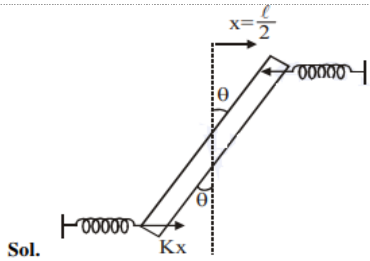
#1332445



Two light identical spring of spring constant k are attached horizontally at the two ends of a uniform horizontally rod AB of length ℓ and mass m. The rod is pivoted at its centre 'O' and can rotate freely in horizontal plane. The other ends of the two spring are fixed to rigid supports as shown in figure. The rod is gently pushed through a small angle and released. The frequency of resulting oscillation is:

A $\frac{1}{2\pi}\sqrt{\frac{6k}{m}}$

B $\frac{1}{2\pi}\sqrt{\frac{2k}{m}}$

C $\frac{1}{2\pi}\sqrt{\frac{k}{m}}$

D $\frac{1}{2\pi}\sqrt{\frac{3k}{m}}$

Solution

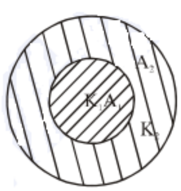
$\tau = -2Kx\frac{\ell}{2}\cos\theta$

$\Rightarrow \tau = \frac{K ill\ell^2}{2}\theta = -C\theta$

$f = \frac{1}{2\pi}\sqrt{\frac{C}{1}} = \frac{1}{2\pi}\sqrt{\frac{\frac{K\ell^2}{2}}{\frac{M\ell^2}{12}}}$

$f = \frac{1}{2\pi}\sqrt{\frac{6k}{M}}$

#1332487



A cylinder of radius R is surrounded by a cylindrical shell of inner radius R and outer radius 2R. The thermal conductivity of the material of the inner cylinder is K_1 and that of the outer cylinder is K_2. Assuming no loss of heat, the effective thermal conductivity if the system for heat flowing along the length of the cylinder is:

A $K_1 + K_2$

B $\frac{K_1+K_2}{2}$

C $\frac{2K_1+3K_2}{5}$

D $\frac{K_1+3K_2}{4}$

Solution

$K_{eq} = \frac{K_1A_1+K_2A_2}{A_1+A_2}$

$= \frac{K_1(\pi R^2)+K_2(3\pi R^2)}{4\pi R^2}$

$= \frac{K_1+3K_2}{4}$

#1332627

A travelling harmonic wave is represented by the equation $y(x,t) = 10^{-3}\sin(50t+2x)$, , where x and y are in meter and t is in seconds. Which of the following is a correct statement about the wave? The wave is propagating along the___?

A negative x-axis with speed $25ms^{-1}$

B The wave is propagating along the positive x-axis with speed $25ms^{-1}$

C The wave is propagating along the positive x-axis with speed $100ms^{-1}$

D The wave is propagating along the negative x-axis with speed $25ms^{-1}$

Solution

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

$\Rightarrow$ wave is moving along-ve x-axis speed

$v = \frac{\omega}{K} \Rightarrow v = \frac{50}{2} = 25m/sec$

#1332698

A straight rod of length L extends from x=a to x=L +a. The gravitational force is exerted on a point mass 'm' at x=0, if the mass per unit length of the rod is $A+Bx^2$ is given by.

A $Gm[A(\frac{1}{a+L}-\frac{1}{a})-BL]$

B $Gm[A(\frac{1}{a}-\frac{1}{a+L})+BL]$

C $Gm[A(\frac{1}{a+L}-\frac{1}{a})+BL]$

D $Gm[A(\frac{1}{a}-\frac{1}{a+L})-BL]$

Solution

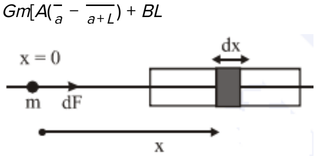
$dm = (A+Bx^2)dx$

$df = \frac{GMdm}{x^2}$

$= F = \int_a^{a+L}\frac{GM}{x^2}(A+Bx^2)dx$

$= GM[-\frac{A}{x}+Bx]_a^{a+L}$

$Gm[A(\frac{1}{a}-\frac{1}{a+L})+BL$



#1332827

A light wave is incident normally on a glass slab of refractive index 1.5. If 4% of light gets reflected and the amplitude of the electric field of the incident light is $30V/m$,then the amplitude of the electric field for the wave propogating in the glass medium will be:

A $10V/m$

B $24V/m$

C $30V/m$

D $6V/m$

Solution

$P_{refracted} = \frac{96}{100} P_1$

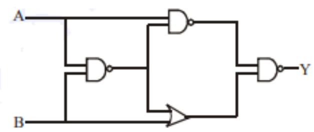
$\Rightarrow K_2 A_t^2 = \frac{96}{100} K_1 A_i^2$

$\Rightarrow r_2 A_t^2 = \frac{96}{100} r_1 A_i^2$

$\Rightarrow A_t^2 = \frac{96}{100} \times \frac{1}{3}2 \times (30)^2$

$A_t \sqrt{\frac{64}{100} \times (30)^2} = 24$

#1332828



The output of the given logic circuit is:

A $\bar{A}B$

B $A\bar{B}$

C $AB + \overline{AB}$

D $A\bar{B} + \bar{A}B$

Solution

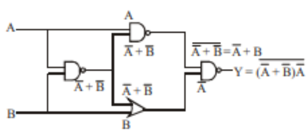
$Y = \overline{(\bar{A} + \bar{B})\bar{A}}$

$= \overline{(\bar{A} + \bar{A}B}$

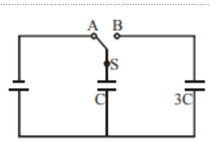
$= A(\overline{\bar{A}B})$

$A(A + \bar{B})$

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

I.


#1332830



In the figure shown, after the switch 'S' is turned from position 'A' toposition 'B', the energy dissipated in the circuit in terms of capacitance 'C' and total charge 'Q' is:

A $\frac{3}{8}\frac{Q^2}{C}$

B $\frac{3}{4}\frac{Q^2}{C}$

C $\frac{1}{8}\frac{Q^2}{C}$

D $\frac{5}{8}\frac{Q^2}{C}$

Solution

$V_i = \frac{1}{2}(CE)^2$

$V_f = \frac{(CE)^2}{2 \times 4c} = \frac{1}{2}\frac{(CE)^2}{4}$

$\Delta E = \frac{1}{2}CE^2 \times \frac{3}{4} = \frac{3}{8}CE^2$

#1332831

A particle of mass m moves in a circular orbit in a central potential field $U(r) = \frac{1}{2}kr^2$. If Bohr's quantization condition is applied, radii of possible orbitals and energy levels vary with quantum number n as:

A $r_n \propto n^2, E_n \propto \frac{1}{n^2}$

B $r_n \propto \sqrt{n}, E_n \propto \frac{1}{n}$

C $r_n \propto n, E_n \propto n$

$\boxed{D}$ $r_n \propto \sqrt{n}, E_n \propto n$

Solution

$F = \frac{dV}{dR} = kr = \frac{mv^2}{r}$

$mvr = \frac{nh}{2\pi}$

$r^2 \infty n$

$r^2 \infty \sqrt{n}$

$E = \frac{1}{2}kr^2 + \frac{1}{2}mv^2 \infty r^2$

#1332832

Two electric bulbs, rated at (25 W, 220 V) and (100 W, 220 V), are connected in series across a 220 V voltage source. If the 25W and 100 W bulbs draw powers P_1 and P_2 respectively then___________?

A $P1 = 9W, P2 = 16W$

B $P1 = 4W, P2 = 16W$

$\boxed{C}$ $P1 = 16W, P2 = 4W$

D $P1 = 16W, P2 = 9W$

Solution

$R_1 = \frac{220^2}{25} = 1936\ \Omega$

$R_2 = \frac{220^2}{100} = 484\ \Omega$

$i = \frac{220}{R_1 + R_2} = \frac{1}{11}A$

$P_1 = i^2R_1 = \frac{1}{121} \times 1936 = 16W$

$P_2 = i^2R_2 = \frac{1}{121} \times 484 = 4W$

#1332835

A satellite of mass M is in a circular orbit of radius R about the centre of the earth. A meteorite of the same mass, falling towards the earth, collides with the satellite completely inelastically. The speed of the satellite and the meteorite are the same, just before the collision. The subsequent motion of the combined body will be:

A in a circular orbit of a different radius

B in the same circular orbit of radius R

$\boxed{C}$ in an elliptical orbit

D such that it escapes to infinity

Solution

$m v \hat{i} + m v \hat{j}$

$= 2 m v^{-1}$

$v = \frac{1}{\sqrt{2}} \times \sqrt{\frac{GM}{R}}$

#1332836

Let the moment of inertia of a hollow cylinder if length$0 cm$ (inner radius $10 cm$ and outer radius$20 cm$), about its axis, be I. The radius of a thin cylinder of the same mass such that its moment of inertia about its axis is also I,is_____?

A 12cm

B 18cm

$\boxed{\text{C}}$ 16cm

D 14cm

Solution

$m\frac{20^2 + 10^2}{2} = mk^2$

$k\sqrt{\frac{400+100}{2}}$

$k = \sqrt{2}50$

$k = 5\sqrt{1}0$

$k = 16$

#1332837

A passenger train of length 60 m travels at a speed of $80 km/hr$. Another freight train of length $120 m$ travels at a speed of $30 km/hr$. The ratio of times taken by the passenger train to completely cross the freight train when: (1)they are moving in the same direction, and (ii) in the opposite directions is_____?

A $\frac{5}{2}$

B $\frac{25}{11}$

C $\frac{3}{2}$

$\boxed{\text{D}}$ $\frac{11}{5}$

Solution

$t_1 = \frac{x}{v-u} = \frac{x}{50}$

$t_2 = \frac{x}{v+u} = \frac{x}{100}$

$\frac{t_1}{t_2} = \frac{11}{5}$

#1332838

An ideal gas occupies a volume of $2 m^3$ at a pressure of $3 \times 10^6 Pa$. The energy of the gas is:

A $3 \times 10^2 J$

B $10^8 J$

C $6 \times 10^4 J$

D $9 \times 10^6 J$

Solution

$Energy = \frac{1}{2}nRT = \frac{f}{2}PV$

$= \frac{f}{2}(3 \times 10^6)(2)$

$= f \times 3 \times 10^6$

Considering gas is monoatomic i.e.f=3

$E = 9 \times 10^6 J$

#1332840

A $100\,V$ carrier wave is made to vary berween $160\,V$ and $40\,V$ by a modulating signal. What is the modulation index?

A 0.6

B 0.5

C 0.3

D 0.4

Solution

$A_c = 100$

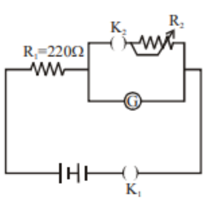
$A_c + A_m = 160$

$A_C - A_m = 40$

$A_c = 100$ and $A_m = 40$

$$\mu = \frac{A_m}{A_c} = 0.6$$

#1332841



The galvanometer deflection, when key K_1 is closed but K_2 is open, equals θ_0 (see figure). On closing K_2 also and adjusting $R_2 to 5\Omega$, the deflection in galvanometer becomes $\frac{\theta_0}{5}$ .The resistance of the galvanometer is, then, given by [Neglect the internal resistance of battery]:

A 12Ω

B 25Ω

C 5Ω

D 22Ω

Solution

case I $i_g = \frac{E}{220+R_g} = C\theta_0$ ..(i)

caseII $i_g = \left(\frac{E}{220+\frac{5R_g}{5+R_g}}\right) \times \frac{5}{(R_g+5)} = \frac{C\theta_0}{5}$...(ii)

$\Rightarrow \frac{5E}{225R_g+1100} = \frac{C\theta_0}{5}$ ..(ii)

$\frac{E}{220+R_g} = C\theta$

...(i)

$\Rightarrow \frac{225R_g+1100}{1100+5R_0} = 5$

$\Rightarrow 5500 + 25R_g = 225R_g = 1100$

$200R_g = 4400$

$R_g = 22\Omega$

-4

#1333173

A person standing on an open ground hears the sound jet aeroplane,coming from north at an angle 60^o with ground level.But he finds the aeroplane right vertically above his position. If u is the speed of sound, speed of the plane is:

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

B u

C $\frac{u}{2}$

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

Solution

$AB = V_p \times t$

$BC = Vt$

$\cos 60^o = \frac{AB}{BC}$

$\frac{1}{2} = \frac{V_p \times t}{Vt}$

$V_p = \frac{V}{2}$

#1333201

A proton and an $\alpha -$ particle (with their masses in the ratio of $1:4$ and charges in the ratio of $1:2$) are accelerated from rest through a potential difference V. If a uniform magnetic field (B) is set up perpendicular to their velocities, the ratio of the radii $r_p : r_\alpha$ of the circular path described by them will be :

A $1:\sqrt{2}$

B $1:2$

C $1:3$

D $1:\sqrt{3}$

Solution

$KE = q\Delta V$

$$r = \frac{\sqrt{2mq\Delta V}}{qB}$$

$$r \propto \sqrt{\frac{m}{q}}$$

$$\frac{r_p}{r_\propto} = \frac{1}{\sqrt{2}}$$

#1333266

A point source of light, S is placed at a distance L in front of the centre of plane mirror of width d which is hanging vertically on a wall. A man walks in front of the mirror along a line parallel to the mirror, at a distance $2L$ as shown below. The distance over which the man can see the image of the light source in the mirror is :

A $3d$

B $\frac{d}{2}$

C d

D $2d$

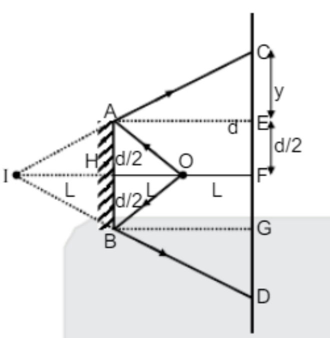
Solution

By similar triangles, $\Delta AEC \approx \Delta IHA$

$$\frac{y}{2L} = \frac{d}{2L}$$

$y = d$

Total distance, CD = $y + \frac{d}{2} + \frac{d}{2} + y = 3d$



#1333279

The least count of the main scale of a screw gauge is $1mm$.The minimum number of division on its circular scale required to measure $5\mu m$ diameter of wire is:

A 50

B 100

C 200

D 500

Solution

Least count $= \frac{Pitch}{Number\ of\ division\ on\ circular\ scale}$

$5 \times 10^{-6} = \frac{10^3}{N}$

$N = 200$

#1333287

A simple pendulum, made of a string of length l and a bob of mass m, is released from a small angle θ_0. It strikes a block of mass M, kept on a horizontal surface at its lowest point of oscillations, elastically. It bounces back and goes up to an angle θ_1. Then M is given by :

A $m(\frac{\theta_o + \theta_1}{\theta_o - \theta_1})$

B $\frac{m}{2}(\frac{\theta_o - \theta_1}{\theta_o + \theta_1})$

C $\frac{m}{2}(\frac{\theta_o + \theta_1}{\theta_o - \theta_1})$

D $m(\frac{\theta_o - \theta_1}{\theta_o + \theta_1})$

Solution

$u = \sqrt{2gl(1 - cos\theta_o)}$ .... (1)

v = velocity of ball after collision

$v = \frac{m - M}{m + M}u$

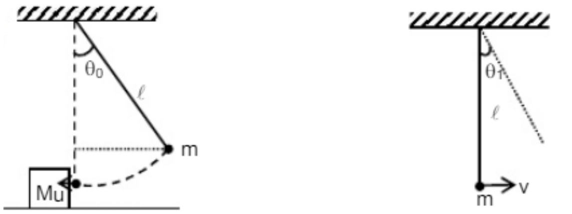
Since ball rises upto height θ_1

$v = \sqrt{2gl(1 - cos\theta_1)} = \frac{m - M}{m + M}u$ .... (2)

From (1) and (2) $\frac{m - M}{m + M} = \frac{1 - cos\theta_1}{1 - cos\theta_0} = \frac{sin\frac{\theta_1}{2}}{sin\frac{\theta_0}{2}}$

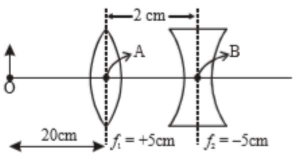
$\frac{M}{m} = \frac{\theta_0 - \theta_1}{\theta_0 + \theta_1}$

$M = (\frac{\theta_0 - \theta_1}{\theta_0 + \theta_1})m$



Just before collision Just after collision

#1333298



What is the position and nature of image formed by lens combination shown in figure?

(f_1, f_2 are focal length)

A 70 cm from point B at left; virtual

B 40cm from point B at right ;real

C $\frac{20}{3}$ cm from point B at right ,real

D 70cm from point B at right ,real

Solution

For first lens

$$\frac{1}{V} - \frac{1}{-20} = \frac{1}{5}$$

$$V = \frac{20}{3}$$

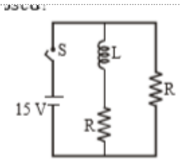
For second lens

$$V = \frac{20}{3} - 2 = \frac{14}{3}$$

$$\frac{1}{V} - \frac{1}{\frac{14}{3}} = \frac{1}{-5}$$

$$V = 70cm$$

#1333308



In the figure shown, a circuit contains two identical resistors with resistance $R = 5\Omega$ and an inductance with $L = 2mH$. An ideal battery of $15V$ is connected in the circuit. What will be the current through the battery long after the switch is closed?

A $6A$

B $7.5A$

C $5.5A$

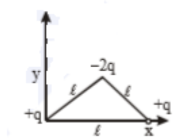
D $3A$

Solution

Ideal inductor will behave like zero resistance long time after switch is closed

$$I = \frac{2\varepsilon}{R} = \frac{2 \times 15}{5} = 6A$$

#1333326



Determine the electric dipole moment of the system of three charges,placed on the vertices of an equilateral triangle ,as shown in the figure:

A $(ql)\frac{\hat{i}+\hat{j}}{\sqrt{2}}$

B $\sqrt{3}ql\frac{\hat{j}-\hat{i}}{\sqrt{2}}$

C $-\sqrt{3}ql\hat{j}$

D $2ql\hat{j}$

Solution

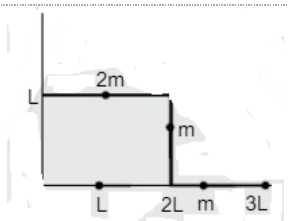
$|P_1| = q(d)$

$|P_2| = qd$

$|Resultant| = 2P\cos 30^o$

$2qd\left(\frac{\sqrt{3}}{2}\right) = \sqrt{3}qd$

#1333359



The position vector of the centre of mass $\vec{r}cm$ of an symmetric uniform bar of negligible area of cross section as shown in figure is:

A $\vec{r}cm = \frac{13}{8}L\hat{x} + \frac{5}{8}L\hat{y}$

B $\vec{r}cm = \frac{11}{8}L\hat{x} + \frac{3}{8}L\hat{y}$

C $\vec{r}cm = \frac{13}{8}L\hat{x} + \frac{11}{8}L\hat{y}$

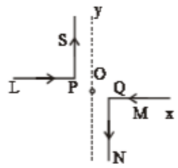
D $\vec{r}cm = \frac{5}{8}L\hat{x} + \frac{13}{8}L\hat{y}$

Solution

$$X_{cm} = \frac{2mL + 2mL + \frac{5mL}{2}}{4m} = \frac{13}{8}L$$

$$Y_{cm} = \frac{2m \times L + m \times \left(\frac{L}{2}\right) + m \times 0}{4m} = \frac{5L}{8}$$

#1333394



As shown in the figure, two infinitely long, identical wires are bent by90 and placed in such a way that the segments LP and QM are along the x-axis, while segments PS and QN are parallel to the y-axis. If OP = OQ = 4cm, and the magnitude of the magnetic field at O is $10^4 T$, and the two wires carry equal currents (see figure), the magnitude of the current in each wire and the direction of the magnetic field at O will be ($\mu 0 = 4\pi 10^7 NA2$)

A $40A$, perpendicular into the page

B $40A$, perpendicular out of the page

C $20A$, perpendicular out of the page

D $20A$, perpendicular into the page

Solution

Magnetic field at $'O'$ will be done to 'PS' and $'QN'$ only

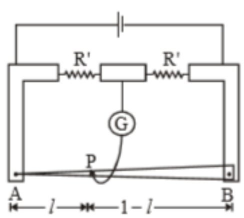
i.e $B_0 = B_{PS} + B_{QN}$ → Both inwards

Let current in each wire $= i$

$\therefore B_0 = \frac{\mu_0 i}{4\pi d} + \frac{\mu_0 i}{4\pi d}$

$\therefore i = 20A$

#1333449



In a meter bridge, the wire of length 1 m has a non-uniform cross-section such that, the variation $\frac{dR}{dl}$ of its resistance R with length l is $\frac{dR}{dl} \propto \frac{1}{\sqrt{l}}$. Two equal resistances are connected as shown in the figure. The galvanometer has zero deflection when the jockey is at point P. What is the length AP:

A $0.25m$

B $0.3m$

C $0.35m$

D $0.2m$

Solution

For the given wire : $dR = C\frac{dl}{\sqrt{l}}$, where $C =$ constant

Let resistance of part AP is R_1 and PB is R_2

$\therefore \frac{R'}{R'} = \frac{R_1}{R_2}$ or $R_1 = R_2$ By balanced WSB concept

Now $\int dR = c\int \frac{dl}{\sqrt{l}}$

$\therefore R_1 = c\int_0^l l^{-1/2} dl = C.2.\sqrt{l}$

$R_2 = c\int_l^1 l^{-1/2} dl = C.(2 - 2\sqrt{l})$

Putting $R_1 = R_2$

$C2\sqrt{l} = C(2 - 2\sqrt{l})$

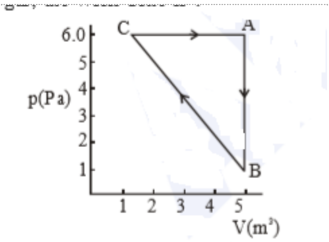
$\therefore 2 sqrtl = 1$

$\sqrt{l} = \frac{1}{2}$

$l = \frac{1}{4} m$

$\Rightarrow 0.25 m$

#1333461



For the given cyclic process CAB as shown for a gas, the work done is :

A $1J$

B $5J$

C $10J$

D $30J$

Solution

Since PV indicator diagram is given, so work done by gas is area under the cyclic diagram.

$\therefore \Delta W =$ Work done by gas $= \frac{1}{2} \times 4 \times 5J$

$= 10J$

#1333486

An ideal battery of $4V$ and resistance R are connected in series in the primary circuit of a potentiometer of length $1m$ and resistance 5Ω. The value of R, to given a potential difference of $5mV$ across $10cm$ of potentiometer wire is:

A 490Ω

B 480Ω

C 395Ω

D 495Ω

Solution

Let current flowing in the wire is i.

$\therefore i = \left(\frac{4}{R+5}\right)A$

If resistance of $10m$ length of wire is x

then $x = 0.5\Omega = 5 \times \frac{0.1}{1}\Omega$

$\therefore \Delta V = P.d$ on wire $= i.x$

$5 \times 10^{-3} = \left(\frac{4}{R+5}\right)(0.5)$

$\therefore \frac{4}{R+5} = 10^{-2}$

$\therefore R = 395\Omega$

#1333497

A particle A of mass 'm' and charge 'q' is accelerated by a potential difference of $50V$. Another particle B of mass '4 m' and charge 'q' is accelerated by a potential difference of $2500V$ The ratio of de-Broglie wavelengths $\frac{\lambda_A}{\lambda_B}$ is close to :

A 10.00

B 14.14

C 4.47

D 0.07

Solution

K.E acquired by change $= K = qV$

$\lambda = \frac{h}{p} = \frac{h}{\sqrt{2mK}} = \frac{h}{\sqrt{2mqV}}$

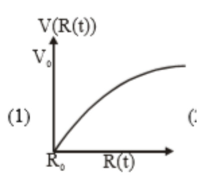
$\frac{\lambda_A}{\lambda_B} = \frac{\sqrt{2m_Bq_BV_B}}{2m_Aq_AV_A} = 2\sqrt{50}$

$= 2 \times 7.07 = 14.14$

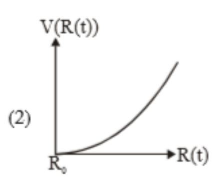
#1333518

There is a uniform spherically symmetric surface charge density at a distance R_0 from the origin. The charge distribution is initially at rest and starts expanding because of mutual repulsion. The figure that represents best the speed $V(R(t))$ of the distribution as a function of its instantaneous radius $R(t)$ is

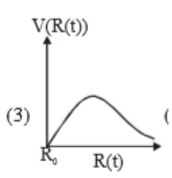
A



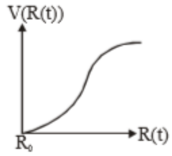
B



C



D

(4) 

Solution

At any instant 't'

Total energy of change distribution is constant

$i.\,e.\ \frac{1}{2}mV^2 + \frac{KQ^2}{2R} = 0 + \frac{KQ^2}{2R_0}$

$\therefore\ \frac{1}{2}mV^2 = \frac{KQ^2}{2R_0} - \frac{KQ^2}{2R}$

$\therefore\ V = \sqrt{\frac{KQ^2}{m}\left(\frac{1}{R_0} - \frac{1}{R}\right)} = C\sqrt{\frac{1}{R_0} - \frac{1}{R}}$

Also the slop of v-s curve will go on decreasing

$\therefore$ Graph is correctly shown by option (1)

#1332581

8g of $NaOH$ is dissolved in 18g of H_2O. Mole fraction of $NaOH$ in solution and molality (in mol kg^{-1}) of the solutions respectively are:

A 0.167, 11.11

B 0.2, 22.20

C 0.2, 11.11

D 0.167, 22.20

Solution

8g NaOH, mol of NaOH $= \frac{8}{40} = 0.2$mol

18g of H_2O, mol of $H_2O = \frac{18}{18} = 1$ mol

$\therefore X_{NaOH} = \frac{0.2}{1.2} = 0.167$

Molality $= \frac{0.2 \times 1000}{18} = 11.11$m.

8g $NaOH$, mol of $NaOH$ $= \frac{8}{40} = 0.2$mol

18g of H_2O, mol of $H_2O = \frac{18}{18} = 1$ mol

$\therefore X_{NaOH} = \frac{0.2}{1.2} = 0.167$

Molality $= \frac{0.2 \times 1000}{18} = 11.11$m.

#1332594

The correct statement(s) among I to III with respect to potassium ions that are abundant within the cell fluids is/are:

I. They activate many enzymes

II. They participate in the oxidation of glucose to produce ATP

III. Along with sodium ions, they are responsible for the transmission of nerve signals.

A I, II and III

B I and III only

C III only

D I and II only

Solution

The Potassium ions that are abundant within the cell fluids can activate many enzymes

They participate in the oxidation of glucose to produce ATP and along with Sodium ions , they are responsible for the transmission of nerve signals.

So ,Option A is correct

#1332604

The magnetic moment of an octahedral homoleptic $Mn(II)$ complex is 5.9 BM. The suitable ligand for this complex is:

A CN^-

B NCS^-

C CO

D Ethylenediamine

Solution

$\mu = 5.9BM$ $\therefore$ n(no of unpaired e) = 5

Cation $Mn^{II} - 3d^5$ confn only possible for relatively weak ligand.

$\therefore NCS^-$

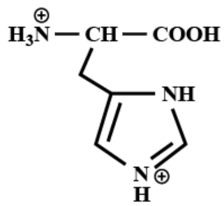
$\mu = 5.9BM$ $\therefore$ n(no of unpaired e) = 5

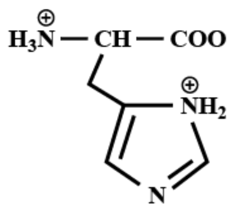
Cation $Mn^{II} - 3d^5$ confn only possible for relatively weak ligand.

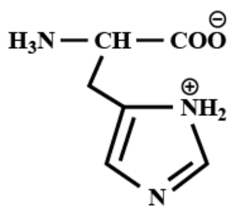
$\therefore NCS^-$ is the answer.

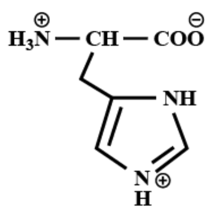
#1332617

The correct structure of histidine in a strongly acidic solution $(pH = 2)$ is:

A 

B 

C 

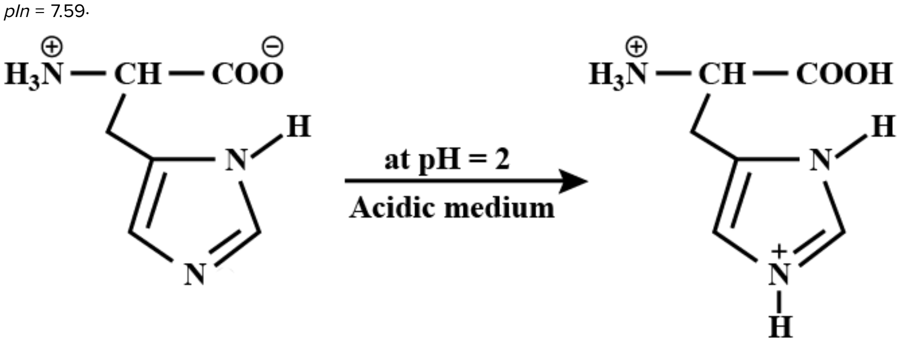
D 

Solution

Histidine is (see figure)

Zwitter ionic form

$pIn = 7.59$.



#1332618

The compound that is not a common component of photochemical smog is:

A O_3

B $CH_2 = CHCHO$

C (boxed) CF_2Cl_2

D $H_3C - C||O - OONO_2$

Solution

Freons (CFC's) are not common components of photo chemical smog.

#1332640

The upper stratosphere consisting of the ozone layer protects us from the sun's radiation that falls in the wavelength region of:

A $600 - 750$ nm

B $0.8 - 1.5$ nm

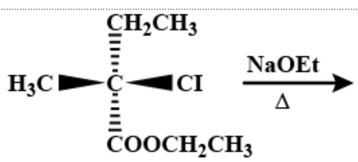
C $400 - 550$ nm

D (boxed) $200 - 315$ nm

Solution

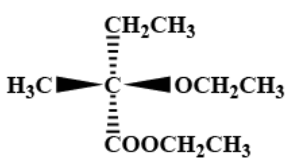
Ozone protects most of the medium frequencies ultraviolet light from $200 - 315$nm wave length.

#1332649

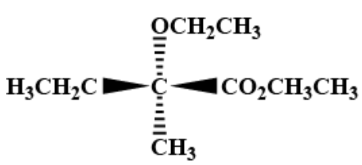


The major product of the following reaction is:

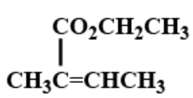
A



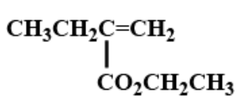
B (boxed)



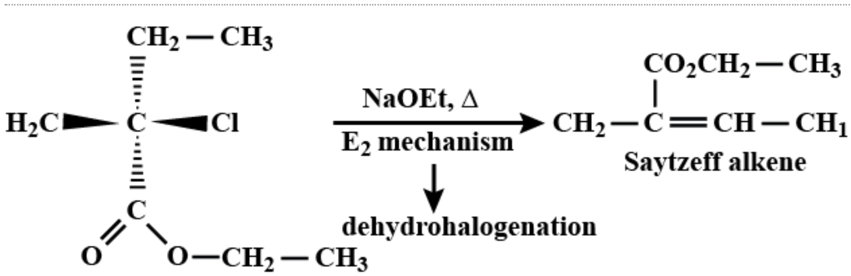
C



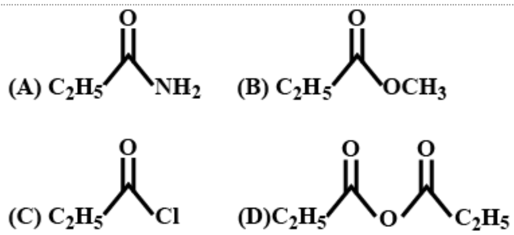
D



Solution



#1332666



The increasing order of the reactivity of the following with $LiAlH_4$ is:

A (A) < (B) < (D) < (C)

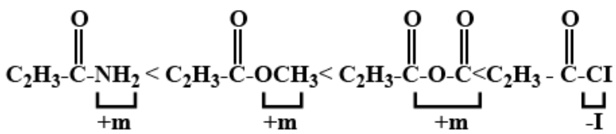
B (A) < (B) < (C) < (D)

C (B) < (A) < (D) < (C)

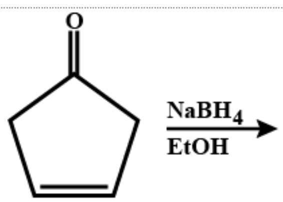
D (B) < (A) < (C) < (D)

Solution

Rate of nucleophilic attack on carbonyl $\propto$ Electrophilicity of carbonyl group.

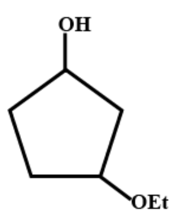


#1332677

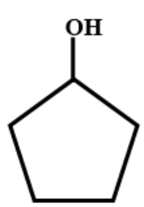


The major product of the following reaction is:

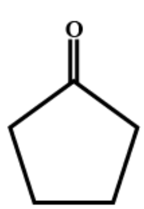
A

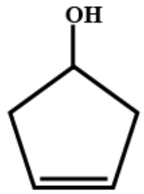


B



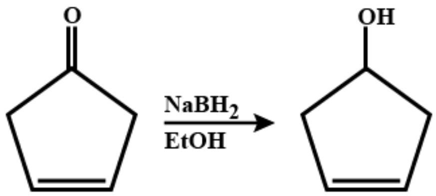
C



D 

Solution

$NaBH_4$ can not reduce $C=C$ but can reduce $-C||O-$ into -OH.



#1332706

Molecules of benzoic acid (C_6H_5COOH) dimerise in benzene. 'w' g of the acid dissolved in 30g of benzene shows a depression in freezing point equal to 2K. If the percentage association of the acid to form dimer in the solution is 80, then w is:

(Given that K_f = 5K kg mol^{-1}, Molar mass of benzoic acid = 122 g mol^{-1})

A 1.8g

$\boxed{\text{B}}$ 2.4g

C 1.0g

D 1.5g

Solution

$2(C_6H_5COOH)_{Wg} \xrightarrow[(30g)]{C_6H_6} C_6H_5COOH)_{2diser}$

$\Delta_f T = ik_f m$

$2 = 0.6 \times 5 \times \frac{w \times 1000}{122 \times 30}$

($i = 1 - 0.8 + 0.4 = 0.6$)

$w = 2.44$g.

#1332729

Given:

(i) C (graphite)+ $O_2(g) \rightarrow CO_2(g)$; $\Delta rH^o = xkJmol^{-1}$.

(ii) C (graphite)+ $\frac{1}{2}O_2(g) \rightarrow CO_2(g)$;

$\Delta rH^o = ykJmol^{-1}$

(iii) $CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g)$;

$\Delta rH^o = zkJmol^{-1}$

Based on the given thermochemical equations, find out which one of the following algebraic relationships is correct?

A $z = x + y$

B $x = y - z$

$\boxed{\text{C}}$ $x = y + z$

D $y = 2z - x$

Solution

$C_{(graphite)} + O_2(g) \rightarrow CO_2(g)\Delta_r H^o = xkJ/mol$ ·(1)

$C_{(graphite)} + \frac{1}{2}O_2(g) \rightarrow CO(g)\Delta_r H^o = ykJ/mol$ ··(2)

$CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g)\Delta_r H^o = zkJ/mol$ ·(3)

(1) = (2) + (3)

$x = y + z$.

#1332742

An open vessel at 27^oC is heated until two fifth of the air(assumed as an ideal gas) in it has escaped from the vessel. Assuming that the volume of the vessel remains constant, the temperature at which the vessel has been heated is:

A 720^oC

B 500^oC

C 750^oC

D (boxed) 500K

Solution

$\frac{2}{5}$ air escaped from vessel, $\therefore \frac{3}{5}$ air remain is vessel. P, V constant

$n_1 T_1 = n_2 T_2$

$n_1(300) = \left(\frac{3}{5}n_1\right)T_2 \Rightarrow T_2 = 500$K.

#1332758

$\wedge_m^o$ for $NaCl$, HCl and NaA are 126.4, 425.9 and 100.5 S $cm^2 mol^{-1}$, respectively. If the conductivity of 0.001M HA is 5×10^{-5}S cm^{-1}, degree of dissociation of HA is:

A 0.75

B (boxed) 0.125

C 0.25

D 0.50

Solution

$\wedge_m^0(HA) = \wedge_m^0(HCl) + \wedge_m^0(NaA) - \wedge_m^0(NaCl)$

$= 425.9 + 100.5 - 126.4$

$= 400 Scm^2 mol^{-1}$

$\wedge_m = \frac{1000K}{M} = \frac{1000 \times 5 \times 10^{-5}}{10^{-3}} = 50 Scm^2 mol^{-1}$

$\alpha = \frac{\wedge_m}{\wedge_m^0} = \frac{50}{400} = 0.125$.

$\wedge_m^0(HA) = \wedge_m^0(HCl) + \wedge_m^0(NaA) - \wedge_m^0(NaCl)$

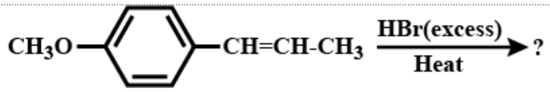
$= 425.9 + 100.5 - 126.4$

$= 400 Scm^2 mol^{-1}$

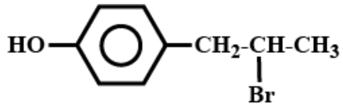
$\wedge_m = \frac{1000K}{M} = \frac{1000 \times 5 \times 10^{-5}}{10^{-3}} = 50 Scm^2 mol^{-1}$

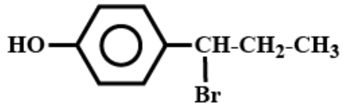
$\alpha = \frac{\wedge_m}{\wedge_m^0} = \frac{50}{400} = 0.125$.

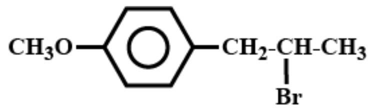
#1332768

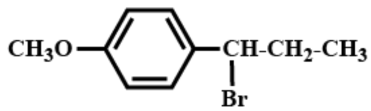


The major product in the following conversion is:

A 

B 

C 

D 

Solution

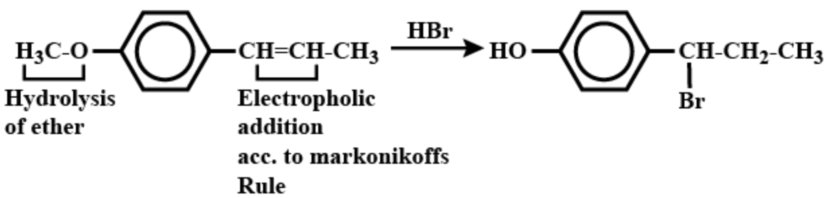
$\wedge_m^0(HA) = \wedge_m^0(HCl) + \wedge_m^0(NaA) - \wedge_m^0(NaCl)$

$= 425.9 + 100.5 - 126.4$

$= 400 Scm^2 mol^{-1}$

$\wedge_m = \frac{1000K}{M} = \frac{1000 \times 5 \times 10^{-5}}{10^{-3}} = 50 Scm^2 mol^{-1}$

$\alpha = \frac{\wedge_m}{\wedge_m^0} = \frac{50}{400} = 0.125.$



#1332783

If K_{sp} of Ag_2CO_3 is 8×10^{-12}, the molar solubility of Ag_2CO_3 in 0.1M $AgNO_3$ is:

A 8×10^{-12}M

B 8×10^{-10}M

C 8×10^{-11}M

D 8×10^{-13}M

Solution

$Ag_2CO_3(s) \rightleftharpoons 2Ag^+(aq.)_{(0.1+2S)M} + CO_3^{-2}(aq)_{SM}$

$Ksp = [Ag^+]^2[CO_3^{-2}]$

$8 \times 10^{-12} = (0.1 + 2S)^2(S)$

$S = 8 \times 10^{-10} M.$

$Ag_2CO_3(s) \rightleftharpoons 2Ag^+(aq.)_{(0.1+2S)M} + CO_3^{-2}(aq)_{SM}$

$Ksp = [Ag^+]^2[CO_3^{-2}]$

$8 \times 10^{-12} = (0.1 + 2S)^2(S)$

$S = 8 \times 10^{-10} M.$

#1332790

Among the following, the false statements is:

A latex is a colloidal solution of rubber particles which are positively charged

B tyndall effect can be used to distinguish between a colloidal solution and a true solution

C it is possible to cause artificial rain by throwing electrified sand carrying charge opposite to the one on clouds from an aeroplane

D lyophilic sol can be coagulated by adding an electrolyte

Solution

Colloidal solution of rubber are negatively charged.

Colloidal solution of rubber are negatively charged.

#1332794

The pair that does not require calcination is:

A ZnO and MgO

B Fe_2O_3 and $CaCO_3 \cdot MgCO_3$

C ZnO and $Fe_2O_3 \cdot xH_2O$

D $ZnCO_3$ and CaO

Solution

ZnO & MgO both are in oxide form therefore no change on calcination.

ZnO and MgO both are in oxide form therefore no change on calcination.

#1332798

The correct order of atomic radii is:

A $Ce > Eu > Ho > N$

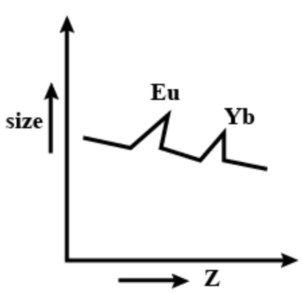
B $N > Ce > Eu > Ho$

C $Eu > Ce > Ho > N$

D $Ho > N > Eu > Ce$

Solution

Hence the order is $Eu > Ce > Ho > N$.



#1332801

The element that does not show catenation is:

A Sn

B *Ge*

C *Si*

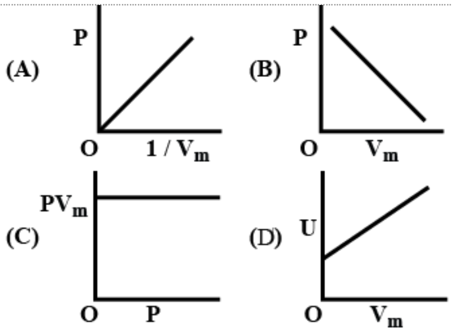
D *Pb*

Solution

Catenation is not shown by lead.

Catenation is not shown by lead.

#1332808



The combination of plots which does not represent isothermal expansion of an ideal gas is:

A (A) and (C)

B (A) and (D)

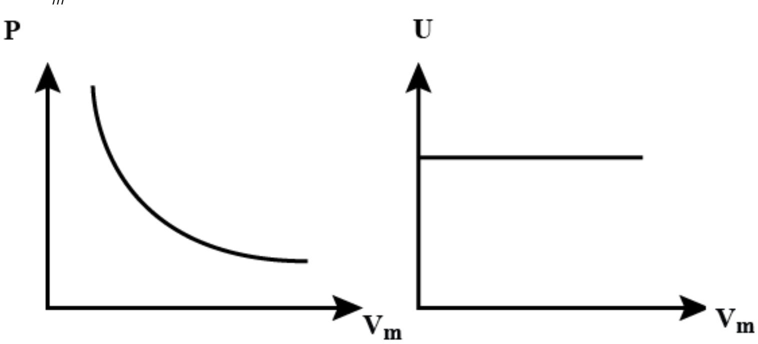
C (B) and (D)

D (B) and (C)

Solution

Isothermal expansion $PV_m = K$ (Graph-C)

$P = \dfrac{K}{V_m}$(Graph-A).



#1332814

The volume strength of 1M H_2O_2 is:

(Molar mass of H_2O_2 = 34g mol^{-1})

A 16.8

B 11.35

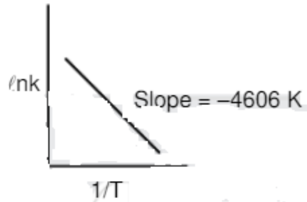
C 22.4

D 5.6

Solution

1L−1M H_2O_2 solution will produce 11.35L O_2 gas at STP.

#1332850



For a reaction consider the plot of ln k versus $1/T$ given in the figure. If the rate constant of this reaction at 400K is $10^{-5}\ s^{-1}$, then the rate constant at 500K is:

A $2 \times 10^{-4} s^{-1}$

B $10^{-4} s^{-1}$

C $10^{-6} s^{-1}$

D $4 \times 10^{-4} s^{-1}$

Solution

$$ln\frac{K_2}{K_1} = \frac{E_a}{R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$$

$$2.303 log\frac{K_2}{10^{-5}} = 4606\left[\frac{1}{400} - \frac{1}{500}\right]$$

$$\Rightarrow K_2 = 10^{-4} s^{-1}.$$

#1332878

The element that shows greater ability to form $p\pi - p\pi$ multiple bonds, is:

A Si

B Ge

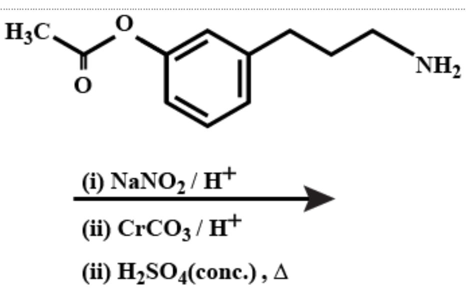
C Sn

D C

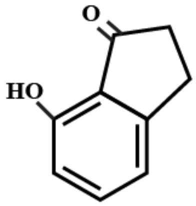
Solution

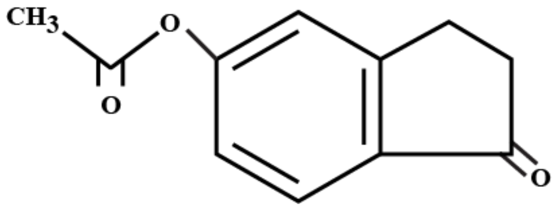
Carbon atom have 2p orbitals able to form strongest $p\pi - p\pi$ bonds.

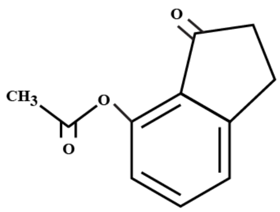
#1332884

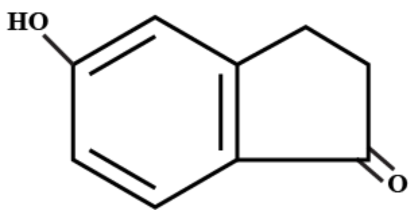


The major product of the following reaction is:

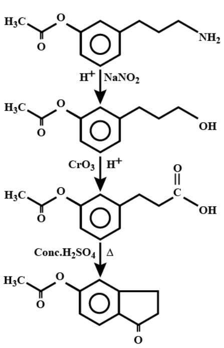
A 

B 

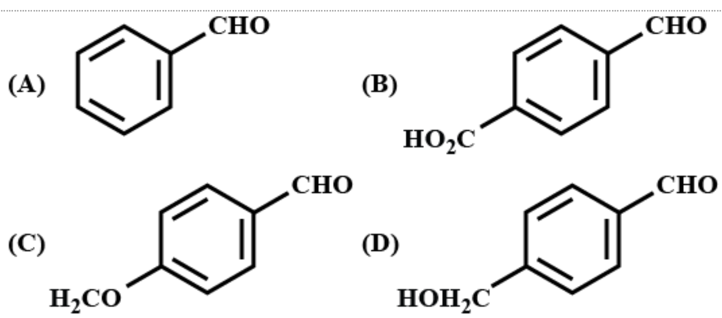
C 

D 

Solution



#1332892



The aldehydes which will not form Grignard product with one equivalent Grignard reagents are:

A (B), (C), (D)

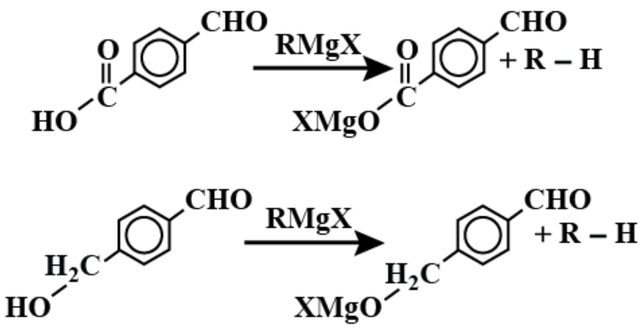
B (B), (D)

C (B), (C)

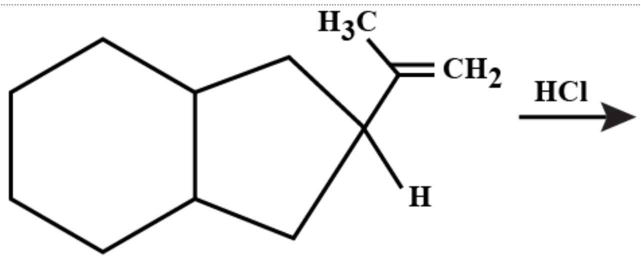
D (C), (D)

Solution

Acid-base reaction of grignard reagent are fast.

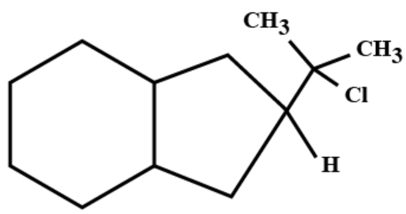


#1332896

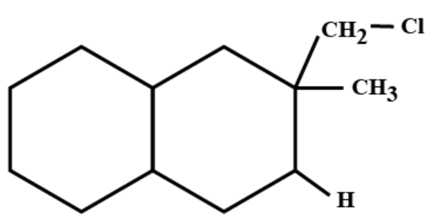


The major product of the following reaction is:

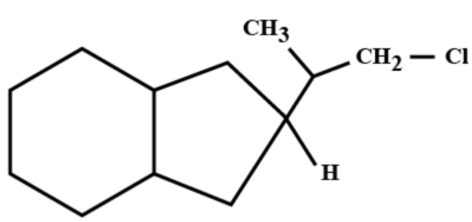
A



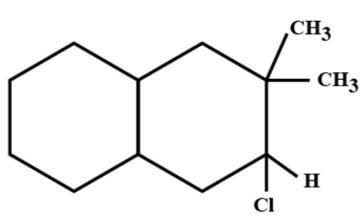
B



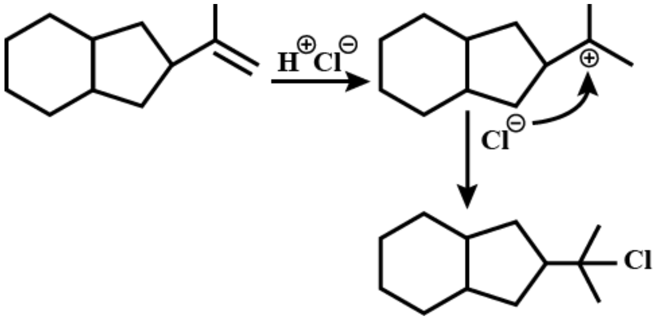
C



D



Solution



#1332902

Chlorine on reaction with hot and concentrated sodium hydroxide gives:

A Cl^- and ClO_2^-

$\boxed{\text{B}}$ Cl^- and ClO_3^-

C Cl^- and ClO^-

D ClO_3^- and ClO_2^-

Solution

$3Cl_2 + 6OH \rightarrow 5Cl^- + ClO_3^- + 3H_2O.$

#1332918

The major product of the following reaction is $CH_3CH_2C_{\mid Br}H - C_{\mid Br}H_2 \xrightarrow[(ii)\,NaNH_2 inliqNH_3]{(i)\,KOHalc.}$

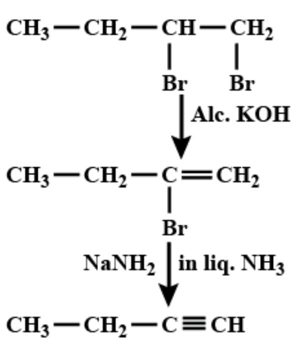
$\boxed{\text{A}}$ $CH_3CH_2C \equiv CH$

B $CH_3CH_2C_{\mid NH_2}H - C_{\mid NH_2}H_2$

C $CH_3CH = CH = CH_2$

D $CH_3CH = CHCH_2NH_2$

Solution



#1332922

If the de Broglie wavelength of the electron in n^{th} Bohr orbit in a hydrogenic atom is equal to $1.5\ \pi a_0$ (a_0 is Bohr radius), then the value of n/z is:

A 1.0

$\boxed{\text{B}}$ 0.75

C 0.40

D 1.50

Solution

According to de-Broglie's hypothesis $2\pi r_a = n\lambda \Rightarrow 2\pi \cdot a_0 = \frac{n^2}{z} = n \times 1.5\pi a_0$

$\frac{n}{z} = 0.75$.

#1332928

The two monomers for the synthesis of Nylone $6, 6$ are:

A $HOOC(CH_2)_6COOH, H_2N(CH_2)_6NH_2$

B $HOOC(CH_2)_4COOH, H_2N(CH_2)_4NH_2$

C $HOOC(CH_2)_6COOH, H_2N(CH_2)_4NH_2$

$\boxed{D}$ $HOOC(CH_2)_4COOH, H_2N(CH_2)_6NH_2$

Solution

Nylon-$6, 6$ is polymer of $Hexamethylene \quad diamine \downarrow H_2N-(CH_2)_6-NH_2$ & $Adipic \quad acid \downarrow HOOC-(CH_2)_4-COOH$.

#1331385

Let Z be the set of integers. If $A = \{x \epsilon Z : 2(x+2)(x^2-5x+6)\} = 1$ and $B = \{x \epsilon Z : -3 < 2x - 1 < 9\}$, then the number of subsets of the set A $\times$ B, is :

A 2^{18}

B 2^{10}

$\boxed{\text{C}}$ 2^{15}

D 2^{12}

Solution

$A = \{x \epsilon z : 2^{(x+2)(x^2-5x+6)} = 1\}$

$2^{(x+2)(x^2-5x+6)} = 2^0 \Rightarrow x = -2, 2, 3$

$A = \{-2, 2, 3\}$

$B = \{x \epsilon Z : -3 < 2x - 1 < 9\}$

$B = \{0, 1, 2, 3, 4\}$

A $\times$ B has is 15 elements so number of subsets of A $\times$ B is 2^{15}.

#1331590

If $\sin^4\alpha + 4\cos^4\beta + 2 = 4\sqrt{2}\sin\alpha\cos\beta;\ \alpha, \beta \epsilon [0, \pi]$, then $\cos(\alpha+\beta) - \cos(\alpha+\beta)$ is equal to :

A 0

$\boxed{\text{B}}$ $-\sqrt{2}$

C -1

D $\sqrt{2}$

Solution

A.M. $\geq$ G.M.

$\dfrac{\sin^4\alpha + 4\cos^4\beta + 1 + 1}{4} \geq (\sin^4\alpha\cos^4\beta.1.1)^{\frac{1}{4}}$

$\Rightarrow A.M. = G.M. \Rightarrow \sin^4\alpha = 1 = 4\cos^4\beta$

$\sin\alpha = 1, \cos\beta = \pm\dfrac{1}{\sqrt{2}}$

$\sin\beta = \dfrac{1}{\sqrt{2}}$ as $\beta \epsilon [0, \pi]$

$\cos(\alpha+\beta) - \cos(\alpha-\beta) = -2\sin\alpha\sin\beta$

$= -\sqrt{2}$

#1331714

If an angle between the line, $\dfrac{x+1}{2} = \dfrac{y-2}{1} = \dfrac{z-3}{-2}$ and the plane, $x - 2y - kz = 3$ is $\cos^{-1}\left(\dfrac{2\sqrt{2}}{3}\right)$, then a value of k is:

A $-\dfrac{5}{3}$

B $\sqrt{\dfrac{3}{5}}$

$\boxed{\text{C}}$ $\sqrt{\dfrac{5}{3}}$

D $-\dfrac{3}{5}$

Solution

DR's of line are 2, 1, -2

normal vector of plane is $\hat{i} - 2\hat{j} - k\hat{k}$

$sin\alpha = \frac{(2\hat{i}+\hat{j}-2\hat{k}) \cdot (\hat{i}-2\hat{j}-k\hat{k})}{3\sqrt{1+4+k^2}}$

$sin\alpha = \frac{2k}{3\sqrt{k^2+5}}$ ....(1)

$cos\alpha = \frac{2\sqrt{2}}{3}$ .... (2)

$(1)^2 + (2)^2 = 1 = k^2 = \frac{5}{3}$

#1331795

If a straight line passing through the point $P(-3, 4)$ is such that its intercepted portion between the coordinate axes is bisected at P, then its equation is:

A $x - y + 7 = 0$

B $3x - 4y + 25 = 0$

C $4x + 3y = 0$

$\boxed{D}$ $4x - 3y + 24 = 0$

Solution

Let the line be $\frac{x}{a} + \frac{y}{b} = 1$

$(-3, 4) = \left(\frac{a}{2}, \frac{b}{2}\right)$

$a = -6, b = 8$

equation of line is $4x - 3y + 24 = 0$

#1331900

The integral $\int \frac{3x^{13} + 2x^{11}}{(2x^4 + 3x^2 + 1)^4} dx$ is equal to: (where C is a constant of integration)

A $\frac{x^4}{(2x^4 + 3x^2 + 1)^3} + C$

$\boxed{B}$ $\frac{x^{12}}{6(2x^4 + 3x^2 + 1)^3} + C$

C $\frac{x^4}{6(2x^4 + 3x^2 + 1)^3} + C$

D $\frac{x^{12}}{(2x^4 + 3x^2 + 1)^3} + C$

Solution

$\int \frac{3x^{13} + 2x^{11}}{(2x^4 + 3x^2 + 1)^4} dx$

$\int \frac{\left(\frac{3}{x^3} + \frac{2}{x^5}\right) dx}{\left(2 + \frac{3}{x^2} + \frac{1}{x^4}\right)^4}$

Let $\left(2 + \frac{3}{x^2} + \frac{1}{x^4}\right) = t$

$-\frac{1}{2}\int \frac{dt}{t^4} = \frac{1}{6t^3} + C \Rightarrow \frac{x^{12}}{6(2x^4 + 3x^2 + 1)^4} + C$

#1331949

There are m men and two women participating in a chess tournament. Each participant plays two games with every other participant. If the number of games played by the men between themselves exceeds the number of games played between the men and the women by 84, then the value of m is :

A 9

B 11

$\boxed{\text{C}}$ 12

D 7

Solution

Let m-men, 2-women

${}^{m}C_2 \times 2 - {}^{m}C_1\,{}^{2}C_1 .\, 2 = 84$

$m^2 - 5m - 84 = 0 \Rightarrow (m - 12)(m + 7) = 0$

$m = 12$

#1332057

If the function f given by $f(x) = x^3 - 3(a - 2)x^2 + 3ax + 7$, for some $a \in R$ is increasing in $(0, 1]$ and decreasing in $[1, 5)$, then a root of the equation, $\frac{f(x) - 14}{(x - 1)^2} = 0 (x \neq 1)$ is

A 6

B 5

$\boxed{\text{C}}$ 7

D -7

Solution

$f'(x) = 3x^2 - 6(a - 2)x + 3a$

$f'(x) \geq 0 \forall x \in (0, 1]$

$f'(x) \leq 0 \forall x \in [1, 5)$

$\Rightarrow f'(x) = 0$ at $x = 1 \Rightarrow a = 5$

$f(x) - 14 = (x - 1)^2(x - 7)$

$\frac{f(x) - 14}{(x - 1)^2} = x - 7$

$\therefore$ answer is 7

#1332081

Let f be a differentiable function such that $f(1) = 2$ and $f'(x) = f(x)$ for all $x \in R$. If $h(x) = f'(f(x))$, then $h'(1)$ is equal to :

$\boxed{\text{A}}$ 4e

B $4e^2$

C 2e

D $2e^2$

Solution

$\frac{f'(x)}{f(x)} = 1 \forall x \in R$

Integrate and use f(1) = 2

$f(x) = 2e^{x-1} \Rightarrow f'(x) = 2e^{x-1}$

$h(x) = f(f(x) \Rightarrow h'(x) = f'(f(x))f'(x)$

$h'(1) = f'(f(1))f'(1)$

$= f'(2)f'(1)$

= 2e. 2 = 4e

#1332224

The tangent to the curve $y = x^2 - 5x + 5$, parallel to the line $2y = 4x + 1$, also passes through the point

A $\left(\frac{1}{4}, \frac{7}{2}\right)$

B $\left(\frac{7}{2}, \frac{1}{4}\right)$

C $\left(-\frac{1}{8}, 7\right)$

D $\left(\frac{1}{8}, -7\right)$

Solution

$y = x^2 - 5x + 5$

$\frac{dy}{dx} = 2x - 5 = 2 \Rightarrow x = \frac{7}{2}$

at $x = \frac{7}{2},\ y = \frac{-1}{4}$

Equation of tangent at $\left(\frac{7}{2}, -\frac{1}{4}\right)$ is $2x - y - \frac{29}{4} = 0$

Now check options

$x = \frac{1}{8},\ y = -7$

#1332302

Let S be the set of all real values of λ such that a pllane passing through the points $(-\lambda^2, 1, 1)$, $(1, -\lambda^2, 1)$ and $(1, 1, -\lambda^2)$ also passes through the point (-1, -1, 1). Then S is equal to:

A $\{\sqrt{3}\}$

B $\{\sqrt{3} - \sqrt{3}\}$

C {1, -1}

D {3, -3}

Solution

All four points are coplanar so

$$\begin{vmatrix} 1-\lambda^2 & 2 & 0 \\ 2 & -\lambda^2+1 & 0 \\ 2 & 2 & -\lambda^2-1 \end{vmatrix} = 0$$

$(\lambda^2 + 1)^2(3 - \lambda^2) = 0$

$\lambda = \pm\sqrt{3}$

#1332352

If a circle of radius R passes through the origin O and intersects the coordinate axes at A and B, then find the locus of the foot of perpendicular from O on AB.

A $(x^2 + y^2)^2 = 4Rx^2y^2$

B $(x^2 + y^2)(x + y) = R^2xy$

C $(x^2 + y^2)^3 = 4R^2x^2y^2$

D $(x^2 + y^2)^2 = 4R^2x^2y^2$

Solution

Slope of AB $= \frac{-h}{k}$

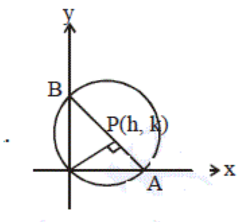
Equation of AB is $hx + ky = h^2 + k^2$

$A\left(\frac{h^2+k^2}{h}, 0\right)$, $B\left(0, \frac{h^2+k^2}{k}\right)$

AB = 2R

$\Rightarrow (h^2 + k^2)^3 = 4R^2h^2k^2$

$\Rightarrow (x^2 + y^2)^3 = 4R^2x^2y^2$



#1332390

The equation of a tangent to the parabola, $x^2 = 8y$, which makes an angle θ with the positive direction of x-axis, is:

A $\quad x = y\,cot\theta + 2tan\theta$

B $\quad x = y\,cot\theta - 2tan\theta$

C $\quad x = x\,tan\theta - 2cot\theta$

D $\quad x = x\,tan\theta + 2cot\theta$

Solution

$x^2 = y$

$\Rightarrow \frac{dy}{dx} = \frac{x}{4} = tan\theta$

$\therefore\ x_1 = 4tan\theta$

$y_1 = 2tan^2\theta$

Equation of tangent:-

$y - 2tan^2\theta = tan\theta(x - 4tan\theta)$

$\Rightarrow x = ycot\theta + 2tan\theta$

#1332503

If the angle of elevation of a cloud from a point P which is 25 m above a lake be 30^0 and the angle of depression of reflection of the cloud in the lake from P be 60^0, then the height of the cloud (in meters) from the surface of the lake is:

A $\quad 42$

B $\quad 50$

C $\quad 45$

D $\quad 60$

Solution

$tan30^0 = \frac{x}{y} \Rightarrow y = \sqrt{3}x$ .... (i)

$tan60^0 = \frac{25+x+25}{y}$

$\Rightarrow \sqrt{3}y = 50 + x$

$\Rightarrow 3x = 50 + x$

$\Rightarrow x = 25\ m$

$\therefore$ Height of cloud from surface $= 25 + 25 = 50$ m

#1332613

The integral $\int_1^e \left\{\left(\frac{x}{e}\right)^{2x} - \left(\frac{e}{x}\right)^{x}\right\} \log_e x\,dx$ is equal to :

A $\frac{1}{2} - e - \frac{1}{e^2}$

B $\frac{3}{2} - \frac{1}{e} - \frac{1}{2e^2}$

C $-\frac{1}{2} + \frac{1}{e} - \frac{1}{2e^2}$

$\boxed{\text{D}}$ $\frac{3}{2} - e - \frac{1}{2e^2}$

Solution

$\int_1^e \left(\frac{x}{e}\right)^{2x} \log_e x.\,dx - \int_1^e \left(\frac{e}{x}\right)^{x} \log_e x.\,dx$

Let $\left(\frac{x}{e}\right)^{2x} = t,\ \left(\frac{e}{x}\right)^{x} = v$

$= \frac{1}{\left(\frac{1}{e}\right)^2}\int_2^1 dt + \int_e^1 dv$

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

#1332756

$\lim_{n\to\infty}\left(\frac{n}{n^2+1^2} + \frac{n}{n^2+2^2} + \frac{n}{n^2+3^2} + \ldots\ldots + \frac{1}{5n}\right)$ is equal to:

A $\frac{\pi}{4}$

$\boxed{\text{B}}$ $tan^{-1}(2)$

C $tan^{-1}(3)$

D $\frac{\pi}{2}$

Solution

$\lim_{x\to\infty}\sum_{r=1}^{2n}\frac{n}{n^2+r^2}$

$\lim_{x\to\infty}\sum_{r=1}^{2n}\frac{1}{\left(1+\frac{r^2}{n^2}\right)} = \int_0^2 \frac{dx}{1+x^2} = tan^{-1}2$

#1332793

The set of all values of λ for which the system of linear equations.

$x - 2y - 2z = \lambda x$

$x + 2y + z = \lambda y$

$-x - y = \lambda z$

has a non-trivial solution.

A contains more than two elements

B is a singleton

C is an empty set

$\boxed{\text{D}}$ contains exactly two elements

Solution

$x - 2y - 2z = \lambda x$

$(1 - \lambda)x - 2y - 2z = 0.....(1)$

$x + 2y + z = \lambda y$

$x + (2 - \lambda)y + z = 0$

$-x - y = \lambda z$

$x + y + \lambda z = 0$

Since the system of given linear equations has a non-trivial solution.

Therefore,

$$\begin{vmatrix} 1 - \lambda & -2 & -2 \\ 1 & 2 - \lambda & 1 \\ 1 & 1 & \lambda \end{vmatrix} = 0$$

$[(1 - \lambda)(\lambda(2 - \lambda) - 1) - 1(- 2\lambda - (- 2)) + 1(- 2 - (- 2(2 - \lambda)))] = 0$

$(1 - \lambda)^2\lambda - 2(1 - \lambda) + 2(1 - \lambda) = 0$

$\lambda(1 - \lambda)^2 = 0$

$\Rightarrow \lambda = 0, 1$

Thus, the set of values of λ contains exactly two elements.

Hence the correct answer is (D) contains exactly two elements.

#1332802

If ${}^nC_4$, ${}^nC_5$ and ${}^nC_6$ are in A.P., then n can be:

A 14

B 11

C 9

D 12

Solution

Given:-

${}^nC_4$, ${}^nC_5$ and ${}^nC_6$ are in A.P.

Therefore,

$${}^nC_5 = \frac{{}^nC_4 + {}^nC_6}{2}$$

$2 \times {}^nC_5 = {}^nC_4 + {}^nC_6$

As we know that,

$${}^nC_r = \frac{n!}{r!(n-r)!}$$

Therefore,

$$2 \times \frac{n!}{5!(n-5)!} = \frac{n!}{4!(n-4)!} + \frac{n!}{6!(n-6)!}$$

$$\frac{2}{5 \times 4! \times (n-5)(n-6)!} = \frac{1}{4! \times (n-4)(n-5)(n-6)!} + \frac{1}{6 \times 5 \times 4! \times (n-6)!}$$

$$\frac{2}{5 \times (n-5)} = \frac{1}{(n-4)(n-5)} + \frac{1}{6 \times 5}$$

$$\frac{2}{5(n-5)} = \frac{30 + (n-4)(n-5)}{30(n-4)(n-5)}$$

$\Rightarrow 12(n-4) = 30 + \left(n^2 - 9n + 20\right)$

$\Rightarrow 12n - 48 = n^2 - 9n + 50$

$\Rightarrow n^2 - 21n + 98 = 0$

$\Rightarrow (n-7)(n-14) = 0$

$\Rightarrow n = 7, 14$

Thus for $n = 7$ or $n = 14$, the terms ${}^nC_4$, ${}^nC_5$ and ${}^nC_6$ are in A.P.

Hence the correct answer is $(A) 14$.

If a, b, c are in $A.P$, then $2b = a + c$

So applying the same condition, we have

$$2 \times ({}^nC_5) = ({}^nC_6) + ({}^nC_4)$$

$$\frac{2 \times n!}{5!(n-5)!} = \frac{n!}{6!(n-6)!} + \frac{n!}{4!(n-4)!}$$

$$\frac{2}{5!(n-5)!} = \frac{1}{6!(n-6)!} + \frac{1}{4!(n-4)!}$$

$$\frac{2}{5!(n-5)(n-6)!} = \frac{1}{6!(n-6)!} + \frac{1}{4!(n-4)(n-5)(n-6)!}$$

$$\frac{2}{5!(n-5)} = \frac{1}{6!} + \frac{1}{4!(n-4)(n-5)}$$

$$\frac{2}{5 \times 4! \times (n-5)} = \frac{1}{6 \times 5 \times 4!} + \frac{1}{4!(n-4)(n-5)}$$

$$\frac{2}{5 \times (n-5)} = \frac{1}{6 \times 5} + \frac{1}{(n-4)(n-5)}$$

$$\frac{2}{5 \times (n-5)} - \frac{1}{(n-4)(n-5)} = \frac{1}{6 \times 5}$$

$12n - 78 = n^2 - 9n + 20$

$n^2 - 21n + 98 = 0$

$(n-7)(n-14) = 0$

$\therefore \ n = 14$ or $n = 7$

#1332874

Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three unit vectors, out of which vectors $\vec{b}$ and $\vec{c}$ are non-parallel. If α and β are the angles which vector $\vec{a}$ makes with vectors $\vec{b}$ and $\vec{c}$ respectively and $\vec{a} \times (\vec{b} \times \vec{c}) = \frac{1}{2}\vec{b}$, then $|\alpha - \beta|$ is equal to:

A 60^0

B 30^0

C $\quad 90^0$

D $\quad 45^0$

Solution

$(\vec{a}\cdot\vec{c})\vec{b} - (\vec{a}\cdot\vec{b})\cdot\vec{c} = \frac{1}{2}\vec{b}$

$\vec{b}$ & $\vec{c}$ are linearly independent

$\therefore \quad \vec{a}\cdot\vec{c} = \frac{1}{2}$ & $\vec{a}\cdot\vec{b} = 0$

(All given vectors are unit vectors)

$\therefore \quad \alpha = 60^0$ & $\beta = 90^0$

$\therefore \quad |\alpha - \beta| = 30^0$

#1332904

If $A = \begin{bmatrix} 1 & \sin\theta & 1 \\ -\sin\theta & 1 & \sin\theta \\ -1 & \sin\theta & 1 \end{bmatrix}$; the for all $\theta \in$ □$\frac{3\pi}{4}, \frac{5\pi}{4}$□, det(A) lies in the interval:

A $\quad \left[\frac{5}{2}, 4\right)$

$\boxed{\text{B}}$ $\quad \left(\frac{3}{2}, 3\right]$

C $\quad \left(0, \frac{3}{2}\right]$

D $\quad \left(1, \frac{5}{2}\right]$

Solution

$|A| = \begin{bmatrix} 1 & sin\theta & 1 \\ -sin\theta & 1 & sin\theta \\ -1 & sin\theta & 1 \end{bmatrix};$

$= 2(1 + sin^2\theta)$

$\theta \in$ □$\frac{3\pi}{4}, \frac{5\pi}{4}$□ $\Rightarrow \frac{1}{\sqrt{2}} < sin\theta < \frac{1}{\sqrt{2}} \Rightarrow 0 \le sin^2\theta < \frac{1}{2}$

$\therefore \quad |A| \in [2, 3)$

#1332975

$\lim\limits_{x \to 1-} \frac{\sqrt{\pi} - \sqrt{2\sin^{-1}x}}{\sqrt{1-x}}$ is equal to

A $\quad \frac{1}{\sqrt{2\pi}}$

B $\quad \sqrt{\frac{\pi}{2}}$

$\boxed{\text{C}}$ $\quad \sqrt{\frac{2}{\pi}}$

D $\quad \sqrt{\pi}$

Solution

$$\lim_{x \to 1^-} \frac{\sqrt{\pi} - \sqrt{2\sin^{-1}x}}{\sqrt{1-x}} \times \frac{\sqrt{\pi} + \sqrt{2\sin^{-1}x}}{\sqrt{\pi} + \sqrt{2\sin^{-1}x}}$$

$$\lim_{x \to 1^-} \frac{2\left(\frac{\pi}{2} - \sin^{-1}x\right)}{\sqrt{1-x}\left(\sqrt{\pi} + \sqrt{2\sin^{-1}x}\right)}$$

$$\lim_{x \to 1^-} \frac{2\cos^{-1}x}{\sqrt{1-x}} \cdot \frac{1}{2\sqrt{\pi}}$$

Put $x = \cos\theta$

$$\lim_{\theta \to 0+} \frac{2\theta}{\sqrt{2}\sin\left(\frac{\theta}{2}\right)} \cdot \frac{1}{2\sqrt{\pi}} = \sqrt{\frac{2}{\pi}}$$

#1332985

The expression ~(~$p \to q$) is logically equivalent to

A ~p ^ ~ q

B p ^ q

C ~ p ^ q

D p ^ ~ q

Solution

p	q	$\sim p$	$\sim p \to q$	$\sim(\sim p \to q)$	$(\sim p \vee \sim q)$
T	T	F	T	F	F
F	T	T	T	F	F
T	F	F	T	F	F
F	F	T	F	T	T

#1333009

The total number of irrational terms in the binomial expansion of $(7^{\frac{1}{5}} - 3^{\frac{1}{10}})^{60}$ is :

A 55

B 49

C 48

D 54

Solution

General term $T_{r+1} = {}^{60}C_r\, 7^{\frac{60-5}{5}}\, 3^{\frac{r}{10}}$

$\therefore$ for rotational term, $r = 0, 10, 20, 30, 40, 50, 60 \Rightarrow$ no of rational terms $= 7$

$\therefore$ number of irrational terms $= 54$

#1333045

The mean and the variance of five observation are 4 and 5.20, respectively. If three of the observations are 3, 4 and 4; then the absolute value of the difference of the other two observations, is:

A 1

B 3

$\boxed{\text{C}}$ 7

D 5

Solution

$\Rightarrow$ Let other two observations are x, y

$\therefore$ $Mean = \dfrac{3+4+4+x+y}{5}$

$\therefore$ $4 = \dfrac{11+x+y}{5}$

$\therefore$ $20 = 11 + x + y$

$\therefore$ $x + y = 9$ ------ (1)

$Variance = \dfrac{1}{5}[(3-4)^2 + (4-4)^2 + (4-4)^2 + (x-4)^2 + (y-4)^2]$

$5.20 = \dfrac{1}{5}[1 + 0 + 0 + x^2 - 8x + 16 + y^2 - 8y + 16]$

$26 = 33 + x^2 + y^2 - 8(x + y)$

$26 = 33 + x^2 + y^2 - 8(9)$ [From (1)]

$\therefore$ $x^2 + y^2 = 65$ ----- (2)

$x + y = 9$ [From (1)]

$x^2 + y^2 + 2xy = 81$ [Squaring both sides]

$65 + 2xy = 81$ [From (2)]

$2xy = 16$

$xy = 8$

$\therefore$ $x = \dfrac{8}{y}$ -- (3)

Substituting (3) in (1),

$\dfrac{8}{y} + y = 9$

$y^2 + 8 = 9y$

$y^2 - 9y + 8 = 0$

$\therefore$ $y = 8$ and $y = 1$

For $y = 8$

$x + 8 = 9$

$\therefore$ $x = 1$

$\therefore$ We get $x = 1$ and $y = 8$

$\therefore$ Difference between other two observation $= 8 - 1 = 7$

#1333088

Let S and S' be the foci of the ellipse and B be any one of the extremities of its minor axis. If $\Delta S'BS$ is a right angled triangle with right angle at B and area $(\Delta S'BS) = 8$ sq. units, then the length of a latus rectum of the ellipse is:

A $2\sqrt{2}$

B 2

$\boxed{\text{C}}$ 4

D $4\sqrt{2}$

Solution

$m_{SB'}.m_{SB} = -1$

$b^2 = a^2e^2$ .... (i)

$\frac{1}{2}S'B.\ SB = 8$

S'B. SB = 16

$a^2e^2 + b^2 = 16$ ......(ii)

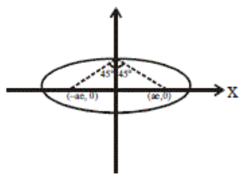
$b^2 = a^2(1 - e^2)$ ....(iii)

using (i), (ii), (iii) a = 4

$b = 2\sqrt{2}$

$e = \frac{1}{\sqrt{2}}$

$\therefore\ l(L.R.) = \frac{2b^2}{a} = 4$



#1333114

In a class of 60 students, 40 opted for NCC, 30 opted for NSS and 20 opted for both NCC and NSS. If one of these students is selected at random, then the probability that the student selected has opted neither for NCC nor for NSS is :

A $\frac{2}{3}$

B $\frac{1}{6}$

C $\frac{1}{3}$

D $\frac{5}{6}$

Solution

Let A denotes the students of NCC .

B denotes the students of NSS.

total number of students n(S) = 60

Given,

number of students opted for NCC n(A) = 40

number of students opted for NSS n(B) = 30

number of students opted for both=20

n(A)=40, n(B)=30

$n(A \cap B)$=20

$n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$n(A \cup B) = 50$

students opted neither NCC nor NSS = $n(S) - n(A \cup B)$

P(students opted neither NCC nor NSS) $= 1 - P(A \cup B)$

= 1 - $\frac{50}{60}$

= $\frac{1}{6}$

Since there are a total of 60 students in the class, therefore,

$n(S) = 60$

Let A and B be the event that a student opted for NCC and NSS respectively.

Given:-

$n(A) = 40$

$n(B) = 30$

$n(A \cap B) = 20$

Therefore,

$P(A) = \frac{n(A)}{n(S)} = \frac{40}{60} = \frac{2}{3}$

$P(B) = \frac{n(B)}{n(S)} = \frac{30}{60} = \frac{1}{2}$

$P(A \cap B) = \frac{n(A \cap B)}{n(S)} = \frac{20}{60} = \frac{1}{3}$

Now, as we know that,

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$\therefore P(A \cup B) = \frac{2}{3} + \frac{1}{2} - \frac{1}{3}$

$\Rightarrow P(A \cup B) = \frac{4 + 3 - 2}{6} = \frac{5}{30}$

Now,

$P\left(A' \cap B'\right) = P(A \cup B)' = 1 - P(A \cup B)$

$\therefore P\left(A' \cup B'\right) = 1 - \frac{5}{6} = \frac{6-5}{6} = \frac{1}{6}$

Thus the probability that the student selected has opted neither for NCC nor for NSS is $\frac{1}{6}$.

Hence the correct answer is $(B)\frac{1}{6}$.

#1333141

The number of integral values of m for which the quadratic expression.

$(1 + 2m)x^2 - 2(1 + 3m)x + 4(1 + m),\ x \in R$, is always positive, is:

A 8

$\boxed{\textbf{B}}$ 7

C 6

D 3

Solution

Expression is always positive it

$2m + 1 > 0 \Rightarrow m > -\frac{1}{2}$

&

$D < 0 \Rightarrow m^2 - 6m - 3 < 0$

$3 - \sqrt{12} < m < 3 + \sqrt{12}$

$\therefore$ integral value of m $0, 1, 2, 3, 4, 5, 6$

#1333191

In a game, a man wins Rs. 100 if he gets 5 of 6 on a throw of a fair die and loses Rs. 50 for getting any other number on the die. If he decides to throw the die either is:till he gets a five or a six or to a maximum of three throws, then his expected gain/loss (in rupees)

A $\frac{400}{3}$ gain

B $\frac{400}{3}$ loss

C 0

D $\frac{400}{9}$ loss

Solution

Expected Gain/Loss =

$= w \times 100 + Lw(-50+100) + L^2 w(-50-50+100) + L^3(-150)$

$= \frac{1}{3} \times 100 + \frac{2}{3} \cdot \frac{1}{3}(50) + \left(\frac{2}{3}\right)^2 \left(\frac{1}{3}\right)(0) + \left(\frac{2}{3}\right)^3(-150) = 0$

here w denotes probability that outcome 5 or 6 ($w = \frac{2}{6} = \frac{1}{3}$)

here denotes probability that outcome

1,2,3,4($L = \frac{4}{6} = \frac{2}{3}$)

#1333219

If a curve passes through the point (1, -2) and has slope of the tangent at any point (x, y) on it as $\frac{x^2-2y}{x}$, then the curve also passes through the point:

A $(-\sqrt{2}, 1)$

B $(\sqrt{3}, 0)$

C (-1, 2)

D (3, 0)

Solution

$\frac{dy}{dx} = \frac{x^2-2y}{x}$ (Given)

$\frac{dy}{dx} + 2\frac{y}{x} = x$

I.F. $= e^{\int \frac{2}{x} dx} = x^2$

$\therefore \quad y.x^2 = \int x x^2 dx + C$

$= \frac{x^4}{y} + C$

hence bpasses through $(1, -2) \Rightarrow C = -\frac{9}{4}$

$\therefore \quad yx^2 = \frac{x^4}{4} - \frac{9}{4}$

Now check option(s), which is satisfied by option (ii)

#1333238

Let z_1 and z_2 be two complex numbers satisfying $|z_1| = 9$ and $|z_3 - 3 - 4i| = 4$. Then the minimum value of $|z_1 - z_2|$ is:

A 0

B 1

C $\sqrt{2}$

D 2

Solution

$|z_1| = 9, |z_2 - (3+4i)| = 4$

$C_1(0, 0)$ radius $r_1 = 9$

$C_2(3, 4)$ radius $r_2 = 4$

$C_1C_2 = |r_1 - r_2| = 5$

$\therefore$ circle touches internally

$\therefore$ $|z_1 - z_2|_{min} = 0$

#1333255

If the sum of the first 15 terms of the series $\left(\frac{3}{4}\right)^3 + \left(2\frac{1}{2}\right)^3 + \left(2\frac{1}{4}\right)^3 + 3^3 + \left(3\frac{3}{4}\right)^3 + \ldots\ldots\ldots\ldots$ is equal to 225 k. then k is equal to:

A 9

B 27

C 108

D 54

Solution

$\left(\frac{3}{4}\right)^3 + \left(\frac{6}{4}\right)^3 + \left(\frac{9}{4}\right)^3 + \left(\frac{12}{4}\right)^3 + \ldots\ldots\ldots\ldots\ldots 15$ term

$= \frac{27}{64} \sum_{r=1}^{15} r^3$

$= \frac{27}{64} \cdot \left[\frac{15(15+1)}{2}\right]^2$

= 225 K (zgiven in question)

K = 27