#1331207

A paramagnetic substance in the form of a cube with sides 1cm has a magnetic dipole moment of 20×10^{-6} J/T when a magnetic intensity of 60×10^{3} A/m is applied. Its magnetic susceptibility is?

A 2.3×10^{-2}

B 3.3×10^{-2}

[✓ **C**] 3.3×10^{-4}

D 4.3×10^{-2}

Solution

$X = \frac{I}{H}$

$I = \frac{Magnetic \quad moment}{Volume}$

$I = \frac{20 \times 10^{-6}}{10^{-6}} = 20N/m^2$

$X = \frac{20}{60 \times 10^{+3}} = \frac{1}{3} \times 10^{-3}$

$= 0.33 \times 10^{-3} = 3.3 \times 10^{-4}$.

#1331233

A particle of mass m is moving in a straight line with momentum p. Starting at time $t = 0$, a force F = kt acts in the same direction on the moving particle during time interval T so that its momentum changes from p to $3p$. Here k is a constant. The value of T is?

[✓ **A**] $2\sqrt{\frac{p}{k}}$

B $\sqrt{\frac{2p}{k}}$

C $\sqrt{\frac{2k}{p}}$

D $2\sqrt{\frac{k}{p}}$

Solution

$\frac{dp}{dt} = F = kt$

$\int_P^{3P} dP = \int_O^T ktdt$

$2p = \frac{KT^2}{2}$

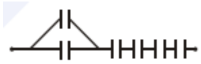
$T = 2\sqrt{\frac{P}{K}}$.

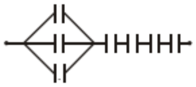
#1331283

Seven capacitors, each of capacitance $2\mu F$, are to be connected in a configuration to obtain an effective capacitance of $\left(\frac{6}{13}\right)\mu F$. Which of the combinations, shown in figures given, will achieve the desired value?

A

B 

C 

D 

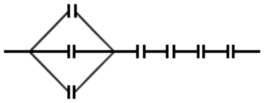
Solution

$C_{eq}=\frac{6}{13}\mu F$

Therefore three capacitors most be in parallel to get 6 in

$$\frac{1}{C_{eq}}=\frac{1}{3C}+\frac{1}{C}+\frac{1}{C}+\frac{1}{C}+\frac{1}{C}$$

$$C_{eq}=\frac{3C}{13}=\frac{6}{13}\mu F.$$



#1331303

An electric field of 1000V/m is applied to an electric dipole at angle of 45^o. The value of electric dipole moment is 10^{-29}C.m. What is the potential energy of the electric dipole?

A -9×10^{-20}J

B -7×10^{-27}J

C -10×10^{-29}J

D -20×10^{-18}J

Solution

$U=-\vec{P}\cdot\vec{E}$

$=-PE\cos\theta$

$=-(10^{-29})(10^{3})\cos45^o$

$=-0.707\times10^{-26}$J

$=-7\times10^{-27}$J.

#1331338

A simple pendulum of length 1m is oscillating with an angular frequency 10 rad/s. The support of the pendulum starts oscillating up and down with a small angular frequency of 1 rad/s and an amplitude of 10^{-2}m. The relative change in the angular frequency of the pendulum is best given by?

A 10^{-3} rad/s

B 10^{-1} rad/s

C 1 rad/s

D 10^{-5} rad/s

Solution

Angular frequency of pendulum

$$\omega = \sqrt{\frac{g_{eff}}{l}}$$

$$\therefore \frac{\Delta\omega}{\omega} = \frac{1}{2}\frac{\Delta g_{eff}}{g_{eff}}$$

$$\Delta\Omega = \frac{1}{2}\frac{\Delta g}{g} \times \omega$$

[$\omega_s =$ angular frequency of support]

$$\Delta\omega = \frac{1}{2} \times \frac{2A\omega_s^2}{100} \times 100$$

$\Delta\omega = 10^{-3}$ rad/s.

#1331359

Two rods A and B of identical dimensions are at temperature 30^oC. If A is heated upto 180^oC and B upto T^oC, then the new lengths are the same. If the ratio of the coefficients of linear expansion of A and B is $4:3$, then the value of T is?

A 270^oC

[✓ B] 230^oC

C 250^oC

D 200^oC

Solution

$\Delta l_1 = \Delta l_2$

$l\alpha_1\Delta T - 1 = l\alpha_2\Delta T_2$

$$\frac{\alpha_1}{\alpha_2} = \frac{\Delta T_1}{\Delta T_2}$$

$$\frac{4}{3} = \frac{T - 30}{180 - 30}$$

$T = 230^oC$.

#1331389

In a double-slit experiment, green light ($5303\overset{o}{A}$) falls on a double slit having a separation of $19.44\ \mu m$ and a width of $4.05\mu m$. The number of bright fringes between the first and the second diffraction minima is?

A 09

B 10

C 04

[✓ D] 05

Solution

For diffraction

location of 1^{st} minima

$$y_1 = \frac{D\lambda}{a} = 0.2469D\lambda$$

Location of 2^{nd} minima

$$y_2 = \frac{2D\lambda}{a} = 0.4938D\lambda$$

Now for interference

Path difference at P.

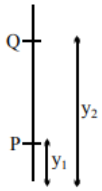
$$\frac{dy}{D} = 4.8\lambda$$

path difference at Q

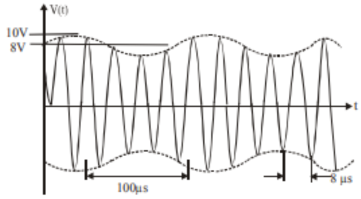
$$\frac{dy}{D} = 9.6\lambda$$

So orders of maxima in between P & Q is $5, 6, 7, 8, 9$

So 5 bright fringes all present between P & Q.



#1331416



An amplitude modulated signal is plotted given:

Which one of the following best describes the given signal?

A $(9 + \sin(2.5\pi \times 10^5 t))\sin(2\pi \times 10^4 t)V$

B $(9 + \sin(4\pi \times 10^4 t))\sin(5\pi \times 10^5 t)V$

C $(1 + 9\sin(2\pi \times 10^4 t))\sin(2.5\pi \times 10^5 t)V$

$\boxed{\text{D}}$ $(9 + \sin(2\pi \times 10^4 t))\sin(2.5\pi \times 10^5 t)V$

Solution

Analysis of graph says

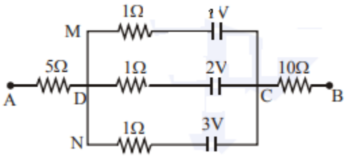
(1) Amplitude varies as $8 - 10$V or 9 ± 1

(2) Two time period as $100\ \mu s$ (signal wave) & $8\mu s$ (carrier wave)

Hence signal is $\left[9 \pm 1\sin\left(\frac{2\pi t}{T_1}\right)\right]\sin\left(\frac{2\pi t}{T_2}\right)$

$= 9 \pm 1\sin(2\pi \times 10^4 t)\sin 2.5\pi \times 10^5 t.$

#1331436



In the circuit, the potential difference between A and B is?

A 6 V

B 1 V

C 3 V

[✓ D] 2 V

Solution

Potential difference across AB will be equal to battery equivalent across CD

$$V_{AB} = V_{CD} = \frac{\frac{E_1}{r_1} + \frac{E_2}{r_2} + \frac{E_3}{r_3}}{\frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3}} = \frac{\frac{1}{1} + \frac{2}{1} + \frac{3}{1}}{\frac{1}{1} + \frac{1}{1} + \frac{1}{1}}$$

$$= \frac{6}{3} = 2V.$$

#1331459

A 27mW laser beam has a cross-sectional area of 10 mm^2. The magnitude of the maximum electric field in this electromagnetic wave is given by?[Given permittivity of space $\in_0 = 9 \times 10^{-12}$SI units, Speed of light $c = 3 \times 10^8$ m/s]

A 1 kV/m

B 2 kV/m

[✓ C] 1.4 kV/m

D 0.7 kV/m

Solution

Intensity of EM wave is given by

$$I = \frac{Power}{Area} = \frac{1}{2}\varepsilon_0 E_0^2 C$$

$$\frac{27 \times 10^{-3}}{10 \times 10^{-6}} = \frac{1}{2} \times 9 \times 10^{-12} \times E^2 \times 3 \times 10^8$$

$$E = \sqrt{2} \times 10^3 \text{ kV/m}$$

= 1.4 kv/m.

#1331477

A pendulum is executing simple harmonic motion and its maximum kinetic energy is K_1. If the length of the pendulum is doubled and it performs simple harmonic motion with the same amplitude as in the first case, its maximum kinetic energy is K_2. Then?

A $K_2 = \frac{K_1}{4}$

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

[✓ C] $K_2 = 2K_1$

D $K_2 = K_1$

Solution

Maximum kinetic energy $= 1/2m\omega^2A^2$

$\omega = \sqrt{\frac{g}{L}}$

$A = L\theta$

$KE = 1/2m\frac{g}{L} \times L^2\theta^2$, KE $= 1/2mgL\theta^2$

$K_1 = 1/2mgL\theta^2$

If length is doubled

$K_2 = 1/2mg(2L)\theta^2$

$\frac{K_1}{K_2} = \frac{1/2mgl\theta^2}{1/2mg(2L)\theta^2} = \frac{1}{2}$

$K_2 = 2K_1$

#1331499

In a hydrogen like atom, when an electron jumps from the M-shell to the L-shell, the wavelength of emitted radiation is λ. If an electron jumps from N-shell to the L-shell, the wavelength of emitted radiation will be?

A $\frac{27}{20}\lambda$

B $\frac{16}{25}\lambda$

[✓ C] $\frac{20}{27}\lambda$

D $\frac{25}{16}\lambda$

Solution

For M → L steel

$\frac{1}{\lambda} = K\left(\frac{1}{2^2} - \frac{1}{3^2}\right) = \frac{K \times 5}{36}$

for N → L

$\frac{1}{\lambda'} = K\left(\frac{1}{2^2} - \frac{1}{4^2}\right) = \frac{K \times 3}{16}$

$\lambda' = \frac{20}{27}\lambda.$

#1331527

If speed(V), acceleration(A) and force(F) are considered as fundamental units, the dimension of Young's modulus will be?

A $V^{-2}A^2F^2$

[✓ B] $V^{-4}A^2F$

C $V^{-4}A^{-2}F$

D $V^{-2}A^2F^{-2}$

Solution

$$\frac{F}{A} = y \cdot \frac{\Delta l}{l}$$

$$[Y] = \frac{F}{A}$$

Now from dimension

$$F = \frac{ML}{T^2}$$

$$L = \frac{F}{M} \cdot T^2$$

$$L^2 = \frac{F^2}{M^2}\left(\frac{V}{A}\right)^4$$

$$\because\ T = \frac{V}{A}$$

$$L^2 = \frac{F^2}{M^2A^2}\frac{v^4}{A^2}\ F = MA$$

$$L^2 = \frac{V^4}{A^2}$$

$$[Y] = \frac{[F]}{[A]} = F^1V^{-4}A^2.$$

#1331568

A particle moves from the point $(2.0\hat{i} + 40\hat{j})m$, at $t = 0$, with an initial velocity $(5.0\hat{i} + 4.0\hat{j})ms^{-1}$. It is acted upon by a constant force which produces a constant acceleration $(4.0\hat{i} + 4.0\hat{j})ms^{-2}$. What is the distance of the particle from the origin at time $2s$?

$\boxed{\text{A}}$ $20\sqrt{2}$m

B $10\sqrt{2}$m

C 5m

D 15m

Solution

$$\vec{s} = (5\hat{i} + 4\hat{j})2 + \frac{1}{2}(4\hat{i} + 4\hat{j})4$$

$$= 10\hat{i} + 8\hat{j} + 8\hat{i} + 8\hat{j}$$

$$\vec{r_f} = \vec{r_i} = 18\hat{i} + 16\hat{j}$$

$$\vec{r_f} = 20\hat{i} + 20\hat{j}$$

$$|\vec{r_f}| = 20\sqrt{2}.$$

#1331583

A monochromatic light is incident at a certain angle on an equivalent triangle prism and suffers minimum deviation. If the refractive index of the material of the prims is $\sqrt{3}$, then the angle of incidence is?

A 30^o

B 45^o

C 90^o

$\boxed{\text{D}}$ 60^o

Solution

$$i = e$$

$$r_1 = r_2 = \frac{A}{2} = 30^o$$

by Snell's law

$$1 \times \sin i = \sqrt{3} \times \frac{1}{2} = \frac{\sqrt{3}}{2}$$

$$i = 60.$$

#1331604

A galvanometer having a resistance of 20Ω and 30 divisions on both sides has figure of merit 0.005 ampere/division. The resistance that should be connected in series such that it can be used as a voltmeter upto 15 volt, is?

[✓ A] 80Ω

B 120Ω

C 125Ω

D 100Ω

Solution

$R_g = 20\Omega$

$N_L = N_R = N = 30$

$FOM = \frac{I}{\phi} = 0.005$A/Div,

Current sensitivity $= \mathrm{CS} = \left(\frac{1}{0.005}\right) = \frac{\phi}{I}$

$Ig_{max} = 0.005 \times 30$

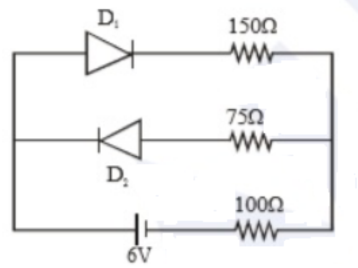
$= 15 \times 10^{-2} = 0.15$

$15 = 0.15[20 + R]$

$100 = 20 + R$

$R = 80.$

#1331616



The circuit shown given contains two ideal diodes, each with a forward resistance of 50Ω. If the battery voltage is 6V, the current through the 100Ω resistance (in Amperes) is?

A 0.027

[✓ B] 0.020

C 0.030

D 0.036

Solution

$I = \frac{6}{300} = 0.002$($D_2$ is in reverse bias).

#1331641

When 100g of a liquid A at 100^oC is added to 50g of a liquid B at temperature 75^oC, the temperature of the mixture becomes 90^oC. The temperature of the mixture, if 100g of liquid A at 100^oC is added to 50g of liquid B at 50^oC, will be?

[✓ A] 80^oC

B 60^oC

C 70^oC

D $85^{o}C$

Solution

$100 \times S_A \times [100 - 90] = 50 \times S_B \times (90 - 75)$

$2S_A = 1.5S_B$

$S_A = \frac{3}{4}S_B$

Now, $100 \times S_A \times [100 - T] = 50 \times S_B(T = 50)$

$2 \times \left(\frac{3}{4}\right)(100 - T) = (T - 50)$

$300 - 3T = 2T - 100$

$400 = 5T$

$T = 80.$

#1331841

The mass of the diameter of a planet are three times the respective values for the Earth. The period of oscillation of a simple pendulum on the Earth is $2s$. The period of oscillation of the same pendulum on the planet would be?

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

$\boxed{\text{B}}$ $2\sqrt{3}s$

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

D $\frac{3}{2}s$

Solution

$\because g = \frac{GM}{R^2}$

$\frac{g_p}{g_o} = \frac{M_o}{M_o}\left(\frac{R_o}{R_p}\right)^2 = 3\left(\frac{1}{3}\right)^2 = \frac{1}{3}$

Also $T \propto \frac{1}{\sqrt{g}}$

$\Rightarrow \frac{T_p}{T_o} = \sqrt{\frac{g_o}{g_p}} = \sqrt{3}$

$\Rightarrow T_p = 2\sqrt{3}s.$

#1331878

The region between $y = 0$ and $y = d$ contains a magnetic field $\vec{B} = B\hat{z}$. A particle of mass m and charge q enters the region with a velocity $\vec{v} = v\hat{i}$. If $d = \frac{mv}{2qB}$, the acceleration of the charged particle at the point of its emergence at the other side is?

A $\frac{qvB}{m}\left(\frac{\hat{i} + \hat{j}}{\sqrt{2}}\right)$

B $\frac{qvB}{m}\left(\frac{1}{2}\hat{i} - \frac{\sqrt{3}}{\sqrt{2}}\hat{j}\right)$

C $\frac{qvB}{m}\left(\frac{-\hat{j} + \hat{i}}{\sqrt{2}}\right)$

$\boxed{\text{D}}$ None of these

Solution

Here entry points of particle is not given, assuming particle enters from (0,d).

$r = \frac{mv}{qB}$, d = r/2

$a = \frac{qVB}{m}\left[\frac{-\sqrt{3}\hat{i} - \hat{j}}{2}\right]$

This option is not given

#1331908

A thermometer graduated according to a linear scale reads a value x_0 when in contact with boiling water, and $x_0/3$ when in contact with ice. What is the temperature of an object in 0^oC, if this thermometer in the contact with the object reads $x_0/2$?

A 35

[✓ B] 25

C 60

D 40

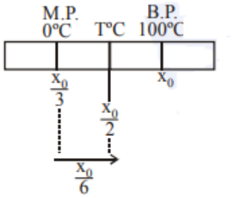
Solution

$\Rightarrow T^oC = \frac{x_0}{6}$ & $\left(x_0 - \frac{x_0}{3}\right) = (100 - 0^oC)$

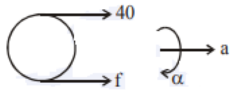
$x_0 = \frac{300}{2}$

$\Rightarrow T^oC = \frac{150}{6} = 25^o$C

I.



#1331943



A string is wound around a hollow cylinder of mass 5kg and radius 0.5m. If the string is now pulled with a horizontal force of 40N, and the cylinder is rolling without slipping on a horizontal surface (see figure), then the angular acceleration of the cylinder will be?(Neglect the mass and thickness of the string)

A 12 rad/s^2

[✓ B] 16 rad/s^2

C 10 rad/s^2

D 20 rad/s^2

Solution

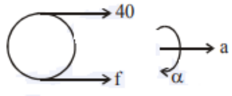
$40 + f = m(R\alpha)$ ..(i)

$40 \times R - f \times R = mR^2\alpha$

$40 - f = mR\alpha$.(ii)

From (i) and (ii)

$\alpha = \frac{40}{mR} = 16$.



#1331980

In a process, temperature and volume of one mole of an ideal monoatomic gas are varied according to the relation $VT = K$, where K is a constant. In this process the temperature of the gas is increased by ΔT. The amount of heat absorbed by gas is? (R is gas constant)

$\boxed{\text{A}}$ $\frac{1}{2}R\Delta T$

B $\frac{3}{2}R\Delta T$

C $\frac{1}{2}KR\Delta T$

D $\frac{2K}{3}\Delta T$

Solution

$VT = K$

$\Rightarrow V\left(\frac{PV}{nR}\right) = k \Rightarrow PV^2 = K$

$\because C = \frac{R}{1-x} + C_V$(For polytropic process)

$C = \frac{R}{1-2} + \frac{3R}{2} = \frac{R}{2}$

$\therefore \Delta Q = nC\Delta T$

$= \frac{R}{2} \times \Delta T$.

#1332016

In a photoelectric experiment, the wavelength of the light incident on a metal is changed from 300nm to 400nm. The decrease in the stopping potential is close to:

$\left(\frac{hc}{e} = 1240nm - V\right)$

A 0.5V

$\boxed{\text{B}}$ 1.0V

C 2.0V

D 1.5V

Solution

$\frac{hc}{\lambda_1} = \phi + eV_1$.(i)

$\frac{hc}{\lambda_2} = \phi + eV_2$ (ii)

(i)-(ii)

$$hc\left(\frac{1}{\lambda_1} - \frac{1}{\lambda_2}\right) = e(V_1 - V_2)$$

$$\Rightarrow V_1 - V_2 = \frac{hc}{e}\left(\frac{\lambda_2 - \lambda_1}{\lambda_1 - \lambda_2}\right)$$

$$= (1240nm - V)\frac{100nm}{300nm \times 400nm}$$

$= 1V.$

#1332044

A metal ball of mass 0.1kg is heated upto 500^{o}C and dropped into a vessel of heat capacity $800\ JK^{-1}$ and containing 0.5 kg water. The initial temperature of water and vessel is 30^{o}C. What is the approximate percentage increment in the temperature of the water? [Specific Heat Capacities of water and metal are, respectively, $4200\ Jkg^{-1}K^{-1}$ and $400\ JKg^{-1}K^{-1}$]

A 30%

[✓ B] 20%

C 25%

D 15%

Solution

$0.1 \times 400 \times (500 - T) = 0.5 \times 4200 \times (T - 30) + 800(T - 30)$

$\Rightarrow 40(500 - T) = (T - 30)(2100 + 800)$

$\Rightarrow 20000 - 40T = 2900T - 30 \times 2900$

$\Rightarrow 20000 + 30 \times 2900 = T(2940)$

$T = 30.4^{o}C$

$\frac{\Delta T}{T} \times 100 = \frac{6.4}{30} \times 100$

$= 20\%.$

#1332061

The magnitude of torque on a particle of mass 1kg is 2.5Nm about the origin. If the force acting on it is 1N, and the distance of the particle from the origin is 5m, the angle between the force and the position vector is?(in radians)

A $\frac{\pi}{8}$

[✓ B] $\frac{\pi}{6}$

C $\frac{\pi}{4}$

D $\frac{\pi}{3}$

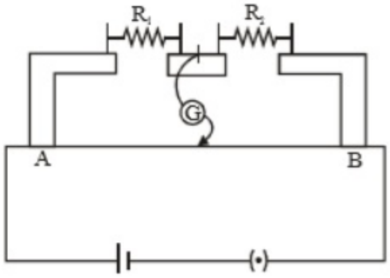
Solution

$2.5 = 1 \times 5\sin\theta$

$\sin\theta = 0.5 = \frac{1}{2}$

$\theta = \frac{\pi}{6}.$

#1332079



In the experimental set up of metre bridge shown in the figure, the null point is obtained at a distance of 40cm from A. If a 10Ω resistor is connected in series with R_1, the null point shifts by 10cm. The resistance that should be connected in parallel with $(R_1 + 10)\Omega$ such that the null point shifts back to its initial position is?

A 40Ω

B 60Ω

C 20Ω

D 30Ω

Solution

$$\frac{R_1}{R_2} = \frac{2}{3} \text{ .(i)}$$

$$\frac{R_1 + 10}{R_2} = 1 \Rightarrow R_1 + 10 = R_2 \text{ ..(ii)}$$

$$\frac{2R_2}{3} + 10 = R_2$$

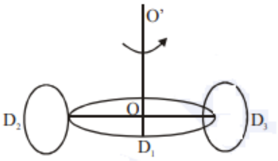
$$10 = \frac{R_2}{3} \Rightarrow R_2 = 30\Omega$$

$\&$ $R_1 = 20\Omega$

$$\frac{\frac{30 \times R}{30 + R}}{30} = \frac{2}{3}$$

$R = 60\Omega$.

#1332088



A circular disc D_1 of mass M and radius R has two identical discs D_2 and D_3 of the same mass M and radius R attached rigidly at its opposite ends(see figure). The moment of inertia of the system about the axis OO', passing through the centre of D_1, as shown in the figure, will be?

A $3MR^2$

B $\frac{2}{3}MR^2$

C MR^2

D $\frac{4}{5}MR^2$

Solution

$$I = \frac{MR^2}{2} + 2\left(\frac{MR^2}{4} + MR^2\right)$$

$$= \frac{MR^2}{2} + \frac{MR^2}{2} + 2MR^2$$

$$= 3MR^2.$$

#1332103

A copper wire is wound on a wooden frame, whose shape is that of an equilateral triangle. If the linear dimension of each side of the frame is increased by a factor of 3, keeping the number of turns of the coil per unit length of the frame the same, then the self inductance of the coil?

A Decrease by a factor of $9\sqrt{3}$

[✓ **B**] Increase by a factor of 3

C Decreases by a factor of 9

D Increases by a factor of 27

Solution

Self inductance $\propto l$

#1332121

A particle of mass m and charge q is in an electric and magnetic field given by $\vec{E} = 2\hat{i} + 3\hat{j}; \vec{B} = 4\hat{j} + 6\hat{k}$. The charged particle is shifted from the origin to the point $P(x = 1; y = 1)$ along a straight path. The magnitude of the total work done is?

A (0.35)q

B (0.15)q

C (2.5)q

[✓ **D**] 5q

Solution

$\vec{F}_{net} = q\vec{E} + q(\vec{v} \times \vec{B})$

$= (2q\hat{i} + 3q\hat{j}) + q(\vec{v} \times \vec{B})$

$W = \vec{F}_{net} \cdot \vec{S}$

$= 2q + 3q$

$= 5q$.

#1333074

The correct option with respect to the pauling electronegativity values of the elements is :

A Ga < Ge

B Si < Al

C P > S

D Te > Se

Solution

B C

Al Si

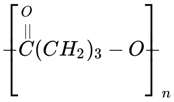
Ga < Ge

Along the period electronegativity increases

#1333085

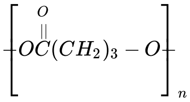
The homopolymer formed from 4-hydroxybutanoic acid is :

A



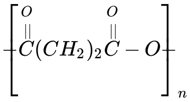
$\left[\overset{O}{\overset{\|}{C}}(CH_2)_3 - O \right]_n$

B



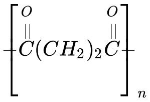
$\left[O\overset{O}{\overset{\|}{C}}(CH_2)_3 - O \right]_n$

C



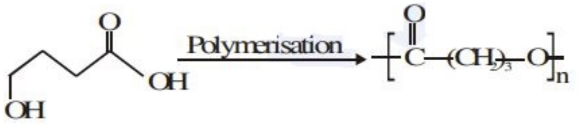
$\left[\overset{O}{\overset{\|}{C}}(CH_2)_2\overset{O}{\overset{\|}{C}} - O \right]_n$

D



$\left[\overset{O}{\overset{\|}{C}}(CH_2)_2\overset{O}{\overset{\|}{C}} \right]_n$

Solution



#1333124

The correct match between Item I and Item II is :

	Item I	Item II
(A)	Ester test	Tyr
(B)	Carbylamine test	Asp
(C)	Phthalein dye test	Ser
		Lys

A $(A) \to (Q); (B) \to (S); (C) \to (P)$

B $(A) \to (R); (B) \to (Q); (C) \to (P)$

C $(A) \to (Q); (B) \to (S); (C) \to (R)$

D $(A) \to (R); (B) \to (S); (C) \to (Q)$

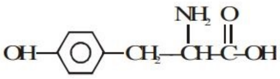
Solution

(A) Ester test (Q) Aspartic acid (Acidic amino acid)

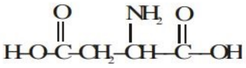
(B) Carbylamine (S) Lysine [NH_2 group present]

(C) Phthalein dye (P) Tyrosine { Phenolic group present)

(P) Tyrosine Tyr

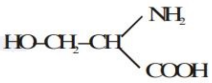


(Q) Aspartic ASP Acid



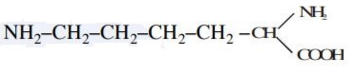
$H-O-\overset{O}{\overset{\|}{C}}-CH_2-\overset{NH_2}{\overset{|}{CH}}-\overset{O}{\overset{\|}{C}}-OH$

(R) Serine Ser



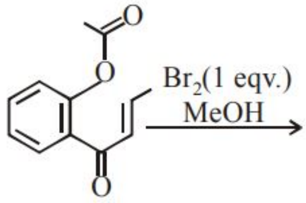
$HO-CH_2-CH(NH_2)(COOH)$

(S) Lysine



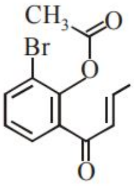
$NH_2-CH_2-CH_2-CH_2-CH_2-CH(NH_2)(COOH)$

#1333169

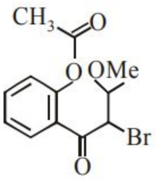


The major product obtained in the following conversion is :

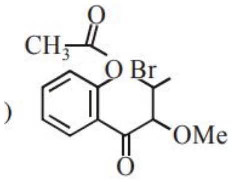
A



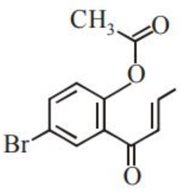
B



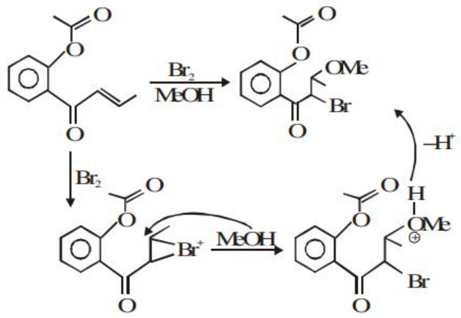
C



D



Solution



#1333206

The number of bridging CO ligand (s) and $CO-CO$ bond (s) in C_2O_3, respectively are:

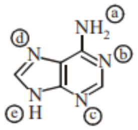
A 0 and 2

B 2 and 0

C 4 and 0

[✓ D] 2 and 1

#1333212



In the following compound, the favourable site/s for protonation is/are:

[✓ A] (b), (c) and (d)

B (a)

C (a) and (e)

D (a) and (d)

Solution

Localised lone pair e^- are favourable sites for protonation so answer would be b,c,d.

#1333220

The higher concentration of which gas in air can cause stiffness of flower buds ?

[✓ A] SO_2

B NO_2

C CO_2

D CO

Solution

Due to acid rain in plants high concentration of SO_2 makes the flower buds stiff and makes them fall.

#1333247

The correct match between item I and item II is

	Item I		Item II
(A)	Allosteric effect	(P)	Molecule binding to the active site of enzyme
(B)	Competitive inhibitor	(Q)	Molecule crucial for communication in the body
(C)	Receptor	(R)	Molecule binding to a site other than the active site of enzyme
(D)	Poison	(S)	Molecule binding to the enzyme covalently

A $(A) \rightarrow (P); (B) \rightarrow (R); (C) \rightarrow (S); (D) \rightarrow (Q)$

B $(A) \rightarrow (R); (B) \rightarrow (P); (C) \rightarrow (S); (D) \rightarrow (Q)$

C $(A) \rightarrow (P); (B) \rightarrow (R); (C) \rightarrow (Q); (D) \rightarrow (S)$

[✓ D] $(A) \rightarrow (R); (B) \rightarrow (P); (C) \rightarrow (Q); (D) \rightarrow (S)$

#1333263

The radius of the largest sphere which fits properly at the centre of the edge of body centred cubic unit cell is:

(Edge length is represented by 'a')

A $0.134a$

B $0.027a$

[✓ C] $0.067a$

D $0.047a$

Solution

$a = 2(R + r)$

$\frac{a}{2} = (R + r)$

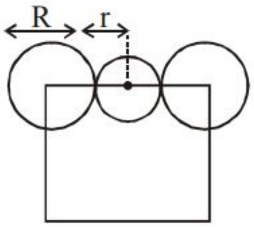
$a\sqrt{3} = 4R$

Using (1) & (2)

$\frac{a}{2} = \frac{a\sqrt{3}}{4} = r$

$a\left(\frac{2-\sqrt{3}}{4}\right) = r$

$r = 0.067a$



#1333271

Among the colloids cheese (C), milk (M) and smoke (S) , the correct combination of the dispersed phase and dispersion medium, respectively is

A C : solid in liquid ; M : solid in liquid ; S : solid in gas

B C: solid is liquid; M : liquid in liquid; S : gas in gas

C C : liquid in solid; M : liquid in solid; S : solid in gas

[✓ D] C : liquid in solid; M : liquid in liquid; S : solid in gas

Solution

	Cheese	Milk	Smoke
Dispersed phase	Liquid	Liquid	Solid
dispersion medium	Solid	Liquid	Gas

#1333395

Taj Mahal is being slowly disfigured and discoloured. this is primarily due to:

A Water pollution

B Global warming

C Soil pollution

[✓ **D**] Acid rain

Solution

Taj Mahal is slowly disfigured and decoloured due to acid rain because acid of water reacts with Calcium Carbonate of Marbel.

#1333412

The reaction that does not define calcination is:

A $ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$

B $Fe_2O_3 \cdot xH_2O \xrightarrow{\Delta} Fe_2O_3 + xH_2O$

C $CaCO_3 \cdot MgCO_3 \xrightarrow{\Delta} CaO + MgO + 2\,CO_2$

[✓ **D**] $2\,Cu_2S + 3\,O_2 \xrightarrow{\Delta} 2\,Cu_2O + 2\,SO_2$

Solution

Calcination in carried out for carbonates and oxide ores in absence of oxygen. Roasting is carried out mainly for sulphide ores in presence of excess of oxygen.

#1333413

The reaction,

$MgO(s) + C(s) \rightarrow Mg(S) + CO(g)$, for which $\Delta_r H^o = +491.1 kJmol^{-1}$ and $\Delta_r S^o = 198.0 JK^{-1} mol^{-1}$ is not feasible at 298 K. Temperature above which reaction will be feasible is :

A 1890.0 K

[✓ **B**] 2480.3 K

C 2040.5 K

D 2380.5 K

Solution

$$T_{eq} = \frac{\Delta H}{\Delta S}$$
$$= \frac{491.1 \times 1000}{198}$$
$$= 2480.3K$$

#1333414

Given the equilibrium constant:

K_c of the reaction:

$Cu(s) + 2Ag^+(aq) \rightarrow Cu^{2+}(aq) + 2Ag(s)$ is 10×10^{25}, calculate the E^o_{cell} of this reaction at $298\ K$

$\left[2.303 \frac{RT}{F} at\ 298\ K = 0.059\ V\right]$

A $0.04736\,V$

[✓ B] $0.4736\,V$

C $0.4736\,mV$

D $0.04736\,mV$

Solution

$$E_{cell} = E^o_{cell} - \frac{0.059}{n} logQ$$

At equilibrium

$$E^o_{cell} = \frac{0.059}{2} log10^{16}$$

$$= 0.059 \times 8$$

$$= 0.472V$$

#1333416

The hydride that is not electron deficent is:

A B_2H_6

B AlH_3

[✓ C] SiH_4

D GaH_3

Solution

(1) B_2H_6 : Electron deficient

(2) AlH_3 : Electron deficient

(3) SiH_4 : Electron prrcise

(4) GaH_3 : Electron deficient

#1333417

The standard reaction Gibbs energy for a chemical reaction at an absolute temperature T is given by $\Delta_r G^o = A - Bt$

Where is A and B are non-zero constants. Which of the following is true about this reaction?

A Exothermic if $B < 0$

B Exothermic is $A > 0$ and $B, 0$

C Endothermic if $A < 0$ and $B > 0$

[✓ D] Endothermic if $A > 0$

#1333419

K_2Hgl_4 is 40% ionised in aqueous solution. The value of its van't Hoff factor (i) is:

[✓ A] 1.8

B 2.2

C 2.0

D 1.6

Solution

For $K_2[Hgl_4]$

$i = 1 + 04(3 - 1)$

$= 1.8$

#1333420

The de Broglie wavelength (λ) associated with a photoelectron varies with the frequency (v) of the incident radiation as, [v_0 is thrshold frequency]:

A $\lambda \propto \frac{1}{(v - v_0)^{\frac{3}{2}}}$

[✓ B] $\lambda \propto \frac{1}{(v - v_0)^{\frac{1}{2}}}$

C a$\lambda \propto \frac{1}{(v - v_0)^{\frac{1}{4}}}$

D $\lambda \propto \frac{1}{(v - v_0)}$

Solution

For electron

$\lambda_{DB} = \frac{\lambda}{\sqrt{2m\,K.E.}}$ (de broglie wavelength)

By photoelectric effect

$hv = hv_0 + KE$

$$\lambda_{DB} = \frac{h}{\sqrt{2m \times (hv - hv_0)}}$$

$$\lambda_{DB} \alpha \frac{1}{(v - v_0)^{\frac{1}{2}}}$$

#1333424

The reaction $2X \rightarrow B$ is a zeroth order reaction. If the initial concentration of X is $0.2\,M$, the half life is $6\,h$. When the initial concentration of X is $0.5\,M$, the times required to reach its final concentration of $0.2\,M$ will be:

[✓ A] $18.0\,h$

B 7.2

C $9.0\,h$

D $12.0\,h$

Solution

For zero order

$[A_0] - [A_1] = kt$

$0.2 - 0.1 = k \times 6$

$k = \frac{1}{60} M/hr$

and $0.5 - 0.2 = \frac{1}{60} \times t$

$t = 18$ hrs.

#1333425

A compound 'X' on treatment with $\frac{Br_2}{NaOH}$, provided C_3H_9N, which gives positive carbylamine test. Compound 'X' is:-

A CH_3COCH_2NHCH

B $CH_3CH_2COCH_2NH_2$

[✓ C] $CH_3CH_2CH_2CHNH_2$

D $CH_2CON(CH_3)_2$

Solution

$[X]\xrightarrow[NaOH]{Br_2}C_3H_9N\xrightarrow[KOH]{CHCl_3}CH_3CH_2CH_2-NC$

Hoff mann's Carbylamine

Bromaide Reaction

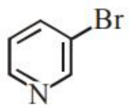
degradation

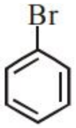
Thus $[X]$ must be aride with oen carbon more than is amine.

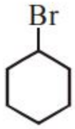
Thus $[X]$ is $CH_3CH_2CH_2CONH_2$

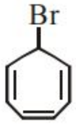
#1333426

Which of the following compounds will produce a precipitate with $AgNO_3$?

A


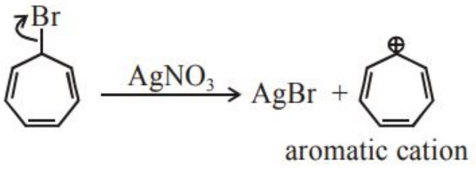
B


C


[✓ D]


Solution

As it can produce aromatic cation so will produce precipitate with $AgNO_3$.



#1333427

The relative stability of +1 oxidation state of group 13 elements follows the order:

A $Al < Ga < Tl < In$

B $Tl < In < Ga < Al$

C $Al < Ga < In < Tl$

D $Ga < Al < In < Tl$

Solution

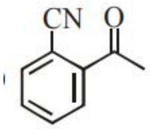
Due to inert pair effect as we move down the group in 13^{th} group lower oxidation state become more stable.

$Al < Ga < In < Tl$

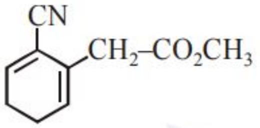
#1333432

Which of the following compounds reacts with ethylmagnesium bromide and also decolourizes bromine water solution?

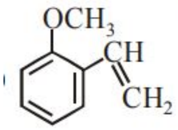
A



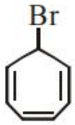
B



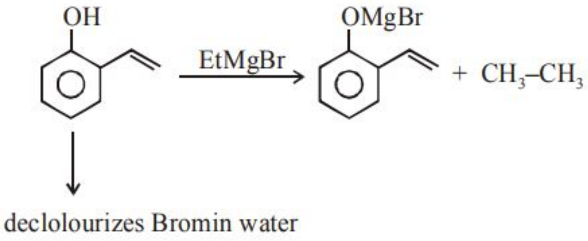
C



D



Solution



#1333436

Match the following items in column I with the corresponding items in column II.

	Column I		Column II
(i)	$Na_2CO_3.10H_2O$	(A)	Portland cement ingredient
(ii)	$Mg(HCO_3)_2$	(B)	Castner Keller process
(iii)	$NaOH$	(C)	Solvay process
(iv)	$Ca_3Al_2O_6$	(D)	Temporary hardness

A $(i) \rightarrow (C); (ii) \rightarrow (B); (iii) \rightarrow (D); (iv) \rightarrow (A)$

B $(i) \rightarrow (C); (ii) \rightarrow (D); (iii) \rightarrow (B); (iv) \rightarrow (A)$

C $(i) \rightarrow (D); (ii) \rightarrow (A); (iii) \rightarrow (B); (iv) \rightarrow (C)$

D $(i) \rightarrow (B); (ii) \rightarrow (C); (iii) \rightarrow (A); (iv) \rightarrow (D)$

Solution

$Na_2CO_3 . 10H_2O \rightarrow$ Solvay process

$Mg(HCO_3)_2 \rightarrow$ Temporary hardness

$NaOH \rightarrow$ Castner - kellner cell

$Ca_3Al_2O_6 \rightarrow$ Portland cement

#1333437

25 ml of the given HCl solution requires 30 mL of 0.1 M sodium carbonate solution. What is the volume of this HCl solution required to titrate 30 mL of 0.2 M aqueous $NaOH$ solution?

$\boxed{\text{A}}$ 25 mL

B 50 mL

C 12.5 mL

D 75 mL

Solution

HCl with Na_2CO_3

Eq. of $HCl =$ eq. of Na_2CO_3

$$\frac{25}{1000} \times M \times 1 = \frac{30}{1000} \times 0.1 \times 2$$
$$M = \frac{6}{25} M$$

Eq of $HCl =$ Eq. of $NaOH$

$$\frac{6}{25} \times 1 \times \frac{V}{1000} = \frac{30}{1000} \times 0.2 \times 1$$
$$V = 25ml$$

#1333439

$$A \xrightarrow{4\,KOH,\,O_2} \underset{(Green)}{2\underline{B}} + 2\,H_2O$$
$$3\underline{B} \xrightarrow{4\,HCl} \underset{(Purple)}{2\underline{C}} + MnO_2 + 2\,H_2O$$
$$2\underline{B} \xrightarrow{H_2O,KI} 2\underline{A} + 2KOH + \underline{D}$$

In the above sequence of reactions, $\underline{A}$ and $\underline{D}$ respectively, are:

A KIO_3 and MnO_2

B KI and K_2MnO_4

$\boxed{\text{C}}$ MnO_2 and KIO_3

D KI and $KMnO_4$

Solution

V

#1333441

The coordination number of Th in $K_4[Th(C_2O_4)_4(OH_2)_2]$ is:

($C_2O_4^{2-}$ = Oxalato)

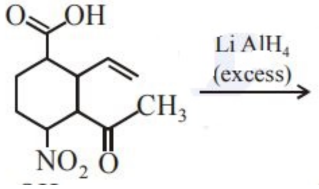
A 6

$\boxed{\text{B}}$ 10

C 14

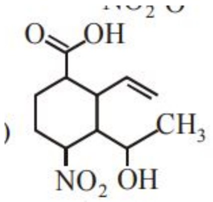
D 8

#1333444

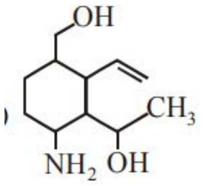


The major product obtained in the following reaction is:

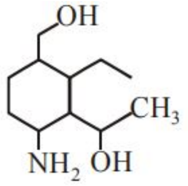
A



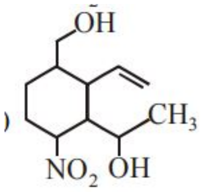
B



C

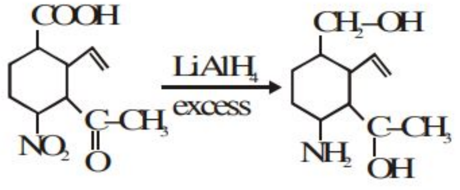


D

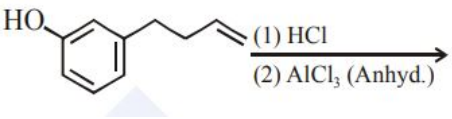


Solution

$LiAlH_4$ will not affect $C = C$ in this compound.

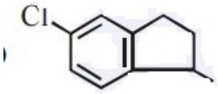


#1333446

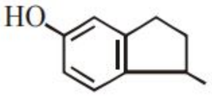


The major product of the following reaction is:

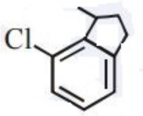
A



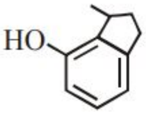
B



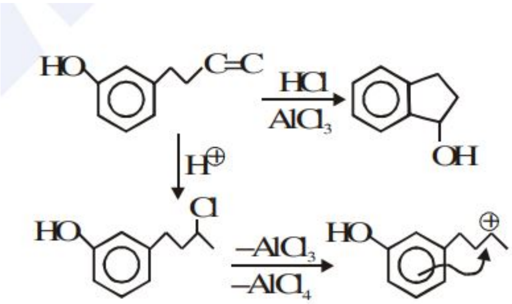
C



D



Solution



#1333450

For the equilibrium, $2H_2O \rightleftharpoons H_3O^+ + OH^-$, the value of ΔG^o at 298 K is approximately:

A $-80 kJmol^{-1}$

B $-100\, kJ\, mol^{-1}$

C $100\, kJ\, mol^{-1}$

D $80\, kJ\, mol^{-1}$

Solution

$2H_2O = H_3O^+ + OH^- \quad K = 10^{-14}$

$\Delta G^o = -RT\ell nK$

$= \dfrac{-8.314}{1000} \times 298 \times \ell n10^{-14}$

$= 80\, KJ/Mole$

#1331530

If the point $(2, \alpha, \beta)$ lies on the plane which passes through the points $(3, 4, 2)$ and $(7, 0, 6)$ and is perpendicular to the plane $2x - 5y = 15$,then $2\alpha - 3\beta$ is equal to:

A 5

B 17

C 12

[✓ **D**] 7

Solution

Let the equation of plane through $(3, 4, 2)$ *be*

$a(x - 3) + b(y - 4) + c(z - 2) = 0 \quad \Rightarrow (1)$

It also passes through $(7, 0, 6)$

$\therefore a(7 - 3) + b(0 - 4) + c(6 - 2) = 0$

$\therefore 4a - 4b + 4c = 0$

$\therefore a - b + c = 0 \quad \Rightarrow (2)$

Also eq(1) *is perpendicular to plane* $2x - 5y - 15 = 0$

$\therefore 2a - 5b + 0c = 0 \quad \Rightarrow (3)$

Solving eq(2) *and* (3) *we get*

$\frac{a}{5} = \frac{b}{2} = \frac{c}{-3} = \lambda$

$a = 5\lambda, \quad b = 2\lambda, \quad c = -3\lambda$

Putting these values in eq(1), *we get*

$5\lambda(x - 3) + 2\lambda(y - 4) - 3\lambda(z - 2) = 0$

$5x - 15 + 2y - 8 - 3z + 6 = 0$

$\therefore 5x + 2y - 3z = 17 \quad \Rightarrow (4)$

This is the required equation of plane

Now, point$(2, \alpha, \beta)$ *lies on this plane eq*(4)

$\therefore 5 \times 2 + 2\alpha - 3\beta = 17$

$\therefore 2\alpha - 3\beta = 7$

#1331631

Let α and β be the roots of the quadratic equation $x^2 \sin\theta - x(\sin\theta\cos\theta + 1) + \cos\theta = 0$

$(0 < \theta < 45^o)$, and $\alpha < \beta$. Then $\sum_{n=0}^{\infty}\left(a^n + \frac{(-1)^n}{\beta^n}\right)$ is equal to:

[✓ **A**] $\frac{1}{1 - cos\theta} + \frac{1}{1 + sin\theta}$

B $\frac{1}{1 + cos\theta} + \frac{1}{1 - sin\theta}$

C $\frac{1}{1 - cos\theta} - \frac{1}{1 + sin\theta}$

D $\frac{1}{1+cos\theta}-\frac{1}{1-sin\theta}$

Solution

$D=(1+sin\theta\, cos\theta)^2-4sin\theta\, cos\theta)^2$

= roots are $\beta = cos\theta$ and $\alpha = cos\theta$

$\Rightarrow \Sigma_{n=0}^{\infty}\left(a^n+\frac{(-1)^n}{\beta^n}\right)=\Sigma_{n=0}^{\infty}(cos\theta)^n+\underset{nn=0}{\overset{\infty}{}}(-sin\theta)^n$

$=\frac{1}{1-cos\theta}+\frac{1}{1+sin\theta}$

#1331663

Let K be the set of all real values of x where the function $f(x)=sin|x|-|x|+2(x-\pi)cos|x|$ is not differentiable. Then the set K is equal to:

A $\{\pi\}$

B $\{0\}$

$\boxed{\text{C}}$ $\phi(an\ empty\ set)$

D $\{0,\pi\}$

Solution

$f(x)=\sin|x|-|x|+2(x-\pi)\cos x$

$\sin|x|-|x|$ *is differentiable function at* $x=0$

$K=\phi$

#1331686

Let the length of the latus rectum of an ellipse with its major axis along x-axis and center at the origin, be 8. If the distance between the foci of this ellipse is equal to the length of its minor axis, then when one of the following points lies on it?

A $(4\sqrt{3},2\sqrt{3})$

$\boxed{\text{B}}$ $(4\sqrt{3},2\sqrt{2})$

C $(4\sqrt{2},2\sqrt{2})$

D $(4\sqrt{2},2\sqrt{3})$

Solution

$\frac{2b^2}{a}=8 and 2ae=2b$

$\Longrightarrow \frac{b}{a}=e\ and\ 1-e^2=e^2\Longrightarrow e=\frac{1}{\sqrt{2}}$

$\Longrightarrow b=4\sqrt{2}\ and\ a+8$

so equation of ellipse is $\frac{x^2}{64}+\frac{y^2}{32}=1$

#1331721

If the area of the triangle whose one vertex is at the vertex of the parabola, $y^2+4(x-a^2)=0$ and the other two vertices are the points on intersection on the parabola and y-axis is $250\ sq.$ units, then a value of 'a' is:

A $5\sqrt{5}$

B $(10)^{\frac{2}{3}}$

C $5\left(2^{\frac{1}{3}}\right)$

D 5

Solution

Rearranging eq $y^2 + 4(x - a^2) = 0$

$\frac{-y^2}{4} + a^2 = x$

here $a = \frac{-1}{4}, \quad b = 0, \quad c = a^2$

$\therefore$ *vertex* $\left(a^2, \ \frac{-b}{2a} = 0,\right)$

$\therefore$ *other vertices formed due to intersection of this parabola and* $y-$ *axis* $(0, 2a)$ $(0, \ -2a)$

$\therefore$ *Area of triangle formed* $= \frac{1}{2} \times 4a \times a^2 = 250$ *sq. units*

$\therefore 2a^3 = 250$

$\therefore a^3 = 125$

$\therefore a = 5$ *units*

Vertex is $(a^2, 0)$

$y^2 = -4(x - a^2)$,and$x = 0 \Rightarrow (0, \ \pm 2a)$

Area of triangle is $= \frac{1}{2}.4a.(a^2) = 250$

$\Rightarrow a^3 = 125$ *or* $a = 5$

#1331780

The integral $\int_{\pi/4}^{\pi/6} \frac{dx}{\sin 2x(\tan^5 x + \cot^5 x)}$ equals:

A $\frac{1}{10}\left(\frac{\pi}{4} - \tan^{-1}\left(\frac{1}{9\sqrt{3}}\right)\right)$

B $\frac{1}{5}\left(\frac{\pi}{4} - \tan^{-1}\left(\frac{1}{3\sqrt{3}}\right)\right)$

C $\frac{\pi}{10}$

D $\frac{1}{20}\tan^{-1}\left(\frac{1}{9\sqrt{3}}\right)$

Solution

$I = \int_{\frac{\pi}{6}}^{\frac{\pi}{4}} \frac{\sec^2 x \, dx}{2\tan x(\tan^5 x + \cot^5 x)}$

$\tan x = t = \int_{\frac{1}{\sqrt{3}}}^{1} \frac{dt}{2t\left(t^5 + \frac{1}{t^5}\right)} = \int_{\frac{1}{\sqrt{3}}}^{1} \frac{t^4 dt}{2(t^{10} + 1)}$

$t^5 = p \Rightarrow t^4 dt = \frac{dp}{5}$

$= \int_{3^{-\frac{5}{2}}}^{1} \frac{1}{2(p^2 + 1)} \frac{dp}{5} = \frac{1}{10}(\tan^{-1} p)_{3^{-\frac{5}{2}}}^{1} = \frac{1}{10}\left(\frac{\pi}{4} - \tan^{-1} 3^{\frac{-5}{2}}\right) = \frac{1}{10}\left(\frac{\pi}{4} - \tan^{-1}\frac{1}{9\sqrt{3}}\right)$

#1331895

Let a function f:$(0, \infty) \to (0, \infty)$ will be defined by $f(x) = \left|1 - \frac{1}{x}\right|$. Then f is:

[✓ A] Injective only

B Not injective but it is surjective

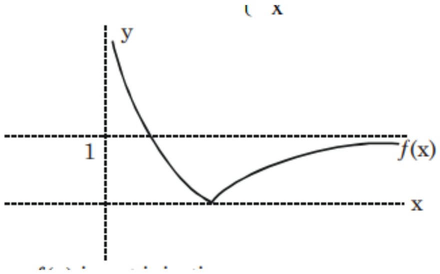
C Both injective as well as surjective

D Neither injective nor surjective

Solution

$$f(x) = \left|1 - \frac{1}{x}\right| = \frac{|x-1|}{x} = \begin{cases} \frac{1-x}{x} & 0 < x \leq 1 \\ \frac{x-1}{x} & x \geq 1 \end{cases}$$

$\Rightarrow f(x)$ is not injective



#1331929

Let $S = \{1, 2, \ldots, 20\}$.A subset B of S is said to be "nice", if the sum of the elements of B is 203. Then the probability that a randomly chosen subset of S is "nice" is:

A $\frac{6}{2^{20}}$

[✓ B] $\frac{5}{2^{20}}$

C $\frac{4}{2^{20}}$

D $\frac{7}{2^{20}}$

Solution

total no. of ways subset of S can be formed = 2^{20}

no. of ways in which word nice comes if sum of the elements = 203

sum of all elements of S = $\frac{21 \times 20}{2} = 210$

so sets can be

$\{1, 2, \ldots .5, 6, 8 .....20\}$ in this 7 is ommited and this formation of sum can be done in $5(7, (1, 6), (2, 5), (3, 4), (1, 2, 4))$ ways

probability=$\frac{5}{2^{20}}$

#1331993

Two lines $\frac{x-3}{1} = \frac{y+1}{3} = \frac{z-6}{-1}$ and $\frac{x+5}{7} = \frac{y-2}{-6} = \frac{z-3}{4}$ intersect at the point R. The reflection of R in the xy-plane has coordinates:

A $(2, 4, 7)$

B $(-2, 4, 7)$

[✓ C] $(2, -4, -7)$

D $(2, -4, 7)$

Solution

Point on $L_1(\lambda + 3, 3\lambda - 1, -\lambda + 6)$

Point on $L_2(7\mu - 5, -6\mu + 2, 4\mu + 3)$

$\Rightarrow \lambda + 3 = 7\mu - 5 \quad ...(i)$

$3\lambda - 1 = -6\mu + 2 \qquad ...(ii) \Rightarrow \lambda = -1, \mu = 1$

Point $R(2, -4, 7)$

Reflection is $(2, -4, -7)$

#1332032

The number of functions f from $\{1, 2, 3, ...20\}$ onto $\{1, 2, 3, ..., 20\}$ such that $f(k)$ is a multiple of 3, whenever k is a multiple of 4, is:

$\boxed{\text{A}}$ $(15)! \times 6!$

B $5^6 \times 15$

C $5! \times 6!$

D $6^5 \times (15)!$

Solution

$f(x) = 3m(3, 6, 9, 12, 15, 18)$

for $k = 4, 8, 12, 16, 206.5.4.3.2$ ways

For rest numbers $15!$ ways

Total ways =$6!(15!)$

#1332050

Contrapositive of the statement

"If two numbers are not equal, then their squares are not equal." is:

$\boxed{\text{A}}$ If the square of two numbers are equal, then the numbers are equal.

B If the square of two numbers are equal, then the numbers are not equal.

C If the square of two numbers are not equal, then the numbers are equal.

D If the square of two numbers are not equal, then the numbers are not equal.

Solution

Contrapositive of $p \rightarrow q$ is $\sim q \rightarrow \sim p$

#1332065

The solution of the differential equation,

$\dfrac{dy}{dx} = (x - y)^2$, when $y(1) = 1$, is :

A $log_e\left|\dfrac{2 - y}{2 - x}\right| = 2(y - 1)$

B $log_e\left|\dfrac{2 - x}{2 - y}\right| = x - y$

C $-log_e\left|\dfrac{1 + x - y}{1 - x + y}\right| = x + y - 2$

$\boxed{\text{D}}$ $-log_e\left|\dfrac{1 - x + y}{1 + x - y}\right| = 2(x - 1)$

Solution

$x - y = t \Rightarrow \frac{dy}{dx} = 1 - \frac{dt}{dx}$

$\Rightarrow 1 - \frac{dt}{dx} \Rightarrow \int \frac{dt}{1 - t^2} = \int 1 dx$

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

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

$\frac{1}{2} ln(1) = 1 + \lambda \Rightarrow \lambda = -1$

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

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

#1332100

Let A and B be two invertible matrices of order 3×3. If det $(ABA^T) = 8$ and det $(AB^{-1}) = 8$, then det $(BA^{-1}B^T)$ is equal to:

A 16

[✓ **B**] $\frac{1}{16}$

C $\frac{1}{4}$

D 1

Solution

$|A|^2. |B| = 8$ and $\frac{|A|}{|B|} = 8$(On substituting the value of $|A|$ in teh equations we get)

$\Rightarrow |A| = 4$ and $|B| = \frac{1}{2}$

$det(BA^{-1}. B^T) = \frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$

#1332454

Let $(x + 10)^{50} + (x - 10)^{50} = a_0 + a_1x + a_2x^2 + ... + a_{50}x^{50}$, for all $x \in R$ then $\frac{a_2}{a_0}$ is equal to:-

A 12.50

B 12.00

C 12.75

[✓ **D**] 12.25

Solution

Given:- $(x+10)^{50}+(x-10)^{50}=a_0+a_1x+a_2x^2+..........+a_{50}x^{50}$

To find:- $\frac{a_2}{a_0}=\frac{\text{coefficient of } x^2}{\text{Coefficient of } x^0}$

As we know that, the general term in an expansion $(a+b)^n$ is given as,

$T_{r+1}={}^nC_r(a)^{n-r}(b)^r$

Now,

General term of $(x+10)^{50}$-

Here,

$a=x, b=10$

$T_{r+1}={}^{50}C_r(x)^{50-r}(10)^r$

For coefficient of x^2-

$50-r=2\Rightarrow r=48$

$T_{48+1}={}^{50}C_{48}(x)^{50-48}(10)^{48}$

$T_{49}={}^{50}C_{48}(10)^{48}x^2$

For coeficient of x^0-

$50-r=0\Rightarrow r=50$

$T_{50+1}={}^{50}C_{50}(x)^{50-50}(10)^{50}$

$T_{51}={}^{50}C_{50}(10)^{50}x^0$

Now,

General term of $(x+(-10))^{50}$-

Here,

$a=x, b=-10$

$T_{r+1}={}^{50}C_r(x)^{50-r}(-10)^r$

For coeficient of x^2-

$50-r=2\Rightarrow r=48$

$T_{48+1}={}^{50}C_{48}(x)^{50-48}(-10)^{48}$

$T_{49}={}^{50}C_{48}(10)^{48}x^2$

For coeficient of x^0-

$50-r=0\Rightarrow r=50$

$T_{50+1}={}^{50}C_{50}(x)^{50-50}(-10)^{50}$

$T_{51}={}^{50}C_{50}(10)^{50}x^0$

Now from the given expansion,

$a_2={}^{50}C_{48}(10)^{48}+{}^{50}C_{48}(10)^{48}={}^{50}C_{48}\left((10)^{48}+(10)^{48}\right)$

$a_0={}^{50}C_{50}(10)^{50}+{}^{50}C_{50}(10)^{50}={}^{50}C_{50}\left((10)^{50}+(10)^{50}\right)$

Now,

$$\frac{a_2}{a_0}=\frac{{}^{50}C_{48}\left((10)^{48}+(10)^{48}\right)}{{}^{50}C_{50}\left((10)^{50}+(10)^{50}\right)}$$

As we know that,

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

Therefore,

$$\frac{a_2}{a_0}=\frac{50\times49}{2}\times\left(\frac{10^{48}}{10^{50}}\right)$$

$$\Rightarrow\frac{a_2}{a_0}=\frac{49}{4}=12.25$$

Let $x = 0$

$a_0 = 10^{50} + 10^{50} = 2^{50}$

derivative of the equation =

$50(x+10)^{49} + 50(x-10)^{49} = a_1 + 2a_2x + ... + 50a_{50}x^{49}$

Differentiate it once again

$50 \times 49(x+10)^{48} + 50 \times 49(x-10)^{48} = 2a_2 + ...50 \times 49a_{50}x^{48}$

put the value $x = 0$

$a_2 = {}^{50}C_2 10^{48} + {}^{50}C_2 10^{48}$

on solving we get, $\frac{a_2}{a_0} = \frac{{}^{50}C_2 10^{48} + {}^{50}C_2 10^{48}}{210^{48}} = \frac{{}^{50}C_2}{100} = \frac{50 \times 49}{2 \times 100} = \frac{49}{4} = 12.25$

#1332508

If $\int \frac{x+1}{\sqrt{2x-1}}dx = f(x)\sqrt{2x-1} + C$ where C is a constant of integration, then $f(x)$ is equal to:

$\boxed{\text{A}}$ $\frac{1}{3}(x+4)$

B $\frac{1}{3}(x+1)$

C $\frac{2}{3}(x+2)$

D $\frac{2}{3}(x-4)$

Solution

$\sqrt{2x-1} = t \Longrightarrow 2x - 1 = t^2 \Longrightarrow 2dx = 2t.\ dt$

$$\int \frac{x+1}{\sqrt{2x-1}}dx = \int \frac{\frac{t^2+1}{2}}{t}\, t\, dt = \int \frac{t^2+3}{2}$$

$$= \frac{1}{2}\left(\frac{t^3}{3} + 3t\right) = \frac{t}{6}(t^2+9) + c$$

$$= \sqrt{2x-1}\left(\frac{2x-1+9}{6}\right) + c = \sqrt{2x-1}\left(\frac{x+4}{3}\right) + c$$

$$\Longrightarrow f(x) = \frac{x+4}{3}$$

#1332579

A bag contains 30 white balls and 10 red balls. 16 balls are drawn one by one randomly from the bag with replacement. If X be the number of white balls drawn, the $\frac{\text{mean of X}}{\text{standard deviation of X}}$ is equal to:-

A 4

B $\frac{4\sqrt{3}}{3}$

$\boxed{\text{C}}$ $4\sqrt{3}$

D $3\sqrt{2}$

Solution

p (probability of getting white ball) $= \frac{30}{40}$

$q = \frac{1}{4}$ and $n = 16$

mean $= np = 16.\frac{3}{4} = 12$ and standard deviation $= \sqrt{npq} = \sqrt{16\frac{3}{4}.\frac{1}{4}} = \sqrt{3}$

$\frac{\text{mean of X}}{\text{standard deviation of X}} = \frac{12}{\sqrt{3}} = 4\sqrt{3}$

#1332622

If in a parallelogram $ABCD$, the coordinate of A, B and C are respectively $(1, 2)$, $(3, 4)$ and $(2, 5)$, then the equation of the diagonal BD is:-

A $5x + 3y - 11 = 0$

B $3x - 5y + 7 = 0$

C $3x + 5y - 13 = 0$

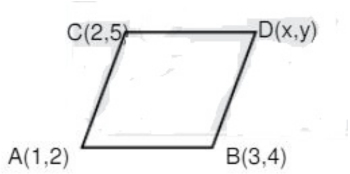
D $5x - 3y + 1 = 0$

Solution

Let let coordinates of D are x and y then $x + 1 = 5$, $y + 2 = 9$

$x = 4$, $y = 7$

Only above coordinates statisfied by $5x - 3y + 1 = 0$



#1332699

If a hyperbola has length of its conjugate axis equal to 5 and the distance between its foci is 13, then teh eccentricity of the hyperbola is:-

A 2

B $\frac{13}{6}$

C $\frac{13}{8}$

D $\frac{13}{12}$

Solution

$2b = 5$ and $2ae = 13$

$b^2 = a^2(e^2 - 1) \Rightarrow \frac{25}{4} = \frac{169}{4} - a^2$

$\Rightarrow a = 6 \Rightarrow e = \frac{13}{12}$

#1332728

The area (in sq. units) in the first quadrant bounded by the parabola, $y = x^2 + 1$, the tangent to it at the point $(2, 5)$ and the coordinate axes is:-

A $\frac{14}{3}$

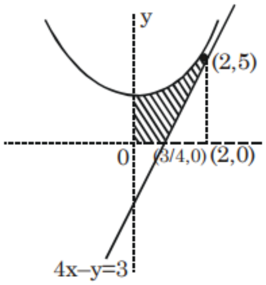
B $\frac{187}{24}$

[✓ **C**] $\frac{37}{24}$

D $\frac{8}{3}$

Solution

Area $= \int_0^2 (x^2+1)dx - \frac{1}{2}\left(\frac{5}{4}\right)(5) = \frac{37}{24}$



#1333466

Let $\sqrt{3}\hat{i}+\hat{j}, \hat{i}+\sqrt{3}\hat{j}$ and $\beta\hat{i}+(1-\beta)\hat{j}$ respectively be the position vectors of the points A, B and c with respect to the origin O. if the distance of C from the bisector of the acute angle between OA and OB is $\frac{3}{\sqrt{2}}$, then the sum of all possible values of β is

A 2

[✓ **B**] 1

C 3

D 4

Solution

$tan\theta\ of A, B = 30^0, 60^0$

bisector of A,B is at angle $= 45^0$

equation of bisector $= \hat{i}+\hat{j}$

distance$= (\beta-1)^2+(1-\beta-1)^2 = \frac{9}{2}$

$4\beta^2-4\beta-7=0$

sum of values of $\beta = 1$

#1333485

If $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix}$

$=(a+b+c)(x+a+b+c)^2, x\neq 0$ and $a+b+c\neq 0$, then is equal to:-

A $-(a+b+c)$

B $2(a+b+c)$

C abc

[✓ **D**] $-2(a+b+c)$

Solution

$$\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix}$$

$R_1 \rightarrow R_1 + R_2 + R_3$

$$= \begin{vmatrix} a+b+c & a+b+c & a+b+c \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix}$$

$$= (a+b+c)\begin{vmatrix} 1 & 0 & 0 \\ 2b & -(a+b+c) & 0 \\ 2c & 2c & c-a-b \end{vmatrix}$$

$(a+b+c)(a+b+c)^2$

$\Rightarrow x = -2(a+b+c)$

#1333530

Let $s_n = 1 + q + Q^2 + \ldots\ldots\ldots\ldots\ldots\ldots + q^n$ and

$$T_n = 1 + \left(\frac{q+1}{2}\right) + \left(\frac{q+1}{2}\right)^2 + \ldots\ldots\ldots \left(\frac{q+1}{2}\right)^n$$

where q is a real number and q $\neq$ 1.

If ${}^{101}C_1 + 101^{C_2}.\, S_1 + \ldots\ldots + 101^{C}_{101}.\, S_{100} = \alpha T_{100},\ then\ \alpha$ is equal to :-

[✓ **A**] 2^{100}

B 200

C 2^{99}

D 202

Solution

$101^{C}_{1} + 101^{C}2S1 + \ldots\ldots\ldots + 101^{C}101S_{100} = \alpha T_1 00$

${}^{101}C1 + 101^{c}2(1+q) + 101^{c}3(1+q+q^2) + \ldots\ldots + {}^{101}C_{101}(1+q+\ldots\ldots + q^1 00)$

$$2\alpha\left(1 - \left(\frac{1+q}{1-q}\right)^{101}\right)$$

$\Rightarrow {}^{101}C_1(1-q + {}^{101}C_2(1-q^2) + \ldots\ldots + {}^{101}C_{101}(1-q^{101})$

$$2\alpha\left(1 - \left(\frac{1+q}{1-q}\right)^{101}\right)$$

$(2^{101} - 1) - ((1 + q^{101} - 1)$

$$2\alpha\left(1 - \left(\frac{1+q}{1-q}\right)^{101}\right)$$

$2\alpha\left(1 - \left(\frac{1+q}{1-q}\right)^{101}\right)$ =2 \alpha $2\alpha\left(1 - \left(\frac{1+q}{1-q}\right)^{101}\right)$

$\alpha = 2^{100}$

#1333540

A circle cuts a chord of length $4a$ on the x-axis and passes through a point on the y-axis, distant $2b$ from the origin. Then the locus of the centre of the circle, is:-

A A hyperbola

[✓ **B**] A parabola

C A straight line

D An ellipse

Solution

Let equation of circle is

$x^2 + y^2 + 2fx + 2fy + e = 0,$ *it passes through*$(0, 2b)$

$\Rightarrow 0 + 4b^2 2g \times 0 + 4f + c = 0$

$\Rightarrow 4b^2 + 4f + c = 0......(i)$

$2\sqrt{g^2 - c = 4a}$ ......(ii)

$g^2 - c = 4a^2 \Rightarrow C = (g^2 - 4a^2)$

Putting in equation (1)

$\Rightarrow 4b^2 + 4f + g^2 - 4a^2 = 0$

$\Rightarrow x^2 + 4y + 4(b^2 - a^2) = 0$, it represent a parabola

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#1333585

If 19th term of a non-zero $A.P$ is zero, then its (49th term) : (29th term) is :-

[✓ **A**] $3:1$

B $4:1$

C $2:1$

D $1:3$

Solution

$a + 18d = 0$ ....(1)

$$\frac{a + 48d}{a + 28d} = \frac{-18d + 48d}{-18d + 28d} = \frac{3}{1}$$

#1333633

Let f(x) = $\dfrac{x}{\sqrt{a^2 + x^2}} - \dfrac{d - x}{\sqrt{b^2 + (d - x)^2}}$ ' $x \in R$,

Where a, b and d are non - zero real constants. Then :-

A f is a decreasing function of x

B f is neither increasing nor decreasing function of x

C f' is not continuous function of x

[✓ **D**] f is an increasing function of x

Solution

$$f'(x) = \frac{\sqrt{a^2 + x^2} - \dfrac{x^2}{\sqrt{a^2 + x^2}}}{(a^2 + x^2)} - \frac{-\sqrt{b^2 + (d - x)^2} + \dfrac{(d - x)^2}{\sqrt{b^2 + (d - x)^2}}}{b^2 + (d - x)^2}$$

$$= \frac{a^2}{(a^2 + x^2)^{3/2}} + \frac{b^2}{(b^2 + (d - x)^2)^{3/2}}$$

Hence $f(x)$ is increasing.

#1333654

Let z be a complex number such that $|z| + z = 3 + i$ (where $i = \sqrt{-1}$). Then $|z|$ is equal to:-

A $\dfrac{5}{4}$

B $\frac{\sqrt{41}}{4}$

C $\frac{\sqrt{34}}{3}$

[✓ **D**] $\frac{5}{3}$

Solution

$|z| + z = 3 + i$

44z = 3 - |z| + i44

$Let 3 - |z| = a \implies |z| = (3 - a)$

$\implies z = a + i \implies |z| = \sqrt{a^2 + 1}$

$\implies 9 + a^2 - 6a = a^2 + 1 \implies a = \frac{8}{6} = \frac{4}{3}$

$\implies |z| = 3 - \frac{4}{3} = \frac{5}{3}$

#1333672

All x satisfying the inequality

$(\cot^{-1}x)^2 - 7(\cot^{-1}x) +) + 10 > 0$, lie in the interval:-

A $(-\infty, \cot 5) \cup (\cot 4, \cot 2)$

B $(\cot 5, \cot 4)$$$

C $(\cot 2, \infty)$

[✓ **D**] $(-\infty, \cot\ 5) \cup (\cot\ 2,\ \infty)$

Solution

let $\cot^{-1}x = t$

$t^2 - 7t + 10 > 0$

on factorizing,

$(t - 2)(t - 5) > 0$

$\cot^{-1}x = 2, 5$

$x = \cot 2, \cot 5$

on plotting the x on wavy curve

we get $x\ lie\ in(-\infty, \cot 5) \cup (\cot 2, \infty)$

#1333701

Given $\frac{b+c}{11} = \frac{c+a}{12} = \frac{a+b}{13}$ for a ΔABC with usual notation. If $\frac{cosA}{\alpha} = \frac{cosB}{\beta} = \frac{cosC}{\gamma}$, then the ordered triad (α, β, γ) has a value:-

A (3, 4, 5)

B (19, 7, 25)

[✓ **C**] (7, 19, 25)

D (5, 12, 13)

Solution

$b + c = 11\ \lambda, c + a = 12\lambda, a = b = 13\lambda$

$\implies a = 7\lambda, b = 5\lambda, c = 5\lambda$

(using cosine formula)

$cosA = \frac{1}{5}, cosB = \frac{19}{35}, cosC = \frac{5}{7}$

$\alpha : \beta : \gamma \implies 7 : 19 : 25$

#1333833

Let x, y be positive real number and m, n positive integers. The maximum value of the expression

$\frac{x^m y^n}{(1+x^{2m})(1+y^{2n})}$ is :-

A $\frac{1}{2}$

[✓ B] $\frac{1}{4}$

C $\frac{m+n}{6mn}$

D 1

Solution

$$\frac{x^m y^n}{(1+x^{2m})(1+y^{2n)}}$$

Divide by $x^m y^n$

$$= \frac{1}{\left(\frac{1}{x^m}+x^m\right)\left(\frac{1}{y^n}+y^n\right)}$$

$$\frac{1}{x^m}+x^m \geq 2, \frac{1}{y^n}+y^n \geq 2$$

There by maximum value of $\frac{x^m y^n}{(1+x^{2m})(1+y^{2n})} = \frac{1}{2 \times 2}$

#1333848

$\lim_{x \to 0} \frac{xcot(4x)}{sin^2 xcot^2(2x)}$ is equal to :-

A 2

B 0

C 4

[✓ D] 1

Solution

$$\lim_{x \to 0} \frac{x\cot(4x)}{\sin^2 x\cot^2(2x)}$$

$$= lim_{x \to 0} \frac{x\tan^2 x}{\tan 4x \sin^2 x}$$

$$= lim_{x \to 0} \frac{x\left(\frac{\tan^2 2x}{4x^2}\right)4x^2}{\left(\frac{\tan 4x}{4x}\right)4x\left(\frac{\sin^2 x}{x^2}\right)x^2} = 1$$