Question Review

All

The principle of conservation of linear momentum can be strictly applied during a collision between two particles provided the time of impact is

- Extremely small
- Moderately small
- Extremely large
- Depends on a particular case

A uniform magnetic field B is acting from south to north and is of magnitude 1.5 Wb/m^2. If a proton having mass $= 1.7 \times 10^{-27}\ kg$ and charge $= 1.6 \times 10^{-19}\ C$ moves in this field vertically downwards with energy 5 MeV, then the force acting on it will be

- 7.4×10^{12} N
- 7.4×10^{-12} N
- 7.4×10^{19} N
- 7.4×10^{-19} N

EXPLANATIONS

Report

60 % were correct!

$F = qvB$ and $K = \frac{1}{2}mv^2$

$\Rightarrow F = qB\sqrt{\frac{2k}{m}}$

$$= 1.6 \times 10^{-19} \times 1.5\sqrt{\frac{2 \times 5 \times 10^6 \times 1.6 \times 10^{-19}}{1.7 \times 10^{-27}}}$$

$$= 7.344 \times 10^{-12}\ N$$

The dimensions of thermal resistance are

- $M^{-1}L^{-2}T^{3}K$
- $ML^{2}T^{-2}K^{-1}$

○ $ML^2T^{-3}K$

○ $ML^2T^{-2}K^{-2}$

EXPLANATIONS Report

38 % were correct!

$$\frac{Q}{t} = \frac{KA\Delta\theta}{l} = \frac{\Delta\theta}{(l/KA)} = \frac{\Delta\theta}{R}\left(R = \frac{l}{KA} = \text{Thermal resistance}\right)$$

$$\therefore R = \frac{l}{KA} = \left[\frac{L}{MLT^{-3}K^{-1} \times L^2}\right] = [M^{-1}L^{-2}T^3K]$$

Positive rays in discharge tube is also called

○ Cathode rays

◉ Canal rays

○ Both a and b

○ None of these

EXPLANATIONS Report

38 % were correct!

Canal rays is the another name of anode rays which consists of positively charged particles.

The electric intensity due to an infinite cylinder of radius R and having charge q per unit length at a distance $r(r > R)$ from its axis is

○ Directly proportional to r^2

○ Directly proportional to r^3

◉ Inversely proportional to r

○ Inversely proportional to r^2

EXPLANATIONS Report

52 % were correct!

According to Gauss law,

$$\oint E \cdot ds = \frac{ql}{\varepsilon_0}$$

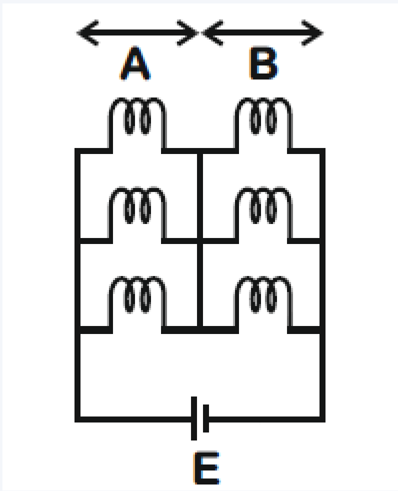
(E is constant)

$$E \oint ds = \frac{ql}{\varepsilon_0}$$

We have, $\oint ds = 2\pi rl$

$$\therefore E \cdot 2\pi rl = \frac{ql}{\varepsilon_0} \Rightarrow E = \frac{q}{2\pi\varepsilon_0 r} \text{ i.e. } E \propto \frac{1}{r}$$

Six identical bulbs are connected as shown in the figure with a DC source of emf E and zero internal resistance. The ratio of power consumption by the bulbs when (i) all are glowing and (ii) in the situation when two from section A and one from section B are glowing, will be



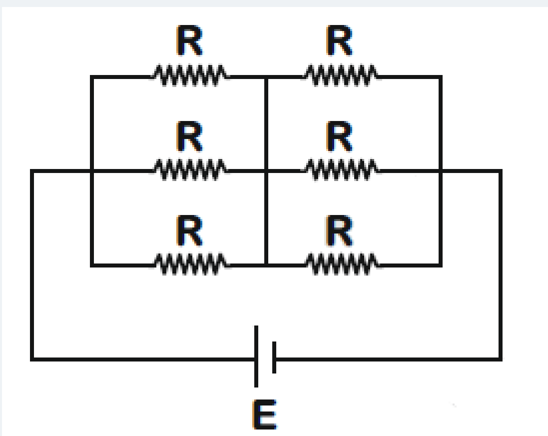
- 4:9
- 9:4
- 1:2
- 2:1

EXPLANATIONS

Report

53 % were correct!

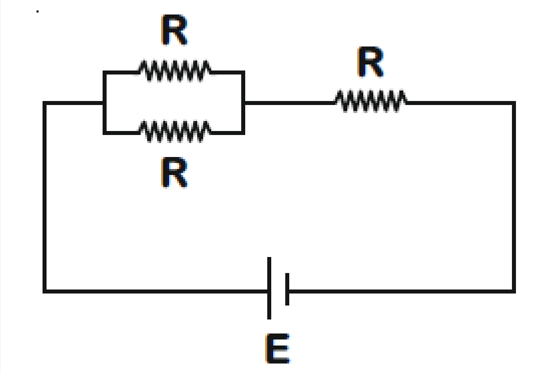
(i) When all bulbs are glowing,



$$R_{eq} = \frac{R}{3} + \frac{R}{3} = \frac{2R}{3}$$

Power $P_{(i)} = \frac{E^2}{R_{eq}} = \frac{3E^2}{2R} \quad \ldots(1)$

(ii) When two from section A and one from section B are glowing,



$$R_{eq} = \frac{R}{2} + R = \frac{3R}{2}$$

Power $P_{(ii)} = \frac{2E^2}{3R} \quad \ldots(2)$

$$\therefore \frac{P_{(i)}}{P_{(ii)}} = \frac{\frac{3E^2}{2R}}{\frac{2E^2}{3R}} = 9:4$$

A charged particle is suspended in equilibrium in a uniform vertical electric field of intensity 20000 V/m. If mass of the particle is 9.6×10^{-16}kg, the charge on it and excess number of electrons on the particle are respectively $(g = 10m/s^2)$

- 4.8×10^{-19}C, 3
- 5.8×10^{-19}C, 4
- 3.8×10^{-19}C, 2
- 2.8×10^{-19}C, 1

EXPLANATIONS

Report

76 % were correct!

In equilibrium,

$$QE = mg \Rightarrow n = \frac{mg}{Ee} = \frac{9.6 \times 10^{-16} \times 10}{20,000 \times 1.6 \times 10^{-19}} = 3$$

Two small conducting spheres of equal radius have charges $+10\mu C$ and $-20\mu C$ respectively and placed at a distance R from each other experience force F_1 . If they are brought in contact and separated to the same distance, they experience force F_2 . The ratio of F_1 to F_2 is

- 1 : 8
- − 8 : 1
- 1 : 2
- − 2 : 1

EXPLANATIONS

Report

50 % were correct!

$$F \propto Q_1Q_2 \Rightarrow \frac{F_1}{F_2} = \frac{Q_1Q_2}{Q_1Q_2'} = \frac{10 \times -20}{-5 \times -5} = -\frac{8}{1}$$

A manometer connected to a closed tap reads 3.5 × 10^5 N/m^2. When the valve is opened, the reading of manometer falls to 3.0 × 10^5 N/m^2, then velocity of flow of water is

- 100m/s
- 10m/s
- 1m/s
- 10 $\sqrt{10}$ m/s

EXPLANATIONS

Report

61 % were correct!

Bernoulli's theorem for unit mass of liquid

$$\frac{P}{\rho} + \frac{1}{2}v^2 = \text{constant}$$

As the liquid starts flowing, it pressure energy decreases

$$\frac{1}{2}v^2 = \frac{P_1 - P_2}{\rho} \Rightarrow \frac{1}{2}v^2 = \frac{3.5 \times 10^5 - 3 \times 10^5}{10^3} \Rightarrow v^2$$

$$= \frac{2 \times 0.5 \times 10^5}{10^3} \Rightarrow v^2 = 100 \Rightarrow v = 10\text{m/s}$$

In a Coolidge tube, the potential difference across the tube is 20 kV, and 10 mA current flows through the voltage supply. Only 0.5 % of the energy carried by the electrons striking the target is converted into X-rays. The X-ray beam carries a power of

- 0.1 W
- 1 W
- 2 W
- 10 W

EXPLANATIONS

Report

58 % were correct!

Energy supplied to electrons by Coolidge tube = Charge × Potential Difference to which they are accelerated

i.e. $\text{Energy} = qV$

Power drawn by Coolidge tube for accelerating charges $= \frac{\text{Energy}}{\text{Time}} = \frac{qV}{t} = I \times V = \left(20 \times 10^3 \text{V}\right)\left(10 \times 10^{-3} \text{A}\right) = 200\text{W}$

Power radiated through X-ray beam $= \frac{0.5}{100} \times 200\text{W} = 1\text{W}$

When a 1.0*kg* mass hangs attached to a spring of length 50 *cm*, the spring stretches by 2 *cm*. The mass is pulled down until the length of the spring becomes 60 *cm*. What is the amount of elastic energy stored in the spring in this condition, if $g = 10\ m/s^2$

- 3.0J
- 1.5J
- 2.0J
- 2.5J

EXPLANATIONS

Report

35 % were correct!

Force constant of a spring

$$k = \frac{F}{x} = \frac{mg}{x} = \frac{1 \times 10}{2 \times 10^{-2}} \Rightarrow k = 500\text{Nm}$$

Increment in the length = 60 − 50 = 10 *cm*

$$U = \frac{1}{2}kx^2 = \frac{1}{2}500\left(10 \times 10^{-2}\right)^2 = 2.5J$$

A wheel starts from rest and attains an angular velocity of 20 radian/s after being uniformly accelerated for 10 s. The total angle in radian through which it has turned in 10 second is

- 20π
- 40π
- 100
- 100π

EXPLANATIONS

Report

47 % were correct!

$$\omega_f = \omega_l + \alpha t$$
$$20 = 0 + \alpha(10)$$
$$\alpha = 2\text{rad/s}^2$$

Also,

$\theta = \omega_i t + \frac{1}{2}\alpha t^2$

$\theta = \frac{1}{2}(2)(100)$

$= 100$ radian

If $a = 2i + 2j - k$ and $|x\,a| = 1$, then x =

- $\pm\frac{1}{3}$
- $\pm\frac{1}{4}$
- $\pm\frac{1}{5}$
- $\pm\frac{1}{6}$

EXPLANATIONS

Report

$|xa| = |x||a| \Rightarrow |x|\sqrt{4+4+1} = 1 \Rightarrow x = \pm\frac{1}{3}.$

If $1, a$ and 2 are in HP, then the value of a is:

- 3/4
- 2/3
- 4/3
- none of these

EXPLANATIONS

Report

76 % were correct!

By given $1, a, 2$ are in HP.

So, $a = \frac{2 \times 1 \times 2}{1+2} = 4/3$

If ${}^nP_r = {}^nC_r$, then $r =$

- 0
- 1
- 0,1
- 2

EXPLANATIONS

Report

62 % were correct!

For $r = 0, {}^nP_r = {}^nC_r = 1$

And,

For $r = 1, {}^nP_r = {}^nC_r = n$

If A is any set, then

- $A \cup A' = \phi$
- $A \cup A' = U$
- $A \cap A' = U$
- None of these

EXPLANATIONS

Report

77 % were correct!

By definition, $A' = U - A$

So, $A \cup A' = U$

If $a,\ b,\ c$ are in G.P., then

- a^2, b^2, c^2 are in G.P.
- $a^2(b+c), c^2(a+b), b^2(a+c)$ are in G.P.
- $\frac{a}{b+c}, \frac{b}{c+a}, \frac{c}{a+b}$ are in G.P.
- None of the above

EXPLANATIONS

Report

83 % were correct!

Let r be the common ratio.

The,

$b = ar \Rightarrow b^2 = a^2(r^2)$

$c = ar^2 \Rightarrow c^2 = a^2(r^4)$

Obviously a^2, b^2, c^2 are in GP

$$\int_0^\infty e^{-ax}dx =$$

- $\frac{1}{a}$
- a
- 1
- 0

EXPLANATIONS

Report

56 % were correct!

Let

$$I = \int_0^\infty e^{-ax}dx$$

Put $t = ax \Rightarrow dt = adx$

The limits are not changed. So,

$$I = \frac{1}{a}\int_0^\infty e^{-t}dt$$

$$= \frac{1}{a}\left[-e^{-t}\right]_0^\infty$$

$$= \frac{1}{a}(0+1)$$

$$= \frac{1}{a}$$

Which of the following points lie on the parabola $x^2 = 4ay$

- x = at2, y = 2at
- x = 2at, y = at

- $x = 2at^2, y = at$
- $x = 2at, y = at^2$

EXPLANATIONS

Report

58 % were correct!

Looking the equation, $x^2 = 4ay$,

x should contain t and y should contain t^2.

Let $x = 2at$ Squaring, $x^2 = 4a(at^2)$

So, $x = 2at, y = at^2$ satisfy.

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

- $e^{\sqrt{x}}$
- $\frac{e^{\sqrt{x}}}{2}$
- $2e^{\sqrt{x}}$
- $\sqrt{x} \cdot e^{\sqrt{x}}$

EXPLANATIONS

Report

73 % were correct!

$$\int \frac{e^{\sqrt{x}}}{\sqrt{x}} dx = I \quad \text{(say)}$$

$$\frac{d}{dx} e^{\sqrt{x}} = e^{\sqrt{x}} \times \frac{1}{2} x^{-1/2}$$

$$= \frac{e^{\sqrt{x}}}{2\sqrt{x}}$$

So,

$$I = 2e^{\sqrt{x}}$$

Previous 1 2 Next