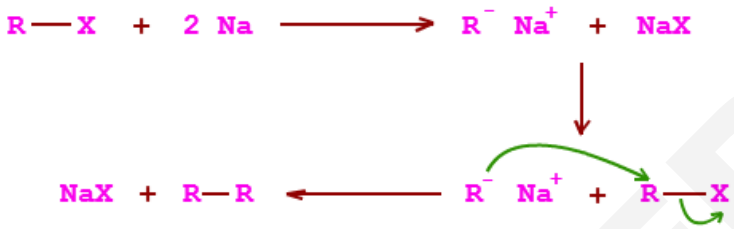
Solution:

As we learn

Preparation of Alkane from alkyl halide (Wurtz Reaction) -

Alkyl halide on treatment with metal in dry ether (free from moisture) solution give higher alkane.

- wherein



$CH_3 - C \equiv CH + 2H_2 \overset{Pd/c}{\rightarrow} CH_3 - CH_2 - CH_3$

Correct option is 4

Q. 30 Caustic soda is prepared by :

Option 1:

Gossage process

Option 2:

Solvay process

Option 3:

Deacon process

Option 4:

Contact process

Correct Answer:
Gossage process

Solution:
As we learn

Preparation of NaOH by Gossage process -

Also known as causticizing process

- wherein

$$Na_2CO_3 + Ca(OH)_2 \rightarrow 2NaOH + CaCO_3$$

NaoH is known as caustic soda. It is prepared by Gossage process and Castener- Kellner cell process.

Q. 31 Identify the biomolecules in following:-

a. Carbohydrates
b. Starch
c. Polyester
d. Bakelite

Option 1:
a,c

Option 2:
b,c

Option 3:
a,d

Option 4:
a,b

Correct Answer:
a,b

Solution:
As we learn

Biomolecules -

The complex macromolecules that built up living organisms and are required for their growth and maintenance.

- wherein

Eg. Carbohydrates, Proteins, Nucleic acids, Lipids.

Biomolecules are the complex macromolecules that built up living organisms and are required for their growth & maintenance.

Polyester and Bakelite are synthetic polymers, whereas carbohydrates and starch are Biomolecules.

Q. 32 Sodium superoxide is not formed when sodium reacts with excess oxygen due to-

Option 1:
Low stability of NaO_2 because of low lattice energy

Option 2:
Bigger size of Na^+ than Li^+

Option 3:
Less reactivity of Na than Li

Option 4:
Low ionisation energy of Na metal

Correct Answer:
Low stability of NaO_2 because of low lattice energy

Solution:
As we learn

Reason for different alkalis forming different oxides -

Increasing stability of peroxides and superoxides from Li to Cs is due to stabilization of larger anions and cations through lattice energy

-

O_2^- ions are bigger in size so it does not combine with Na^+ due to large difference in their atomic Radii as lattice energy will be low.

Q. 33 The minimum $(H-\hat{X}-H)$ bond angle is present in:

Option 1:
H_2O

Option 2:
H_2S

Option 3:
H_2Se

Option 4:
H_2Te

Correct Answer:
H_2Te

Solution:
As we learn

The bond angle of hydrides of oxygen family -

All these hydrides are angular molecules and the bond angle H-X-H (X is O, S, Se, Te)

decreases from H_2O to H_2T_e

-

	H_2O	H_2S	H_2Se	H_2Te
$H-\hat{X}-H$	104.5^0	92^0	91^0	95^0

Bond angle continuously decreases down the group.

Q. 34 What is the IUPAC name of $[Co(NH_3)_3(NO_2)(Cl)(CN)]$ compound ?

Option 1:
Chlorocyanonitro triamine cobalt (3)

Option 2:
Triamine chloro cyno cobalt (3)

Option 3:
Cyano Chloro nitro triamine cobalt (3)

Option 4:
nitro chloro cyano triamine cobalt (3)

Correct Answer:
Triamine chloro cyno cobalt (3)

Solution:
As we have learned

Writing the name of Complex compound formula -

(i) Cation is named first

(ii) ligands are named in alphabetical order before name of central metal atom.

(iii) Prefixes, mono, di, tri are used to indicate the no of ligands

(iv) when name of ligand used a numerical prefix, then term bix, tris, tetrakis are used.

eg:

$[Ni\ Cl_2\ (PPh_3)_2]$

is named as dichlorobis (triphenylphosphine)nickel(II)

(v) Oxidation state is represented by roman numerical in parenthesis

(vi) If the complex ion is an anion, the name of metal ends with suffix -ate

eg: co in complex anion $[Co\ (SCN_4)]^{2-}$

is called cobaltate.

Fe - ferrate

- wherein

$[Co(NH_3)_3(NO_2)(Cl)(CN)]$

x-1-1-1 = 0

x = +3

Q. 35 Reaction for the preparation of 1^{o} amines is:

Option 1:
Hoffmann carbylamines reaction

Option 2:
Hoffmann mustered oil rxn

Option 3:
Hoffmann bromamide reaction

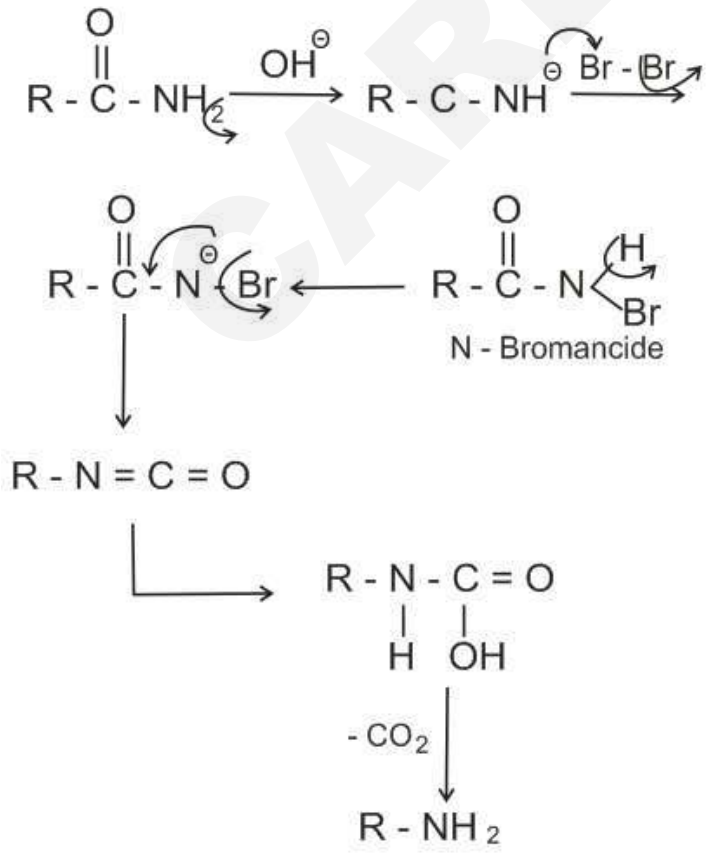
Option 4:
Lieberman nitro reaction

Correct Answer:
Hoffmann bromamide reaction

Solution:
As we learn

Hofmann Bromamide Degradation -

Amines (only primary) can also be prepared by Hofmann degradation. In this method the amine will have one carbon atom less than the amide.



Hoffmann bromamide reaction

$R\text{-}C\text{-}NH_2 + Br_2 + 4KOH \rightarrow R\text{-}NH_2 + K_2Co_3 + 2KBr + 2H_2O$

Q. 36 The pair of elements which differ maximum in their boiling point:

Option 1:
'O' and 'S'

Option 2:
'S' and 'Se'

Option 3:
'Se' and 'Te'

Option 4:
'Te' and 'Po'

Correct Answer:
'O' and 'S'

Solution:
As we learn

Melting and boiling point points of oxygen family -

The melting point and boiling points increases on moving down the group

-

'O' and 'S' differ maximum in their b.p and m.p due to the difference in their atomicity (O_2 and S_8 molecules).

Correct option is 1.

Q. 37 Which element do not form hydride on reaction with hydrogen directly.

Option 1:
Mg

Option 2:
Ca

Option 3:
Be

Option 4:
Sr

Correct Answer:
Be

Solution:
As we learn

Reaction of hydrogen with alkaline earth metals -

Form hydride except beryllium

- wherein

$$M + H_2 \overset{heat}{\rightarrow} MH_2$$

Mg, Ca, Sr react directly with hydrogen to form hydrides but Be doesn't react. BeH_2 is difficult to prepare.

Q. 38 Which of the following is a compound?

Option 1:
Sodium

Option 2:
Teflon

Option 3:
Granite

Option 4:
Diorite

Correct Answer:
Teflon

Solution:
As we learnt in

Concept of Compound -

When two or more elements combine, the molecule of a compound is obtained

- wherein

$$H_2 + \frac{1}{2}O_2 \rightarrow H_2O$$

Thus,
Teflon is the only compound above.

Therefore, **Option(2) is correct**

Q. 39 **Assertion (A):** Ethane polymerized in the presence of Ziegler Natta catalyst at high temperature and pressure is used to make bucket and dustbin.

Reason (R): High-density polymers are closely packed and are chemically inert.

Choose the correct answer:

Option 1:
(A) and (R) both are wrong

Option 2:
(A) is correct but (R) is wrong

Option 3:
Both (A) and (R) are correct but (R) is not the correct explanation of (A)

Option 4:
Both (A) and (R) are correct and (R) is the correct explanation of (A)

Correct Answer:
Both (A) and (R) are correct and (R) is the correct explanation of (A)

Solution:
The polymerization of ethene with Ziegler Natta catalyst under high temperature and pressure produces high-density polyethylene which has density due to close packing and is chemically inert. It is used to prepare buckets, dustbin bottles, pipes, etc.

Hence, (A) and (R) are both correct and (R) is the correct explanation of (A).

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

Q. 40 Gabriel phthalimide reaction is used in the synthesis of:

Option 1:
Primary aromatic amines

Option 2:
Secondary amines

Option 3:
Primary aliphatic amines

Option 4:
Tertiary amines

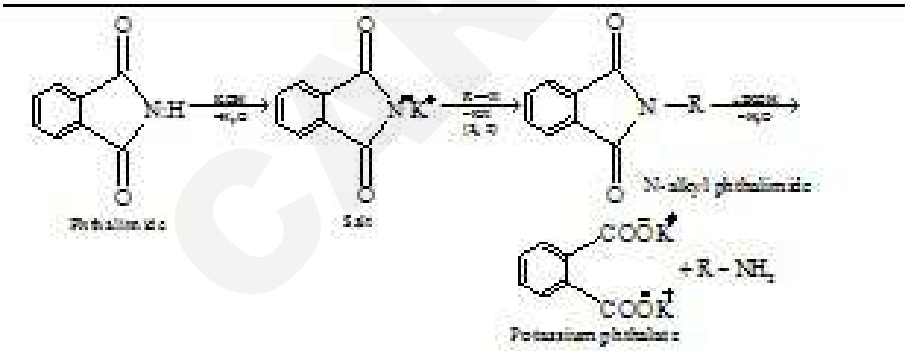
Correct Answer:
Primary aliphatic amines

Solution:
As we learn

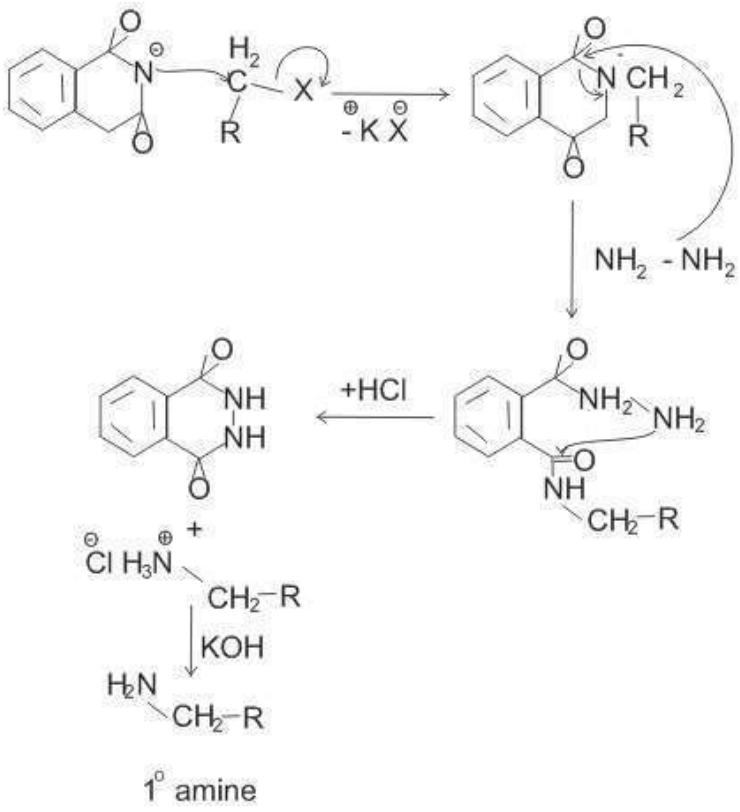
Gabriel Phthalimide Synthesis -

Further alkylation can be stopped and a pure primary amine can be obtained by alkylation of phthalimide (Gabriel synthesis) followed by hydrolysis.

- wherein



Gabriel phthalimide row is used in the synthesis of primary aliphatic amines.



Maths

Q. 1 Vector product is :

Option 1:
Commutative

Option 2:
Not Commutative

Option 3:
Associative

Option 4:
None of these

Correct Answer:
Not Commutative

Solution:
As we learned

Properties of Vector Product -

$\vec{a} \times \vec{b} \neq \vec{b} \times \vec{a}$

- wherein

Vector Product is not Commutative

Q. 2 $\cos^{-1}(\frac{\sqrt{3}}{2}) =$

Option 1:
$\frac{5\pi}{6}$

Option 2:
$-\frac{\pi}{6}$

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

Option 4:
None of these

Correct Answer:
None of these

Solution:
As we have learnt

Domains and Ranges of Inverse Trigonometric Functions -

For $\cos^{-1} x$

Domain $\epsilon \left[-1, 1\right]$

Range $\epsilon \left[0, \pi\right]$

-

$\cos^{-1}(\frac{\sqrt{3}}{2}) = \frac{\pi}{6}$

Q. 3 In a plane , $\hat{i}$ and $\hat{j}$ are 2 perpendicular unit vectors, then vector $\vec{OP}$ of magnitude 4 units and making angle 30° with $\hat{i}$ is ?

Option 1:
$2\hat{i} + 2\sqrt{3}\hat{j}$

Option 2:
$2\sqrt{3}\hat{i} + 2\hat{j}$

Option 3:
$2\hat{i} + 2\hat{j}$

Option 4:
$\sqrt{3}\hat{i} + 2\sqrt{3}\hat{j}$

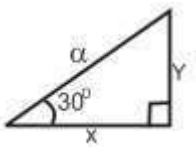
Correct Answer:
$2\sqrt{3}\hat{i} + 2\hat{j}$

Solution:
As we have learnt

Collinear Vectors -

Representation of any vector as a linear combination of non-collinear vectors $\vec{A}$ and $\vec{B}$ is unique.

-



$$\sin 30^\circ = \frac{y}{4}; \quad y = 2$$

$$\cos 30^\circ = \frac{x}{4}; \quad x = 2\sqrt{3}$$

Q. 4 The expression ${}^nC_{r+1} + {}^nC_{r-1} + 2 \times {}^nC_r \; equals$

Option 1:
${}^{n+2}C_{r+1}$

Option 2:
${}^{n+1}C_r$

Option 3:
${}^{n+1}C_{r+1}$

Option 4:
${}^{n+2}C_{r}$

Correct Answer:
${}^{n+2}C_{r+1}$

Solution:
As we have learned

Properties of Binomial Theorem -

$${}^{n}C_{r} +{}^{n} C_{r-1} ={}^{n+1} C_{r}$$

Now,

$${}^{n}C_{r+1} +{}^{n} C_{r-1} + 2 \times{}^{n} C_{r}$$

$$({}^{n}C_{r+1} +{}^{n} C_{r}) + ({}^{n}C_{r-1} +{}^{n} C_{r})$$

$$({}^{n+1}C_{r+1}) + ({}^{n+1}C_{r})$$

$$({}^{n+2}C_{r+1})$$

Q. 5 If $\left|z^2-1\right|=|z|^2+1$, then z lies on

Option 1:
a circle

Option 2:
the imaginary axis

Option 3:
the real axis

Option 4:
an ellipse.

Correct Answer:
the imaginary axis

Solution:
$|z^2-1|=|z|^2+1$

Let z = x + iy

$\therefore \quad \left|(x+iy)^2-1\right| = x^2+y^2+1$

$\therefore \quad \left|(x^2-y^2-1)+i2xy\right| = (x^2+y^2+1)$

$(x^2-y^2-1)^2+4x^2y^2 = (x^2+y^2+1)^2$

$\therefore \quad 4x^2y^2 = (x^2+y^2+1)^2-(x^2-y^2-1)^2$

$= (x^2+y^2+1+x^2-y^2-1)(x^2+y^2+1-x^2+y^2+1)$

(Using a^2 - b^2 formula)

$= 2x^2.2(y^2+1)$

Hence $4x^2y^2 = 4x^2y^2+4x^2$

$\therefore \quad x = 0$

The correct option is 2.

Q. 6 $\frac{dy}{dx}-\frac{y}{x} = xy$ General Solution of this equation is

Option 1:
$y = x^2e^{x/2}+c$

Option 2:
$y = xe^{x^2}+c$

Option 3:
$y = xe^{x^2/2}+c$

Option 4:
None of these

Correct Answer:
$y = xe^{x^2/2}+c$

Solution:
As we learnt

General form of Variable Separation -

$$d\left(log\frac{y}{x}\right) = \frac{xdy-ydx}{xy}$$

-

$$\frac{dy}{dx}-\frac{y}{x}=xy \Rightarrow \frac{xdy-ydx}{xy}=xdx$$

$$\Rightarrow \frac{xdy-ydx}{xy}=d\left[\log\left(\frac{y}{x}\right)\right]$$

So, $\Rightarrow d\left[\log\left(\frac{y}{x}\right)\right]=xdx$

Integrate both side

$$\log\left[\frac{y}{x}\right]=\frac{x^2}{2}+C$$

OR

$$y=xe^{\frac{x^2}{2}+C}$$

Q. 7 If $f(x)=\int 4log_4 x dx$ and $g(x)=\int log_2 x^2 dx$ Then

Option 1:
f (x) > g (x)

Option 2:
f (x) = g (x)

Option 3:
f (x) < g (x)

Option 4:
none of these

Correct Answer:
f (x) = g (x)

Solution:
As we have learned

Rule for integration -

Integral of constant times a function is constant times integral of function

$$\int kf\left(x\right)dx = k\int f\left(x\right)dx$$

- wherein

Where k is constant

$$f(x) = \int 4log_4 x dx$$

simplify =

$$4log_4 x dx$$

$$= \frac{4}{2} log_2 x = 2log_2 x$$

$$f(x) = 2\int log_2 x$$

$$now, g(x) = \int log_2 x dx = 2\int log_2 x dx$$

$$so, f(x) = g(x)$$

Q. 8 The height/length of an object or the distance between 2 objects can be determined with the help of :

Option 1:
Co-ordinate geometry

Option 2:
Calculus

Option 3:
Trigonometric ratios

Option 4:
All of the above

Correct Answer:
All of the above

Solution:
As we learned

Height and Distances -

The height or length of an object or the distance between two distant objects can be determined with the help of trigonometric ratios.

-

Q. 9 Find $\overset{Lim}{x \to} 0\,(e^x.log\,(x^x+x+2))$

Option 1:
1

Option 2:
e

Option 3:

$\log 2$

Option 4:
0

Correct Answer:

$\log 2$

Solution:
As we learned

Limit of product / quotient -

Limit of product/quotient is the product/quotient of individual limits such that

$\lim_{x \to a}\,(f(x).g(x))$

$= \lim_{x \to a} f(x).\ \lim_{x \to a} g(x)$, given that f(x) and g(x) are non-zero finite values

$\lim_{x \to a} \frac{f(x)}{g(x)} = \frac{\lim_{x \to a} f(x)}{\lim_{x \to a} g(x)}$, given that f(x) and g(x) are non-zero finite values

$Also\ \lim_{x \to a} kf(x)$

$= k \lim_{x \to a} f(x)$

-

$= \overset{Lim}{x \to} 0 \left(e^x . log\left(x^x + x + 2\right)\right)$

$= \overset{lim}{x \to} 0 \left(e^x\right) . \overset{lim}{x \to} 0 log\left(x^2 + x + 2\right)$

$=1 * log2 = log2$

Q. 10 If $a = i + j + k, b = i + 3j + 5k$ and $c = 7i + 9j + 11k$ then the area of the parallelogram having diagonals a+b and b+c is

Option 1:
$4\sqrt{6}$

Option 2:
$\frac{1}{2}\sqrt{21}$

Option 3:
$\frac{\sqrt{6}}{2}$

Option 4:
$\sqrt{6}$

Correct Answer:
$4\sqrt{6}$

Solution:
As we learn

Properties of vector product -

$\vec{a} \times (\vec{b} + \vec{c}) = \vec{a} \times \vec{b} + \vec{a} \times \vec{c}$

- wherein

Here $\vec{a}, \vec{b}\, and\, \vec{c}$ are three vectors

Area of the parallelogram with diagonals a+b and b+c $= \frac{1}{2}\left|(a+b)\times(b+c)\right|$

$= \frac{1}{2}\left|\{(i+j+k)+(i+3j+5k)\}\times\{(i+3j+5k)+(7i+9j+11k)\}\right| =$
$\frac{1}{2}\left|\{(2i+4j+6k)\times(8i+12j+16k)\}\right|$

$= 4\left|(i+2j+3k)\times(2i+3j+4k)\right| = 4\begin{Vmatrix} i & j & k \\ 1 & 2 & 3 \\ 2 & 3 & 4 \end{Vmatrix} = 4\left|-i+2j-k\right| =$
$4\sqrt{6}$

Q. 11 $If \sin A = \frac{3}{5}, then \left|\sin\frac{A}{2}+\cos\frac{A}{2}\right| =$

Option 1:
$\frac{2\sqrt{2}}{\sqrt{5}}$

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

Option 3:
$\sqrt{\frac{8}{25}}$

Option 4:
None of these

Correct Answer:
$\frac{2\sqrt{2}}{\sqrt{5}}$

Solution:
As we have learnt

Results from Submultiples of an angle -

$$\left|\sin\frac{A}{2}+\cos\frac{A}{2}\right| = \sqrt{1+\sin A}$$

-

$$\left|\sin\frac{A}{2}+\cos\frac{A}{2}\right|=\sqrt{1+\frac{3}{5}}=\frac{2\sqrt{2}}{\sqrt{5}}$$

Q. 12 If f(a) =7; f(b)=-2, for a=1 & b=3
And f(x) is continuous in [1,3] and differentiable in (1,3). Then $\pounds$ atleast one $C\epsilon$ such that $f'(c)=$

Option 1:
$\frac{9}{2}$

Option 2:
$\frac{-7}{2}$

Option 3:
$\frac{1}{2}$

Option 4:
$\frac{-9}{2}$

Correct Answer:
$\frac{-9}{2}$

Solution:
As we learned

Lagrange's mean value theorem -

If a function f(x)

1. is continuous in the closed interval [a,b] and

2. is differentiable in the open interval (a, b) then

$$f'(c)=\frac{f(b)-f(a)}{b-a}\quad where\ c\epsilon(a,b)$$

-

$$f'(c) = \frac{f(b) - f(a)}{b - a}$$

$$= \frac{-2 - 7}{3 - 1}$$

$$= -\frac{9}{2}$$

Q. 13 Let f (x) = h(x) / g (x) , where h and g are continous function on open interval (a,b) which of the following statement is true

Option 1:
f is continous at all x for which $x \neq 0$

Option 2:
f is continous at all x for which g (x) = 0

Option 3:
f is continous at all x for which $g(x) \neq 0$

Option 4:
f is continous at all x for which $h(x) \neq 0$

Correct Answer:
f is continous at all x for which $g(x) \neq 0$

Solution:
As we have learned

Properties of Continuous function -

If f, g are two continuous functions at a point a of their common domain D.Then $f \pm g$ fg are continuous at a and if $g(a) \neq 0$ then

$\frac{f}{g}$ is also continuous at x = a.

-

If h and g are continous on (a,b) then f is also continous at all x for which g (x)

is not equal to 0

Q. 14 Which of the following is not a strictly Triangular matrix:

Option 1:

$A = \begin{bmatrix} 0 & 4 \\ 2 & 0 \end{bmatrix}$

Option 2:

$A = \begin{bmatrix} 3 & 1 \\ 2 & 0 \end{bmatrix}$

Option 3:

$A = \begin{bmatrix} 0 & 3 & 0 \\ 2 & 0 & 2 \\ 0 & 1 & 0 \end{bmatrix}$

Option 4:

None of these

Correct Answer:

$A = \begin{bmatrix} 3 & 1 \\ 2 & 0 \end{bmatrix}$

Solution:

As we have learnt

Strictly triangular matrix -

$a_{ii} = 0$ for $1 \leq i \leq n$

Where $A = [a_{ij}]_{n \times n}$

-

Q. 15 Find the integral $\int e^x \sin e^x dx$

Option 1:

$\frac{-\cos e^x}{e^x} + c$

Option 2:
$-\cos e^x \cdot e^x + c$

Option 3:
$-\cos e^x + c$

Option 4:
$\cos e^x + c$

Correct Answer:
$-\cos e^x + c$

Solution:
As we have learnt,

Integrals for Trigonometric functions -

$$\frac{\mathrm{d}}{\mathrm{d}x}(-cosx) = sinx$$

$$\therefore \int sinxdx = -cosx + c$$

-

Put $e^x = t \Rightarrow e^x dx = dt$

$$\Rightarrow \int \sin t dt = -\cos t + c = -\cos e^x + c$$

Q. 16 Function is a relation f from a set A to a set b if each element of set A is mapped with _____ element(s) of set b.

Option 1:
Multiple

Option 2:
unique

Option 3:
No

Option 4:
two

Correct Answer:
unique

Solution:
As we have learnt,

FUNCTIONS -

A relation f from a set A to a set B is said to be a function if every element of set A has one and only one image in set B.

-

Q. 17 If (x-3,2x) = (y,-x+y), Then find (x,y)

Option 1:
(-3,-9)

Option 2:
$\left(\frac{-3}{2},\frac{-9}{2}\right)$

Option 3:
(1,3)

Option 4:
None of these

Correct Answer:
$\left(\frac{-3}{2},\frac{-9}{2}\right)$

Solution:
We have x-3=y

and 2x=-x+y

$\Rightarrow x-y-3=0, 3x-y=0$

x = y and x - x - 3 = 0

$$x = -3/2$$
$$y = -9/2$$

Q. 18 Which type of set is

S={2,3,5,7}

Option 1:
Finite Set

Option 2:
Infinite set

Option 3:
Singleton set

Option 4:
Null set

Correct Answer:
Finite Set

Solution:
As we learnt

Finite Set -

A set consists of a definite number of elements.

- wherein

eg. {number of days in a week}

Q. 19 The degree measure corresponding to the given radian $\left[\frac{2\pi}{15}\right]^{\circ}$

Option 1:
21°

Option 2:
22°

Option 3:
23°

Option 4:
24°

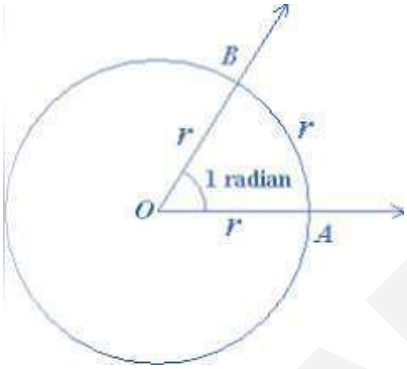
Correct Answer:
24°

Solution:
As we learn

Radian -

Radian is the angle subtended at the centre of a circle by an arc whose length is equal to its radius.

- wherein



We have π radians = 180^0

$$\therefore 1^0 = \left[\frac{180^0}{\pi}\right]^\circ$$

$$\therefore \left[\frac{2\pi}{15}\right]^\circ = \left[\frac{2\pi}{15} \times \frac{180}{\pi}\right]^\circ = 24^\circ$$

Q. 20 If $ax^2 + bx + c \geq 0$ for all $c \epsilon R$, where $a = 4, b = 7$ then c belongs to

Option 1:
$\left[\frac{49}{16}, \infty\right]$

Option 2:
$\left[\frac{16}{49}, \infty\right]$

Option 3:
$(-49, 16)$

Option 4:
$(-16, 49)$

Correct Answer:
$\left[\frac{49}{16}, \infty\right]$

Solution:
As we learned

Quadratic Expression ax^2 + bx + c is non negative -

$ax^2 + bx + c \geqslant 0$ for all $x \epsilon R$ When $a > 0$ & $b^2 - 4ac \leq 0$ $(a, b, c \epsilon R)$

-

$a = 4 > 0$

$b^2 - 4ac \leq 0$

$49 - 16c \leq 0$

$c \geq \frac{49}{16}$

Q. 21 Find the distance between plane $r.(2\hat{i}-\hat{j}+\hat{k})=4$ and a point (1,-1,2)

Option 1:
$1/\sqrt{6}$

Option 2:
$2\sqrt{6}$

Option 3:
$\sqrt{6}$

Option 4:
$2/\sqrt{6}$

Correct Answer:
$1/\sqrt{6}$

Solution:
As we know that

Distance of a point from plane(vector form) -

The length of perpendicular from P(a) to the plane

$\vec{r}\cdot\vec{n}=d$ is given by $\frac{|\vec{a}\cdot\vec{n}-d|}{|\vec{n}|}$

-

$P(a)=\hat{i}-\hat{j}+2\hat{k}$

$|2+1+2-4|\sqrt{1}+1+4=1/\sqrt{6}$

Q. 22 $\int \frac{1}{(9x^2-12x+4)^3dx}=?$

Option 1:
$\frac{1}{15(3x-2)^5}+C$

Option 2:
$\frac{1}{15(3x+2)^5}+C$

Option 3:

$$\frac{-1}{15(3x-2)^5}+C$$

Option 4:

$$-\frac{1}{15(3x-2)^5}+C$$

Correct Answer:

$$\frac{1}{15(3x+2)^5}+C$$

Solution:
As we have learned

Type of integration by substitution -

$$\int (ax+b)^n f(x)dx$$

or $$\int \frac{f(x)}{(ax+b)^n}dx$$

- wherein

Where n is any rational number. (+ive or -ive)

Let $(ax+b)=t$

$$\therefore dx=\frac{dt}{a}.$$

$$I=\int \frac{1}{(9x^2-12x+9)^3dx}$$

$$9x^2-12x+4=(3x-2)^2$$

$$I=\int \frac{1}{(3x-2)^6}dx$$

$$I=\frac{1}{3}\int \frac{1}{t^6}dt=-\frac{1}{5t^2}1/3+C$$

$$I=-\frac{1}{15}\frac{1}{(3x-2)^5}+C$$

Q. 23 In how many ways a cricket team of 11 players out of 20 players can be sent for batting if 3 particular players must not be included?

Option 1:
$^{17}P_{11}$

Option 2:
$^{17}C_{11}$

Option 3:
11!

Option 4:
None of these

Correct Answer:
$^{17}P_{11}$

Solution:
As we have learnt in

Rule of Restricted Permutations -

The number of permutations of n dissimilar things takes r at a time when p particular things never occur is $^{n-p}c_r.r!$.

-

$^{17}C_{11}(11)!$

=$^{17}P_{11}$

Q. 24 If $(x+x^7)^7$ is expanded ; How many terms will have terms x^8

Option 1:
1

Option 2:
2

Option 3:
infinite

Option 4:
none of these

Correct Answer:
none of these

Solution:

As we have learned

Theorem on Binomial -

In the expression of $(x+a)^n$.The sum of the power of x and a in each term is equal to n .

- wherein

$x^{n-r} \cdot a^r$

$(n-r+r=n)$

any term has an expression

$x^9 x^{7b}$

$a+b=7$

$a+7b=8$

$6b=1$

$b=1/6$

which is not possible

Q. 25 $\lim_{x \to 3} \frac{x^2-7x+12}{x^2-x-6} =$

Option 1:
$\frac{3}{2}$

Option 2:
$\frac{1}{5}$

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

Option 4:

$$\frac{-1}{5}$$

Correct Answer:

$$\frac{-1}{5}$$

Solution:

As we learned

Method of factorisation -

$$Indeterminate\ form\ of\ \frac{0}{0}\ and\ \frac{\infty}{\infty}$$

We remove the denominator factor which it makes zero.

$$\lim_{x\to 1}\ \frac{x^2-1}{x-1}=\lim_{x\to 1}=\frac{(x-1)(x+1)}{(x-1)}=1+1=2$$

- wherein

$$\frac{0}{finite}=0$$

$$\frac{finite}{0}=\infty$$

$$\overset{lim}{x\to}\ 3\ \frac{x^2-7x+12}{x^2-x-6}=$$

$$=\overset{lim}{x\to}\ 3\ \frac{(x-3)\,(x-4)}{(x-3)\,(x+2)}$$

$$=\overset{lim}{x\to}\ 3\ \ \frac{(x-4)}{(x+2)}$$

$$=\overset{lim}{x\to}\ 3\ \ \frac{x-4}{x+2}=\frac{-1}{5}$$

Q. 26 No. of arbitrary constant that will occur in general solution of D.E $\sqrt{\frac{d^3y}{dx^3}} = \sqrt[3]{\frac{dy}{dx}} + 2$

Option 1:
1

Option 2:
3

Option 3:
6

Option 4:
9

Correct Answer:
3

Solution:
As we learnt

General solution -

A Solution of a differential equation is an equation which contains arbitrary constants as many as the order of the differential equation.

-

Given D.E can be written as

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

Order is 3

Q. 27 $\sin A = \frac{3}{5}(0^\circ < A < 90^\circ), then \tan\frac{A}{2} =$

Option 1:
$\frac{1}{9}$

Option 2:
$\frac{1}{3}$

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

Option 4:
$\frac{2}{9}$

Correct Answer:
$\frac{1}{3}$

Solution:
As we have learnt

Results from Submultiples of an angle -

$$\tan\frac{A}{2}=\pm\sqrt{\frac{1-\cos A}{1+\cos A}}=\frac{\sin A}{1+\cos A}=\frac{1-\cos A}{\sin A}$$

-

$$\cos A=\sqrt{1-\sin^2 A};\ \cos A=\frac{4}{5};\ \tan\frac{A}{2}=\frac{1-\frac{4}{5}}{\frac{3}{5}}=\frac{1}{3}$$

Q. 28 $\cos^{-1}x=\tan^{-1}x, then\ \cos^2\Theta=?$

Option 1:
$\frac{\sqrt{5}-1}{2}$

Option 2:
$\sqrt{5}+2$

Option 3:
$\frac{\sqrt{5}+1}{2}$

Option 4:
none

Correct Answer:
$\frac{\sqrt{5}-1}{2}$

Solution:
As we have learned

Trigonometric Identities -

$\sin^2\Theta+\cos^2\Theta=1$

$1+\tan^2\Theta=\sec^2\Theta$

$1+\cot^2\Theta=cosec^2\Theta$

- wherein

They are true for all real values of θ

$$x=\cos\theta=\tan\theta\Rightarrow\cos^2\theta=\sin\theta$$

$$1-\sin^2\theta=\sin\theta\Rightarrow\sin^2\theta+\sin\theta-1=0$$

$$\sin\theta=\frac{1+\sqrt{5}}{2}$$

$$now,1-\cos^2\theta+\sin\theta-1=0$$

$$\cos^2\theta=\frac{\sqrt{5}-1}{2}$$

Q. 29 If $\frac{dy}{dx}=y+3>0\ and\ y(0)=2,then\ y(1n\ 2)$ is equal to

Option 1:
13

Option 2:
– 2

Option 3:
7

Option 4:
5

Correct Answer:
7

Solution:
As we learnt in

Solution of Differential Equation -

$$\frac{\mathrm{d}y}{\mathrm{d}x} = f\left(ax + by + c\right)$$

put

$$Z = ax + by + c$$

- wherein

Equation with convert to

$$\int \frac{dz}{bf\left(z\right) + a} = x + c$$

$$\frac{dy}{dx} = y + 3 > 0,\ \ y(0) = 2,\ \ y(ln2) = ?$$

$$\Rightarrow \int \frac{dy}{y+3} = \int dx$$

$$\Rightarrow \log|y+3| = x + C$$

$$\Rightarrow \log 5 = C$$

$$\Rightarrow \log|y+3| = x + \log 5$$

$$= \log 2 + \log 5 = \log 10$$

$$y + 3 = 10 \qquad \Rightarrow y = 7$$

Q. 30 Which of the following is false?

Option 1:
$(A+B+\bar{C})^{\theta}=A^{\theta}+B^{\theta}+C'$

Option 2:
$(A+B+C)^{\theta}=A^{\theta}+B^{\theta}+C^{\theta}$

Option 3:
$\left(\overline{A+B+C}\right)^{\Theta}=A'+B'+C'$

Option 4:
None of these.

Correct Answer:
None of these.

Solution:
As we have learnt

Property of Transpose Conjugate -

$$(A+B)^{\Theta}=A^{\Theta}+B^{\Theta}$$

- wherein

A^{Θ} is the conjugate matrix of A

Correct option d

Q. 31 If matrix $A=\begin{bmatrix}1 & 0 & w\\ 1 & w^2 & 1\\ 1 & w^2 & w\end{bmatrix}$ where ω is a cube root of unity.Then matrix $A-A^{\theta}$ is

Option 1:
Hermition matrix

Option 2:
unit matrix

Option 3:
Skew hermition matrix

Option 4:
None of the above

Correct Answer:
Skew hermition matrix

Solution:
As we have learnt

Skew hermitian matrices -

$$A^{\Theta} = -A$$

- wherein

A^{Θ} is complex conjugate transpose matrix of matrix A

$A^{\theta} = -A \Rightarrow A$ is skew hermition.

$$(A - A^{\theta})^{\theta} = A^{\theta} - (A^{\theta})^{\theta} = A^{\theta} - A = -(A - A^{\theta})$$

Q. 32 If gof is a bijective function then,

Option 1:
f is one-one and f is onto

Option 2:
f is many-one and g is onto

Option 3:
f is one-one and g is onto

Option 4:
g is one-one and g is onto

Correct Answer:
f is one-one and g is onto

Solution:
As we learnt

Property of Composition of Functions -

If f: A → B and g: B → C are one-one, then g o f? A → C is also one-one
If f: A → B and g: B → C are onto, then g o f? A → C is also onto
If g o(f) is one-one, Then f is one-one.
If g o(f) is onto, Then g is onto.

Q. 33 What is the probability of occurence face cards when withdrawing one card from the deck of 52 cards ?

Option 1:
4/13

Option 2:
3/13

Option 3:
3/52

Option 4:
1/26

Correct Answer:
3/13

Solution:
As we learned that

Probability of occurrence of an event -

Let S be the sample space then the probability of occurrence of an event E is denoted by P(E) and it is defined as

$$P(E) = \frac{n(E)}{n(S)}$$

$$P(E) \leq 1$$

$$P(E) = \lim_{n \to \infty} \left(\frac{r}{n}\right)$$

- wherein

Where n repeated experiment and E occurs r times.

$$P(E)=\frac{n(E)}{n(S)}$$
$$=\frac{12}{52}=\frac{3}{13}$$

Q. 34 If the some of two vectors is a unit vector, then the magnitude of their difference is :

Option 1:
$\sqrt{2}$

Option 2:
$\sqrt{3}$

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

Option 4:
1

Correct Answer:
$\sqrt{3}$

Solution:
As we learn

Difference of two vectors -

$$\vec{a}+\left(-\vec{b}\right)=\vec{a}-\vec{b}$$

- wherein

The difference of two vectors is same as the sum of one vector and negative of other vector

$|a| = 1, |b| = 1 \; and \; |a+b| = 1 \Rightarrow |a+b|^2 = 1 \Rightarrow 1+1+2\cos\Theta = 1 \Rightarrow$

Let $\cos\Theta = -\frac{1}{2} \Rightarrow \Theta = 120^0$

$\therefore |a-b|^2 = 1+1-2\cos\Theta = 3 \Rightarrow |a-b| = \sqrt{3}$

Q. 35 If we add zero vector ($\vec{0}$) to a vector $2\vec{i} - \vec{j} + \vec{k}$, we get :

Option 1:
$\vec{0}$

Option 2:
$2\hat{i} - \hat{j} + \hat{k}$

Option 3:
$-2\hat{i} + \hat{j} - \hat{k}$

Option 4:
$\hat{i} - \frac{\hat{j}}{2} + \frac{\hat{k}}{2}$

Correct Answer:
$2\hat{i} - \hat{j} + \hat{k}$

Solution:
As we have learnt

laws of vector addition -

$\vec{a} + \vec{0} = \vec{a} = \vec{0} + \vec{a}$

-

Q. 36 $\lim\limits_{x \to 2} \frac{|x-2|}{x-2} =$

Option 1:
1

Option 2:
-1

Option 3:
Does not exit

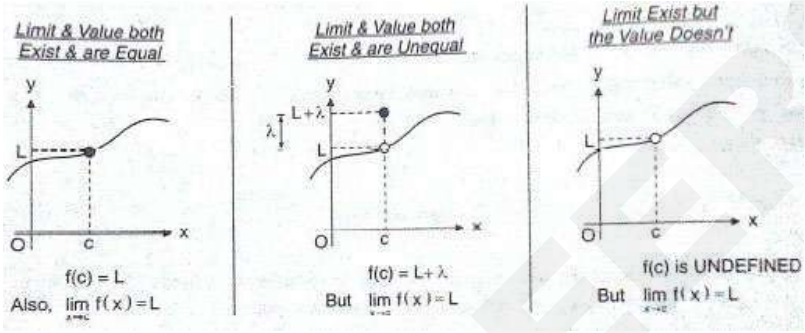
Option 4:
None of these

Correct Answer:
Does not exit

Solution:
As we learned

Condition of Geometrical limit -

Limits describe the behaviour of a function near a particular point not necessarily at the point itself.



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$$L.H.L = \lim_{x \to 2^-} \frac{|x-2|}{x-2} = \lim_{h \to 0} \frac{|2-h-2}{2-h-2} = \lim_{h \to 0} \frac{h}{-h} = -1 \cdots\cdots\cdots\cdots (i)$$

and, $$R.H.L = \lim_{x \to 2^+} \frac{|x-2|}{x-2} = \lim_{h \to 0} \frac{|2+h-2}{2+h-2} = \lim_{h \to 0} \frac{h}{h} = -1 \cdots\cdots\cdots\cdots (ii)$$

From (i) and (ii) $L.H.L. \neq R.H.L.$ i.e. $\lim_{x \to 2} \frac{|x-2|}{x-2}$ does not exit

Q. 37 $\left|(1+i)\frac{2+i}{(3+i)}\right| =$

Option 1:
-1/2

Option 2:
1/2

Option 3:
1

Option 4:
-1

Correct Answer:
1

Solution:
As we learn

Property of Modulus of z(Complex Number) -

$|z_1z_2|=|z_1||z_2|$

- wherein

$|.|$ denotes modulus of complex number

$$z=\frac{(1+i)(2+i)}{(3+i)}=\frac{1+3i}{3+i}\times\frac{3-i}{3-i}=\frac{3+4i}{5}\Rightarrow|z|=1$$

Trick : $|z|=\frac{|z_1||z_2|}{|z_3|}=\frac{\sqrt{2}.\sqrt{5}}{\sqrt{10}}=1$

Q. 38 What is the vertex of graph of the quadratic expression

$$x^2+3x+\frac{9}{4}=0$$

Option 1:
$\left(\frac{3}{2}0\right)$

Option 2:

$\left(\frac{2}{3}, 0\right)$

Option 3:

$\left(o, \frac{-3}{2}\right)$

Option 4:

$\left(\frac{-3}{2}, o\right)$

Correct Answer:

$\left(\frac{-3}{2}, o\right)$

Solution:

As we learned

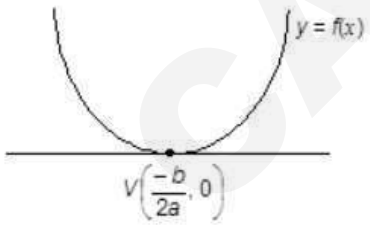
Quadratic Expression Graph when a > 0 & D = 0 -

Real and Equal roots of

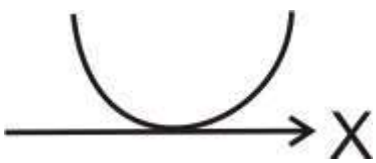
$f(x) = ax^2 + bx + c$

& $D = b^2 - 4ac$

- wherein



$a = 1, D = 9 - 9 = 0$



$$\left(\frac{-b}{2a}, 0\right)$$

So, $\frac{-b}{2a} = \frac{-3}{2}$

Q. 39 For $f(x) = [x]$, where $[\ ]$ stands for the greatest integer function, the function is ____ at $x = 0$. Fill in the blank.

Option 1:
Continuous

Option 2:
Removable Discontinuous

Option 3:
Infinite non-removable discontinuous

Option 4:
finite non-removable discontinuous

Correct Answer:
finite non-removable discontinuous

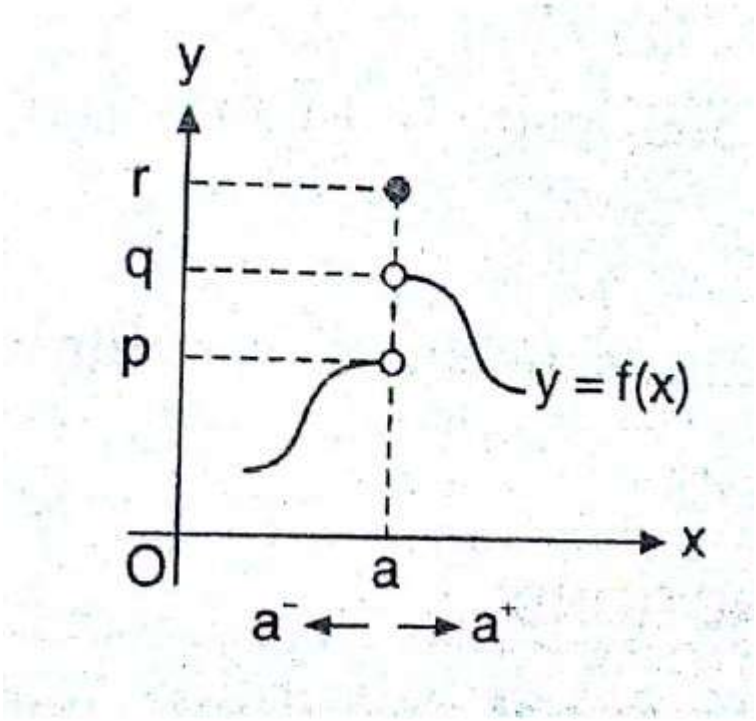
Solution:
As we have learnt,

Finite non-removable discontinuity -

A function f is said to possess finite irremovable discontinuity at x = a if at x = a the left hand limit both exist finitely but are unequal.

$$\lim_{x \to a^-} f(x) \neq \lim_{x \to a^+} f(x)$$

- wherein



$$\lim_{x\to 0^-} f(x) = -1$$

$$\lim_{x\to 0^+} f(x) = 0$$

Q. 40 Is $\{[x]\}$ continuous at $x = \frac{2}{5}$, where $\{\}$ & $[\,]$ stands for fractional part of integer functions?

Option 1:
Continuous

Option 2:
Removable continuous

Option 3:
Finite irremovable discontinuous

Option 4:
Infinite irremovable discontinuous

Correct Answer:
Finite irremovable discontinuous

Solution:
As we have learnt,

Continuity of composite functions -

A composite function fog(x) is continuous at x = a if g is continuous at x = a and f is continuous at g(a)

-

At $x = \frac{2}{5}$, $[x]$ is continuous.

$$\left[\frac{2}{5}+\right] = \left[\frac{2}{5}-\right] = \left[\frac{2}{5}\right] = 0$$

Now, at $x = 0$, $\{x\}$ is discontinuous.

$$\{0+\} = 0; \{0\} = 0; \{0-\} = 1$$

Q. 41 In how many ways a cricket team of 11 players out of 20 players can be sent for batting if 2 particular players must be included?

Option 1:
$20p_{11}$

Option 2:
$18p_9$

Option 3:
$18p_9(11!)$

Option 4:
$^{18}C_9(11!)$

Correct Answer:
$^{18}C_9(11!)$

Solution:

As we have learnt in

Restricted Permutations -

The number of permutations of n dissimilar things taken r at a time when p particular things always occur ${}^{n-p}C_{r-p}r!$.

-

If 2 particular players are included,

no.of players left to be included-9

Out of total = 20-2=18 Players.

${}^{18}C_9(11)!$

Q. 42 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. 43 Equation of the bisection of the angle b/w the planes $2x+y-2z+3=0 and 3x+2y-6z+8=0$ is

Option 1:
$5x-y+4z+3=0$

Option 2:
$5x-y+4z=3$

Option 3:
$23x+13y-3z+45=0$

Option 4:
both b and c

Correct Answer:
both b and c

Solution:
As we learnt

Angle bisector of planes (cartesian form) -

Equation of plane bisecting the angle between the planes

$ax+by+cz+d=0$

$a_1x+b_1y+c_1z+d_1=0$ is

$$\frac{ax+by+cz+d}{\sqrt{a^2+b^2+c^2}}=\pm\frac{a_1x+b_1y+c_1z+d_1}{\sqrt{a_1^2+b_1^2+c_1^2}}$$

-

$(2x+y-2z+3)/\sqrt{4}+1+4=\pm(3x+2y-6z+8)/\sqrt{9}+4+36$

$14x+7y-14z+21=\pm(9x+6y-18z+24)$

$5x - y + 4z = 3$

OR,

$14x + 7y - 14z + 21 = -9x - 6y + 18z - 24$

$23x + 13y - 32z + 45 = 0$

Q. 44 If the probability of dangerous fire is 0.01 and the probability of having a smoke is 0.1. If 90 % of dangerous fire makes smoke the probability of dangerous fire when there is smoke is

Option 1:
0.09

Option 2:
0.11

Option 3:
0.91

Option 4:
0.9

Correct Answer:
0.09

Solution:
As we have learned

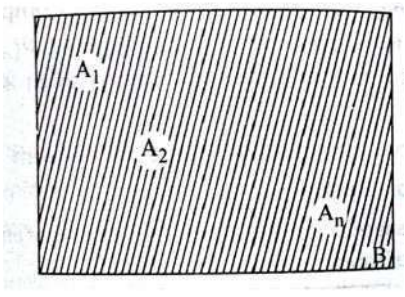
BAYE'S Theorem -

If E_1, E_2, E_3.....E_n be n mutually exclusive and exhaustive events and A is an event that occurs together with either E_1, E_2, E_3.....E_n from a portion of the sample space S and A be an event than

$$P\left(\frac{E_k}{A}\right) = \frac{P\left(E_k\right) \cdot P\left(\frac{A}{E_k}\right)}{P\left(E_1\right) \cdot P\left(\frac{A}{E_1}\right) + P\left(E_2\right) \cdot P\left(\frac{A}{E_2}\right) + \cdots P\left(E_k\right) \cdot P\left(\frac{A}{E_k}\right)}$$

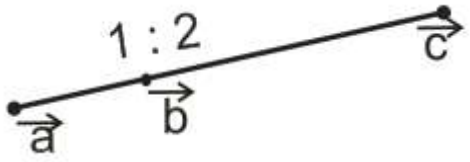
where S = $E_1 \cup E_2 \cup \cdots E_k$ and S is sample space.

- wherein



$$P(Fire|Smoke) = \frac{P(fire)P(Smoke|Fire)}{P(Smoke)} = \frac{0.01 \times 0.9}{0.1} = 0.09$$

Q. 45 In the adjoining figure, find position vector of $\vec{c}$.



Option 1:

$$\frac{2\vec{a}+\vec{b}}{3}$$

Option 2:

$$\frac{\vec{a}+2\vec{b}}{3}$$

Option 3:

$$2\vec{a}-\vec{b}$$

Option 4:

$$\vec{a}-2\vec{b}$$

Correct Answer:

$$\frac{2\vec{a}+\vec{b}}{3}$$

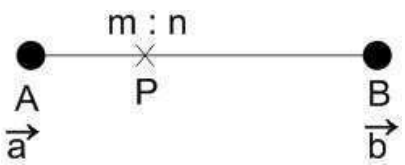
Solution:

As we have learnt

The position vector of the point P -

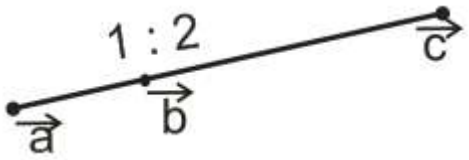
$$Position\ Vector = \frac{m\vec{b}+n\vec{a}}{m+n}$$

- wherein



form the question m=1 and n=2

so for the below figure



so $Position\ Vector = \vec{b} = \frac{1\vec{c} + 2\vec{a}}{1+2} = \frac{1\vec{c} + 2\vec{a}}{3}$

so $Position\ Vector = \vec{c} = 3\vec{b} - 2\vec{a}$

Q. 46 Find the angle between the curves $x^2 + y^2 = 4 \ \ and \ \ x^2 + (y-3)^2 = 1$ at their point of contact or intersection.

Option 1:
0°

Option 2:
90°

Option 3:
45°

Option 4:
60°

Correct Answer:
0°

Solution:
As we learned

Condition for the two curves to touch -

Two curves touch each other if the tangents to each of them are parallel to each other.

$so \ \ \theta = 0$

$\therefore \quad m_1 = m_2$

- wherein

Where m_1 & m_2 are Tangents slopes at the point of intersection of two curves.

On solving given equations,

$3(2y-3) = 3 \Rightarrow y = 2 \;\; and \;\; x = 0$

$dif ferentiating, 2x + 2y\, y^1 = 0$

$\Rightarrow y^1 = \dfrac{-x}{y} \Rightarrow m_1 = 0 \left\{ \begin{matrix} x=0 \\ y=2 \end{matrix} . \right\} \;\; and$

$2x + 2(y-3)y^1 = 0 \Rightarrow m_2 = 0 \left\{ \because, x = 0, y = 2 \right\} \Rightarrow m_1 = m_2$

Q. 47 If $\left|\vec{a}\right| = 5$, find $\vec{a} \cdot \vec{a}$

Option 1:
5

Option 2:
$\sqrt{5}$

Option 3:
25

Option 4:
-25

Correct Answer:
25

Solution:
As we have learnt

Scalar Product of two vectors -

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

$\vec{a}.\vec{a} = a^2 = \left|\vec{a}\right|^2$

- wherein

Dot product is commutative for $\theta = 0$, where θ is the angle between the vectors $\vec{a}\ and\ \vec{b}$

$$\vec{a} \cdot \vec{a} = |\vec{a}|^2 = 25$$

Q. 48 In $\Delta ABC; A = (3,5), B = (1,2), (8,8)$ find the centroid of this ΔABC

Option 1:
(1,2)

Option 2:
(4,5)

Option 3:
(5,4)

Option 4:
(2,2)

Correct Answer:
(4,5)

Solution:
As we have learned

Centroid formula -

$$\left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}\right)$$

- wherein

$A(x_1,y_1)$; $B(x_2,y_2)$ and $C(x_3,y_3)$ are the vertices of ? ABC.

Centroid of a ABC

$$((x_A + x_B + x_C)/3, (y_A + y_B + y_C/3))$$

$$= \left(\frac{3+1+8}{3}, \frac{5+2+8}{3}\right) = (4,5)$$

Q. 49 What is the notation of $3 \cdot 4 \cdot 5 \cdot 6 \cdot 7$?

Option 1:
7!

Option 2:
2!

Option 3:
$\frac{7!}{2!}$

Option 4:
5!

Correct Answer:
$\frac{7!}{2!}$

Solution:

Factorial Notation -

The product of first n natural numbers. n! = n(n - 1) (n - 2) .....3 . 2 . 1

- wherein

Where $n \epsilon N$

3.4.5.6.7

$=\frac{1.2.3.4.5.6.7}{1.2}$

$= \frac{7!}{2!}$

Q. 50 $I = \int 6x \sin(3x^2 + 3)dx$

value of I is ?

Option 1:
$-\cos(3x^2+3)+C$

Option 2:
$-36\cos(3x^2+3)+C$

Option 3:
$-1/6\cos(3x^2+3)+C$

Option 4:
$-36\cos(x^3+3x)+C$

Correct Answer:
$-\cos(3x^2+3)+C$

Solution:
As we have learned

Integration by substitution -

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

- wherein

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

$$3x^2+3=t \Rightarrow 6xdx=dt$$

$$\therefore I=\int \sin(t)dt = -\cos t + c$$

$$= -\cos(3x^2+3)+C$$

Q. 51 Match the following

z	Arg(z)
$(i)\, 1-i$	$(p)\ \frac{-2\pi}{3}$
$(ii)\, 2+2\sqrt{3}i$	$(q)\ \frac{-\pi}{4}$
$(iii)\, -\sqrt{3}+i$	$(r)\ \frac{5\pi}{6}$
$(iv)\, -1-\sqrt{3}i$	$(s)\ \frac{\pi}{3}$

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

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

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

Option 4:
None of these

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

Solution:
As we learned

Definition of Argument/Amplitude of z in Complex Numbers -

$\theta = tan^{-1}|\frac{y}{x}|, z \neq 0$

$\boldsymbol{\theta, \pi-\theta, -\pi+\theta, -\theta}$ are Principal Argument if z lies in first, second, third or fourth quadrant respectively.

$1-i \rightarrow tan\Theta = 1$ & 4^{th} quadrant

$2+2\sqrt{3}i \rightarrow tan\Theta = \sqrt{3}$ & 1^{st} quadrant

$-\sqrt{3}+i \rightarrow tan\Theta = \frac{1}{\sqrt{3}}$ & 2^{nd} quadrant

$-1-\sqrt{3}i \rightarrow tan\Theta = \sqrt{3}$ & 3^{rd} quadrant

Q. 52 Which of the following is true

Option 1:
$\int_0^{100} e^{\sin x dx > 0}$

Option 2:
$\int_0^1 log(x)dx < 0$

Option 3:
both a and b

Option 4:
none of these

Correct Answer:
both a and b

Solution:
As we have learned

Properties of Definite Integration -

If $f(x) \geqslant 0$ for all

$x \in [a, b]$ then

$\int_a^b f(x)\,dx \geqslant 0$

-

$e^{\sin x} \geq 0 \quad x\epsilon[0, 100]$

$log(x) \leq 0 \quad x\epsilon[0, 1]$

Q. 53 If the sum of square of direction cosines of x - axis and y axis of a line L is 16/25 Then angle b/w line and Z axis is

Option 1:
53

Option 2:
37

Option 3:
45

Option 4:
30

Correct Answer:
37

Solution:
As we have learned

Direction Cosines -

i) $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2$

ii) If OP =r then the co-ordinates of P will be (lr,mr,nr)

iii) Direction cosines of X-axis are (1,0,0)

iv) Direction cosines of Y-axis are (0,1,0)

v) Direction cosines of Z-axis are (0,0,1)

-

$$l^2 + m^2 = 16/25$$

$$l^2 + m^2 + n^2 = 16/25 + n^2 = 1$$

$$n^2 = 1 - 16/25 = 9/25$$

$$n = 3/5$$

$$\cos\beta = 3/5$$

$$\beta = 37^\circ$$

Q. 54 $\sin^2 75^\circ - \sin^2 15^\circ =$

Option 1:
$\frac{\sqrt{3}}{2}$

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

Option 3:
$1+\sqrt{\frac{3}{2}}$

Option 4:
$1-\sqrt{\frac{3}{2}}$

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

Solution:
As we have learnt

Results of Compound Angles -

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

- wherein

A and B are two angles.

$$\sin(75^\circ+15^\circ)\sin(75^\circ-15^\circ) = \sin 90^\circ \sin 60^\circ = \frac{\sqrt{3}}{2}$$

Q. 55 Find $\frac{d\sqrt{x^2-4}}{dx}$

Option 1:

$$\frac{x}{\sqrt{x^2-4}}$$

Option 2:

$$\frac{2}{\sqrt{x^2-4}}$$

Option 3:

$$\frac{2x}{\sqrt{x^2-4}}$$

Option 4:

$$2x^2-4$$

Correct Answer:

$$\frac{x}{\sqrt{x^2-4}}$$

Solution:
As we learned

Differentiation by putting x = f(theta) -

$put\ x =$

1. $\sqrt{a^2-x^2}$: $a\ sin\theta\ or\ a\ cos\theta$
2. $\sqrt{x^2-a^2}$: $a\ sec\theta\ or\ a\ cosec\theta$
3. $\sqrt{x^2+a^2}$: $a\ tan\theta\ or\ a\ cot\theta$
4. $\frac{a-x}{a+x}\ or\ \frac{a+x}{a-x}$: $a\ tan\theta$
5. $\sqrt{\frac{a-x}{a+x}}\ or\ \sqrt{\frac{a+x}{a-x}}$: $a\ cos\theta$

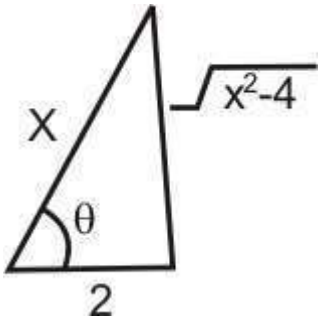
- wherein

use :

$1-cos2\theta = 2sin^2\theta \ \ and \ \ 1+cos2\theta = 2cos^2\theta$

let, $x = 2sec\theta$

so, $\frac{d\sqrt{x^2-4}}{dx}$



$$= \frac{d\sqrt{u\sec^2\theta - 4}}{d(2\sec\theta)}$$

$$= \frac{d(\tan\theta)}{d(sec\theta)} = \frac{\frac{d(\tan\theta)}{d\theta}}{\frac{d(\sec\theta)}{d\theta}}$$

$$= \frac{\sec^2\theta}{\sec\theta\tan\theta} = cosec\,\theta = \frac{x}{\sqrt{x^2-4}}$$

Q. 56 *Graph of* $\tan^{-1}x$ *is symmetric about :*

Option 1:
X-axis

Option 2:
Origin

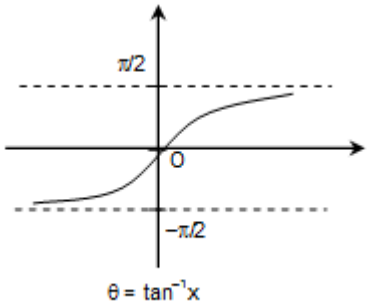
Option 3:
Y-axis

Option 4:
None of these

Correct Answer:
Origin

Solution:
As we have already learnt

Graphs of Inverse Trigonometric Functions -



- wherein

This is the graph for $\tan^{-1} x$

Q. 57 What is division into groups?

Option 1:
Arrangement of r different groups from n different things.

Option 2:
Dividing n objects into 2 groups

Option 3:
Dividing r groups into 2r groups

Option 4:
None of these

Correct Answer:
Arrangement of r different groups from n different things.

Solution:

Division into Groups -

We make arrangement of r different groups from n different things.

-

Q. 58 $\sin 75^\circ = x, \cot 75^\circ = y;$ where x and y are respectively:

Option 1:
$\cot 15^\circ; \cos 15^\circ$

Option 2:
$\cos 15^\circ; \tan 15^\circ$

Option 3:
$\tan 15^\circ; \cos 15^\circ$

Option 4:
$\cos 15^\circ; sin 15^\circ$

Correct Answer:
$\cos 15^\circ; \tan 15^\circ$

Solution:
As we have learnt

Results from Compound Angles -

$$\text{(i)}\ \sin 75^\circ = \frac{\sqrt{3}+1}{2\sqrt{2}} = \cos 15^\circ$$

$$\text{(ii)}\ \cos 75^\circ = \frac{\sqrt{3}-1}{2\sqrt{2}} = \sin 15^\circ$$

$$\text{(iii)}\ \tan 75^\circ = 2+\sqrt{3} = \cot 15^\circ$$

$$\text{(iv)}\ \cot 75^\circ = 2-\sqrt{3} = \tan 15^\circ$$

- wherein

These results can be obtained by compound angle formula i.e. sum and difference formulae.

Q. 59 $a(n) = 1 + 1/2 + 1/3 + 1/4 + ...1/2^n - 1$ then

Option 1:
a(100) < 100

Option 2:
a(100)> 100

Option 3:
a(200)<100

Option 4:
a(200)>100

Correct Answer:
a(100) < 100

Solution:
As we have learned

Divisibility -

To show that an expression is divisible by an integer.

We write

$a^{pn+r} = a^{pn}.a^r$

$= (a^p)^n .a^r$

- wherein

If a, p, n, r are positive integers.

with the help of mamtematical induction

n/2 > a(n) < n

200/2 < a(2a)

a(200) > 100

and a(100) < 100

Q. 60 $R = \{(1,1),(1,2),(2,1),(3,3),(2,3),(3,2)\}$ for $aRa.\ \forall a \in \{1,2,3\}$ is:

Option 1:
Reflexive Relation

Option 2:
Symmetric Relation

Option 3:
Transitive Relation

Option 4:
None of these

Correct Answer:
Symmetric Relation

Solution:
As we have learnt,

SYMMETRIC RELATION -

A relation R in A is said to be symmetric, if a R b ⇒ b R a,∀ a,b ∈ A

-

Q. 61 What is the value of matrix $(\overline{ROSE})$, where E, O, R and S are square matrices of order 3.

Option 1:
$\overline{S}\,\overline{O}\,\overline{R}\,\overline{E}$

Option 2:
$\overline{E}\,\overline{S}\,\overline{O}\,\overline{R}$

Option 3:
$\overline{R}\,\overline{O}\,\overline{S}\,\overline{E}$

Option 4:
All of the above

Correct Answer:
$\overline{R}\,\overline{O}\,\overline{S}\,\overline{E}$

Solution:
As we have learnt,

Property of Conjugate -

$\overline{AB} = \overline{A}\,\overline{B}$

- wherein

A and b are matrices conformable for multiplication, $\overline{A}$ and $\overline{B}$ are their conjugate

$\overline{ROSE}$ = $\overline{R}\ \overline{O}\ \overline{S}\ \overline{E}$

Q. 62 $R = \{(1,1),(1,2),(2,2),(3,3),(2,3)\}$ for $aRa,\ \forall a \in \{1,2,3\}$ is:

Option 1:
Reflexive Relation

Option 2:
Symmetric Relation

Option 3:
Transitive Relation

Option 4:
None of these

Correct Answer:
Reflexive Relation

Solution:
As we have learnt,

REFLEXIVE RELATION -

A relation R in A is said to be reflexive, if a R a ,∀ a ∈ A

-

Q. 63 What is the no. of ways of selecting atleast one player out of 20 players to include in a team?

Option 1:
2^{20}

Option 2:
20^{19}

Option 3:
$2^{20}-1$

Option 4:
$20C_1$

Correct Answer:
$2^{20}-1$

Solution:

Rule for selection of one or more objects -

The number of ways in which a selection of one or more objects can be made from n distinct object is ${}^nc_1+\ {}^nc_2+\ .....{}^nc_n=2^n-1.$

- wherein

$(1+x)=\ {}^nc_0+\ {}^nc_1x+\ {}^nc_2x^2+\ .....+\ {}^nc_nx^n$

Hence x = 1

$2^{20}-1$

Q. 64 Find length of normal to $y^2=x\ \ at\ \ (4,-2)\ \ on\ \ it.$

Option 1:
$\frac{\sqrt{17}}{2}$

Option 2:
$\sqrt{17}$

Option 3:
6

Option 4:
$2\sqrt{17}$

Correct Answer:
$\frac{\sqrt{17}}{2}$

Solution:

As we learned

Length of Normal -

$$L_N = y\sqrt{1+y'^2}$$

- wherein

$$Where \;\; y' = \frac{dy}{dx}$$

$$2y\; y^1 = 1 \Rightarrow y^1 = \frac{-1}{4} \;\; at \;\; P(4,-2)$$

$$So, L_T = \left|y\sqrt{1+y/2}\right| = \left|-2\sqrt{(1+\frac{1}{16})}\right| = \frac{\sqrt{17}}{2}$$

Q. 65 If the line $2x = 3y = -z$and $6x = -y = -\alpha z$ is the perpendicular to each other. Then find the value of α

Option 1:
2

Option 2:
3

Option 3:
4

Option 4:
5

Correct Answer:
4

Solution:
As we have learnt

Condition for perpendicularity -

$\vec{n}.\vec{n_1} = 0$ or $a_1a_2 + b_1b_2 + c_1c_2 = 0$

-

Given equation of line can be rewritten as,

$x/1/2 = y/1/8 = z/-1$ and $x/1/6 = y/-1 = z/-1/\alpha$

If two lines are perpendicular

$a_1a_2 + b_1b_2 + c_1c_2 = 0$

$1/2 * 1/6 - 1/3 + 1/\alpha = 0$

$\alpha = 4$

Q. 66 Let $\frac{d}{dx}f(x) = x^n, \int g(x)dx = \frac{x^n+1}{n+1} + C$ Where $n \neq 1$ and C = 0. If f(x) = y (x) then x = ?

Option 1:
n

Option 2:
n+1

Option 3:
n-1

Option 4:
none of these

Correct Answer:
n+1

Solution:
As we have learned

Indefinite integration -

It is inverse process of differentation.

$\frac{d}{dx}\{F(x)\} = f(x)$

$\therefore \int f(x)dx = F(x) + C$

- wherein

Where

$\frac{d}{dx}F\left(x\right)$ is differential of $f(x)$ w.r.t x

$$\frac{d}{dx}f(x)=x^n \Rightarrow f(x)=\int x^n dx$$

$$f(x=)\frac{x^{n+1}}{n+1}+C$$

$$\int g(x)dx=\frac{x^{n+1}}{n+1}+c$$

$$g(x)=x^n$$

Given, $f(x)=g(x)$

$$\frac{x^{n+1}}{n+1}=x^n$$

we get after solving

$$x=n+1$$

Q. 67 For what Values of C, roots of the equation : $2x^2+Cx-2C=0,$ has opposite sighs?

Option 1:
$C<0$

Option 2:
$C\leq 0$

Option 3:
$C>0$

Option 4:
$-16<C<0$

Correct Answer:
$C>0$

Solution:
As we learned

Roots are of opposite sign -

$$\frac{c}{a} < 0, D = b^2 - 4ac > 0$$

-

$$\frac{-2C}{2} < 0\ ;\ C^2 + 16C > 0$$

$$\Rightarrow C > 0\ ;\ C\left(C + 16\right) > 0$$

$$\Rightarrow C > 0$$

Q. 68

If matrix $A = \begin{bmatrix} 1 & 0 & \omega^2 \\ 0 & \omega & 0 \\ 1 & 0 & \omega^2 \end{bmatrix}$. Then matrix A + A^{Θ} is (where ω is the cube root of unity).

Option 1:
Hermition matrix

Option 2:
Skew hermition matrix

Option 3:
Unit matrix

Option 4:
None of the above

Correct Answer:
Hermition matrix

Solution:
As we have learnt

Herimitian matrices -

$$A^{\Theta} = A$$

- wherein

A^{Θ} is complex conjugate transpose matrix of matrix A

$$\begin{bmatrix} a & b+ic \\ b-ic & d \end{bmatrix}, \begin{bmatrix} 3 & 3-4i & 5+2i \\ 3+4i & 5 & -2+1 \\ 5-2i & -2-i & 2 \end{bmatrix}$$

$(A+A^{\theta})^{\theta}=A^{\theta}+(A^{\theta})^{\theta}=A^{\theta}+A$

$A^{\theta}=A\Rightarrow Hermition\ \ matrix$

Q. 69 Like and unlike vectors are :

Option 1:
Perpendicular

Option 2:
Inclined

Option 3:
Collinear

Option 4:
None of these

Correct Answer:
Collinear

Solution:
As we have learnt

Collinear Vectors -

Like and unlike vectors are collinear

-

Q. 70 If 2,7,3,9,8 have frequencies 2,3,4,5,1 respectively, then find mean deviation about 6.

Option 1:
$\frac{8}{5}$

Option 2:
$\frac{8}{7}$

Option 3:
$\frac{7}{8}$

Option 4:
$\frac{8}{3}$

Correct Answer:
$\frac{8}{3}$

Solution:
As we learned

Mean Deviation -

If x_1, x_2, x_3,.....x_n have frequencies f_1, f_2....f_n then mean deviation :

$$\frac{\sum f_i \left|x_i - A\right|}{\sum f_i}$$

-

$$M.D(6) = \frac{2\left(4\right) + 3\left(1\right) + 4\left(3\right) + 5\left(3\right) + 1\left(2\right)}{2+3+4+5+1}$$

$$= \frac{40}{15} = \frac{8}{3}$$

Q. 71 If $A = \begin{vmatrix} -1 & sinC & sinB \\ \cos C & -1 & cosA \\ \cos B & cosA & -1 \end{vmatrix}$ is symmetric, then $[A, B, CE(0, \frac{\pi}{2})]$

Option 1:
A,B,C are angles of triangle.

Option 2:
A=B=C

Option 3:
both (a) and (b)

Option 4:
None of the above

Correct Answer:
A=B=C

Solution:
As we have learnt

Symmetric determinants -

The elements situated at equal distance from the diagonal are equal both in magnitude and sign

- wherein

$$\begin{vmatrix} a & h & g \\ h & b & f \\ g & f & c \end{vmatrix}$$

A is symmetric. Cos c = sin c

tan c = 1

$$c = 45^o = \pi/4$$

correct option b

Q. 72 Find the number of values of 'c' in $2x^2 - 7x + c = 0$, such that, $x^2 + 5x - 4 = 0$ has one common root with the given equation:

Option 1:
One real value

Option 2:
Two real values

Option 3:
No real values

Option 4:
None of these

Correct Answer:
Two real values

Solution:
As we learned

Condition for one common root -

$$(a'c - ac')^2 = (bc' - b'c)(ab' - a'b)$$

- wherein

$ax^2 + bx + c = 0$ &

$a'x^2 + b'x + c' = 0$

are the 2 equations

$$(ca' - ac')^2 = (ab' - a'b)(bc' - cb')$$

$$(c+8)^2 = (10+7)(28-5c)$$

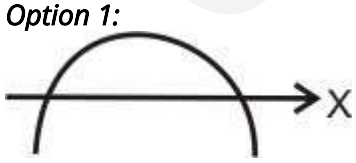
$$c^2 + 64 + 16c = 476 - 85c$$

$$c^2 + 101c - 412 = 0$$

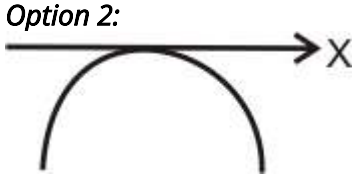
$$c = \frac{-101 \pm \sqrt{11849}}{2}$$

Q. 73 For which of the following graphs; $-3x^2 + 7x - \frac{49}{12}$ is the correct expression

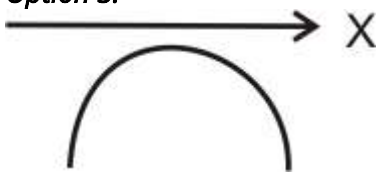
Option 1:



Option 2:



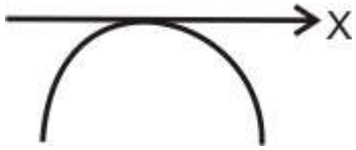
Option 3:



Option 4:

None of these

Correct Answer:



Solution:

As we learned

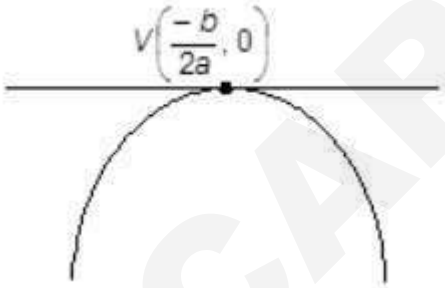
Quadratic Expression Graph when a< 0 & D = 0 -

Real and equal roots of

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

& $D=b^2-4ac$

- wherein



$a=-3<0$

$D=49-49=0$

Q. 74 $\cos^{-1}(x)+\cos^{-1}(-x)=$

Option 1:
π

Option 2:
$2\cos^{-1}(x)$

Option 3:
0

Option 4:
1

Correct Answer:
π

Solution:
As we have learnt

Important Results of Inverse Trigonometric Functions -

$\cos^{-1}(-x) = \pi - \cos^{-1} x$

-

Q. 75 A = { 1,3,5} and B = {2,4,6} while throwing a dice , are

Option 1:
Mutually exclusive events

Option 2:
non - disjoint events

Option 3:
Independent events

Option 4:
None of these

Correct Answer:
Mutually exclusive events

Solution:
From this we learned that

Mutually exclusive events -

Two or more events are said to be mutually exclusive if one of them occurs other cannot occur.

$A_i \cap A_j = \phi$

- wherein

where

A_1 & A_2 having no common element.

Q. 76 $\lim_{x \to 0} \frac{sin3x + sinx}{x} =$

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

Option 2:
3

Option 3:
4

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

Correct Answer:
4

Solution:
As we learned

Evalution of Trigonometric limit -

$\lim_{x \to a} \frac{sin(x-a)}{x-a} = 1$

$\lim_{x \to a} \frac{tan(x-a)}{x-a} = 1$

$put \quad x = a + h \quad where \ h \to 0$

$Then \ it \ comes$

$$\lim_{h\to 0}\ \frac{sinh}{h}=\lim_{h\to 0}\ \frac{tanh}{h}=1$$

$$\therefore\ \lim_{x\to 0}\ \frac{sinx}{x}=1\ \ and$$

$$\therefore\ \lim_{x\to 0}\ \frac{tanx}{x}=1$$

-

$$\lim_{x\to 0}\frac{sin3x+sinx}{x}=\lim_{x\to 0}\frac{sin3x}{x}+\lim_{x\to 0}\frac{sinx}{x}=\lim_{x\to 0}\frac{sin3x}{3x}.3+\lim_{x\to 0}\frac{sinx}{x}=$$
$$3+1=4$$

Q. 77 $I=\int\frac{x^2}{(x^3+1)^4}dx$

Option 1:
$$\frac{1}{9(x^3+1)^3}+C$$

Option 2:
$$\frac{1}{3(x^3+1)^3}+C$$

Option 3:
$$-\frac{1}{3(x^3+1)^3}+C$$

Option 4:
$$-\frac{1}{9(x^3+1)^3}+C$$

Correct Answer:
$$-\frac{1}{9(x^3+1)^3}+C$$

Solution:
As we have learned

Type of integration by substitution -

$$\int(f(x))^n\cdot f'(x)dx$$

$$\therefore \frac{[f(x)]^{n+1}}{n+1}+c$$

- wherein

Let $f(x)=t$

$f'(x)dx=dt$

$$put:\ x^3+1=u \Rightarrow dx=\frac{1}{3x^2}$$

$$I=\frac{1}{3}\int 1/u^4 du$$

$$\int u^n du=\frac{U^{n+1}}{n+1} heren=-4$$

$$I=\frac{1}{3}\left[\frac{4^{-4+1}}{-4+1}\right]=-\frac{1}{9u^3}$$

$$\frac{-1}{9(x^3+1)^3}+C$$

Q. 78 Find the mode of following frequency distribution

x	f
0-5	2
5-10	7
10-15	5
15-20	1
20-25	3

Option 1:
15/7

Option 2:
5-10

Option 3:
60/7

Option 4:
None of these

Correct Answer:
60/7

Solution:
As we learned

MODE -

The mode or modal value of a distribution is that value of the variable for which the frequency is maximum.

In case of a grouped or continuous frequency distribution mode is given by the formula.

$$Mode = l + \left(\frac{f_1 - f_2}{2f - f_1 - f_2}\right) h$$

- wherein

where

l is lower limit of the modal class.

h is width of the modal class.

f_1 is frequency of the class preceding the modal class.

f_2 is frequency of the class following the modal class.

f is frequency of the modal class.

Here, model class is 5-10, which has highest fiequecy.

Now, $Mode = 5 + \left(\frac{7-2}{14-2-5}\right) \times 5$

$$\frac{60}{7}$$

Q. 79 $A * (B - D) =$

Option 1:
$(A - B) * (A - D)$

Option 2:
$(A * B) - (A * D)$

Option 3:
$A * (B - D)$

Option 4:
$(A \cap B') - D$

Correct Answer:
$(A * B) - (A * D)$

Solution:
As we learnt

Theorem of Cartesian Product -

AX(B-C)=(AXB)-(AXC)

-

Q. 80 If $F_1(x)\ and\ F_2(x)$ are two antiderivatives of the function f (x) on the interval [a,b] . Then $F_1(x) - F_2(x)\ is?$

Option 1:
f (x)

Option 2:
constant

Option 3:
$f'(x)$

Option 4:
$F'(x) - F_2(x)$

Correct Answer:
constant

Solution:
As we have 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 .

we have

$F_1^1(x) = f(x)\ F_2^1(x) = f(x)$ ..... (1)

For any value of x on [a,b]

Let us put

$F_1(x) - F_2(x) = Q(x)$ ..... (2)

using eq. 1 we have

$F_1(x) - F_2(x) = f(x) - f(x) = 0$

or

$\phi'(x) = [F_1(x) - F_2(x)]' \equiv 0$

for any value of x on interval [a,b]

$\phi'(x) = 0$, it follows that $\phi(x)$ is constant