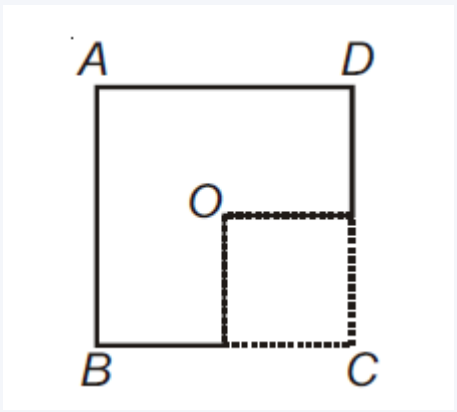
Question Review

All

From a uniform square plate, one-fourth part is removed as shown. The centre of mass of remaining part will lie on

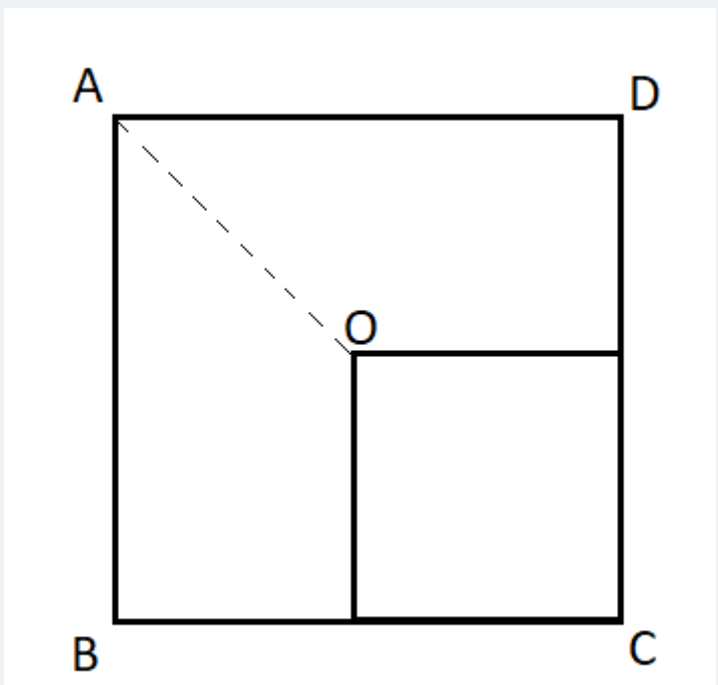


- OC
- OA
- OB
- OD

EXPLANATIONS

Report

Centre of mass will lie on the line of symmetry.



OA is the line of symmetry of the remaining part.

A ball is released from the top of a tower. The ratio of work done by force of gravity in first, second and third second of the motion of the ball is

- 1:2:3
- 1:4:9

1:3:5

1:5:3

EXPLANATIONS

Report

48 % were correct!

When the ball is released from the top of tower then ratio of distances covered by the ball in first, second and third second

$h_I : h_{\text{II}} : h_M = 1 : 3 : 5 : \quad [\text{because } h_n \propto (2n-1)]$

$\therefore$ Ratio of work done $mgh_I : mgh_I : mgh_M = 1 : 3 : 5$

A motorcyclist of mass *m* is to negotiate a curve of radius *r* with a speed *v*. The minimum value of the coefficient of friction so that this negotiation may take place safely, is

v^2rg

$\frac{v^2}{gr}$

$\frac{gr}{v^2}$

$\frac{g}{v^2r}$

The unit of inductance is

Volt/Ampere

Joule/Ampere

(Volt × sec)/Ampere

(Volt × Ampere)/sec

EXPLANATIONS

Report

54 % were correct!

Emf induced in a conductor

$$E = L\frac{di}{dt}$$

$$\Rightarrow L = \frac{\text{Volt} \times \text{sec}}{\text{Ampere}}$$

A ball is projected vertically down with an initial velocity from a height of 20 *m* onto a horizontal floor. During the impact it loses 50% of its energy and rebounds to the same height. The initial velocity of its projection is

20m/s

15 m/s

10 m/s

5 m/s

EXPLANATIONS

Report

49 % were correct!

Let ball is projected vertically downward with velocity *v* from height *h*

Total energy at point $A = \frac{1}{2}mv^2 + mgh$

During collision loss of energy is 50% and the ball rises up to same height. It means it possess only potential energy at same level.

$$50\% \left(\frac{1}{2}mv^2 + mgh\right) = mgh$$

$$\frac{1}{2}\left(\frac{1}{2}mv^2 + mgh\right) = mgh$$

$$v = \sqrt{2gh} = \sqrt{2 \times 10 \times 20}$$

$$\therefore v = 20\text{m/s}$$

A proton and a deutron both having the same kinetic energy, enter perpendicularly into a uniform magnetic field B. For motion of proton and deutron on circular path of radius R_p and R_d respectively, the correct statement is

$R_d = \sqrt{2} R_p$

$R_d = R_p/\sqrt{2}$

$R_d = R_p$

$R_d = 2R_p$

EXPLANATIONS

Report

39 % were correct!

We have $F_{\text{Magnetic}} = F_{\text{Centrifugal}}$

$$\Rightarrow Bqv = \frac{mv^2}{R}$$

For proton $R_p = \frac{m_p v}{qB} = \frac{\sqrt{2m_p E}}{qB}$ $\left[E = \frac{1}{2}mv^2 \Rightarrow v = \sqrt{\frac{2E}{m}}\right]$

And for deutron $R_d = \dfrac{\sqrt{2m_dE}}{qB}$

$$\Rightarrow \quad \frac{R_d}{R_p} = \sqrt{\frac{m_d}{m_p}} = \sqrt{2}$$

$$\Rightarrow R_d = \sqrt{2}R_p$$

The half-life of a radioactive substance is 48 hours. How much time will it take to disintegrate to its $\dfrac{1}{16}$ *th* part

- 12 *h*
- 16 *h*
- 48 *h*
- 192 *h*

EXPLANATIONS Report

76 % were correct!

$$\frac{N}{N_0} = \left(\frac{1}{2}\right)^{t/T} \Rightarrow \frac{1}{16} = \left(\frac{1}{2}\right)^{t/48}$$

$$\Rightarrow \left(\frac{1}{2}\right)^{4} = \left(\frac{1}{2}\right)^{t/48} \Rightarrow t = 192 \text{ hour.}$$

There are n similar conductors each of resistance R. The resultant resistance comes out to be x when connected in parallel. If they are connected in series, the resistance comes out to be

- x/n^2
- n^2x
- x/n
- nx

EXPLANATIONS Report

74 % were correct!

Resistance of a single conductor $= R$

In parallel connection, equivalent resistance $x = \dfrac{R}{n} \quad R = nx$

In series connection, equivalent resistance $= R + R + R \ldots n \text{ times } = nR = n(nx) = n^2X$

In an isochoric process if $T_1 = 27^oC$ and $T_2 = 127^oC$, then P_1/P_2 will be equal to

- 9 / 59
- 2 / 3
- 3 / 4
- None of these

EXPLANATIONS Report

76 % were correct!

At constant volume, $P \propto T$

$$\Rightarrow \frac{P_1}{P_2} = \frac{T_1}{T_2}$$

$$\Rightarrow \frac{P_1}{P_2} = \frac{300}{400} = \frac{3}{4}$$

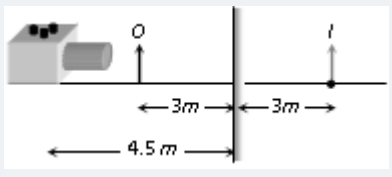
It is desired to photograph the image of an object placed at a distance of 3m from the plane mirror. The camera which is at a distance of 4.5m from the mirror, should be focussed for a distance of

- 3m
- 4.5m
- 6m
- 7.5m

EXPLANATIONS Report

56 % were correct!

F_o using distance of image = 4.5 m + 3 m = 7.5 m.



A Carnot engine absorbs an amount Q of heat from a reservoir at an abosolute temperature T and rejects heat to a sink at a temperature of $T/3$. The amount of heat rejected is

- Q / 4
- Q / 3

Q / 2

2Q / 3

EXPLANATIONS Report

54 % were correct!

Let $Q_1 = Q$ be the heat absorbed from the reservoir and Q_2 be the heat rejected to the sink.

$$\eta = 1 - \frac{T_2}{T_1} = \frac{W}{Q_1}$$

Given $T_2 = \frac{T_1}{3} = \frac{T}{3}$,

$$\Rightarrow 1 - \frac{T/3}{T} = \frac{W}{Q_1}$$

$$\Rightarrow \frac{2}{3} = \frac{Q_1 - Q_2}{Q_1}$$

$$\Rightarrow \frac{2}{3} = 1 - \frac{Q_2}{Q_1}$$

$$\Rightarrow \frac{Q_2}{Q_1} = \frac{1}{3}$$

$$\Rightarrow Q_2 = \frac{Q_1}{3} = \frac{Q}{3}$$

A weightless thread can support tension upto 30 N. A stone of mass 0.5 kg is tied to it and is revolved in a circular path of radius 2 m in a vertical plane. If $g = 10m/s^2$, then the maximum angular velocity of the stone will be

5 rad/s

$\sqrt{30}$ rad/s

$\sqrt{60}$ rad/s

10 rad/s

EXPLANATIONS Report

44 % were correct!

$$T_{\max} = m\omega^2_{\max} r + mg$$

$$\Rightarrow \frac{T_{\max}}{m} = \omega^2 r + g$$

$$\Rightarrow \frac{30}{0.5} = \omega^2{}_{\max} r + 10$$

$$\Rightarrow \omega_{\max} = \sqrt{\frac{50}{r}} = \sqrt{\frac{50}{2}} = 5\, rad/s$$

The angle between the planes $3x - 4y + 5z = 0$ and $2x - y - 2z = 5$ is :

- $\frac{\pi}{3}$
- $\frac{\pi}{2}$
- $\frac{\pi}{6}$
- None of these

EXPLANATIONS Report

73 % were correct!

$$\theta = \cos^{-1}\left[\frac{6 + 4 - 10}{\sqrt{50}\sqrt{9}}\right] = \cos^{-1}(0) = \frac{\pi}{2}.$$

Aliter: Checking for perpendicularity: $3 \cdot 2 - 4 \cdot (-1) + 5 \cdot (-2) = 6 + 4 - 10 = 0$

Product of real roots of the equation $t^2x^2 + |x| + 9 = 0$

- is always positive
- is always negative
- does not exist
- none of these

EXPLANATIONS Report

57 % were correct!

Product of real roots $= \frac{9}{t^2} > 0$ for all $t \in R$

$\therefore$ Product of real roots is always positive.

The angle between the pair of lines $2x^2 - 4xy - 2y^2 = 0$ is:

- 0^o
- 60^o
- 90^o

- ○ none of these

EXPLANATIONS Report

72 % were correct!

Since $a + b = 0$, the lines are perpendicular.

$$\int \frac{1}{x} dx, (x \neq 0) =$$

- ○ ln x + c
- ○ ln |x| + c
- ○ $-\frac{1}{x^2}$ + c
- ○ none of these

EXPLANATIONS Report

57 % were correct!

For $x > 0$,

$$\frac{d}{dx} \ln x = 1/x$$

For $x < 0$

$$\frac{d}{dx} \ln(-x) = -\frac{d}{d(-x)} \ln(-x) = -\frac{1}{-x} = \frac{1}{x}$$

So, $\int \frac{1}{x} dx = \ln |x| + c$

The equivalent function of $\log x^2$ is

- ○ 2 log x
- ○ 2 log |x|
- ○ |log x^2|
- ○ $(\log x)^2$

EXPLANATIONS Report

56 % were correct!

As $\log x$ is defined for only positive values of *x*. But $\log x^2$ defined for all real values of *x*, also $\log |x|$ is also defined for all real *x*. Hence $\log x^2$ and $2 \log |x|$ are identical functions.

$$\int_0^1 0dx =$$

0

constant

not determined

meaningless

EXPLANATIONS Report

43 % were correct!

We have,

$$\int 0dx = c$$

So,

$$\int_0^1 0dx = c - c = 0$$

$\vec{a}.\vec{b} = 0$, then

a ⊥ b

a = b = 0

a = 0 or b = 0

(a) or (c)

EXPLANATIONS Report

45 % were correct!

$a \cdot b = ab\cos\theta$

So, $a \cdot b = 0 \Rightarrow a = 0\, or\, b = 0\, or\, \theta = \pi/2$

The area of triangle formed by $\frac{x}{5} + \frac{y}{6} = 1$ with cartesian axes is:

30

15

60

14

EXPLANATIONS

Report

80 % were correct!

The line $\frac{x}{5}+\frac{y}{6}=1$ cuts cartesian axes at $(5,0)$ and $(0,6)$.

These points along with $(0,0)$ form a right angled triangle with legs 5 and 6.

So the area is 15.

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