Question Review

All

A body of mass 4 *kg* weighs 4.8 *kg* when suspended in a moving lift. The acceleration of the lift is

- 9.8 m/s^2 downwards
- 9.8 m/s^2 upwards
- 1.96 m/s^2 downwards
- **1.96 m/s^2 upwards**

EXPLANATIONS Report

58 % were correct!

The apparent weight of the body is more than its standard weight. Therefore we can say that acceleration of the lift is in upward direction.

$$R = m(g + a) \Rightarrow 4.8g = 4(g + a)$$
$$\Rightarrow a = 0.2g = 1.96\mathrm{m/s^2}$$

When light wave suffers reflection at the interface from air to glass, the change in phase of the reflected wave is equal to

- 0
- $\frac{\pi}{2}$
- **π**
- 2π

EXPLANATIONS Report

36 % were correct!

When light is reflected from denser medium, a phase difference of π always occurs.

A car travelling at a speed of 30 *km/hour* is brought to a halt in 8 *m* by applying brakes. If the same car is travelling at 60 *km/hour*, it can be brought to a halt with the same braking force in

- 8m

- 16m
- 24m
- 32m

EXPLANATIONS Report

56 % were correct!

$s \propto u^2$ i.e. if speed becomes double then stopping distance will become four times *i.e. 8 x 4 = 32m*

If the change in the value of 'g' at a height h above the surface of the earth is the same as at a depth x below it, then (both x and h being much smaller than the radius of the earth)

- x = h
- x = 2h
- $x = \frac{h}{2}$
- $x = h^2$

EXPLANATIONS Report

68 % were correct!

The value of g at the height h from the surface of earth

$$g' = g\left(1 - \frac{2h}{R}\right)$$

The value of g at depth x below the surface of earth

$$g' = g\left(1 - \frac{x}{R}\right)$$

These two are given equal, hence $\left(1 - \frac{2h}{R}\right) = \left(1 - \frac{x}{R}\right)$ On solving, we get $x = 2h$

To get three images of a single object, one should have two plane mirrors at an angle of

- 30°
- 60°
- 90°
- 120°

EXPLANATIONS Report

48 % were correct!

Number of images formed when an object is placed between mirrors inclined at an angle θ° is given by the formula

$$n = \frac{360^\circ}{\theta^0} - 1$$

Given $n = 3$,

$$\Rightarrow 3 = \frac{360^\circ}{\theta^\circ} - 1$$

$$\Rightarrow 4\theta^\circ = 360^\circ$$

$$\Rightarrow \theta^\circ = 90^\circ$$

The momentum of the photon of wavelength 5000$\mathring{A}$ will be

- (●) 1.3 × 10^{-27}kgm/sec
- ( ) 2.6 × 10^{-27}kgm/ sec
- ( ) 3.9 × 10^{-27}kgm/ sec
- ( ) 4.5 × 10^{-27}kgm/ sec

EXPLANATIONS Report

67 % were correct!

$$p = \frac{E}{c} = \frac{hf}{c} = \frac{h}{\lambda} = \frac{6.6 \times 10^{-34}}{\left(5000 \times 10^{-10}\right)} = 1.3 \times 10^{-27} kgm/s$$

An ideal gas undergoes a quasi static, reversible process in which its molar heat capacity C remains constant. If during this process the relation of pressure P and volume V is given by $\mathrm{PV^n}$ = constant, then n is given by (Here $\mathrm{C_P}$ and $\mathrm{C_V}$ are molar specific heat at constant pressure and constant volume, respectively):

- ( ) $n = \frac{C_P}{C - C_V}$
- ( ) $n = \frac{C - C_V}{C - C_P}$
- ( ) $n = \frac{C_P}{C_V}$
- (●) $n = \frac{C - C_P}{C - C_V}$

EXPLANATIONS Report

19 % were correct!

In isobaric process (process in which pressure remains constant),

Molar heat capacity $C = C_p$

Also, $P = \text{const} \Rightarrow PV^0 = \text{constant} \therefore n = 0$

We have,

$C_v = \frac{3}{2}R$ for monoatomic gas

$$C = C_p = C_v + R = \frac{3}{2}R + R = \frac{5}{2}R$$

Now, using the options and verifying n=0 for $C = C_p = \frac{5}{2}R$ and $C_v = \frac{3}{2}R$

we get the correct answer

$$\mathrm{n} = \frac{\mathrm{C} - \mathrm{C_P}}{\mathrm{C} - \mathrm{C_V}}$$

Ionization potential of hydrogen atom is 13.6 eV. Hydrogen atoms in the ground state are excited by monochromatic radiation of photon energy 12.1 eV. The spectral lines emitted by hydrogen atoms according to Bohr's theory will be

- One
- Two
- Three
- Four

EXPLANATIONS

Report

45 % were correct!

Final energy of electron $= -13.6 + 12.1 = -1.51\,eV$. which is corresponds to energy of electron in third orbit $i.e. n = 3$.

$$E = -\frac{13.6}{n^2}\ \mathrm{eV} = -\frac{13.6}{3^2}\ \mathrm{eV} = -1.51\ \mathrm{eV}$$

When electron falls from 3^{rd} orbit to 1^{st} orbit, number of spectral lines emitted is given as $= \frac{n(n-1)}{2} = \frac{3(3-1)}{2} = 3$

This is because following electron transition can occur:-

S/N.	From	To
1	3	2
2	2	1
3	3	1

If the increase in the kinetic energy of a body is 22%, then the increase in the momentum will be

- ○ 22%
- ○ 44%
- ◉ 10%
- ○ 300%

EXPLANATIONS Report

60 % were correct!

$P = \sqrt{2mE}$. If m is constant then

$$\frac{P_2}{P_1} = \sqrt{\frac{E_2}{E_1}} = \sqrt{\frac{1.22E}{E}} \Rightarrow \frac{P_2}{P_1} = \sqrt{1.22} = 1.1$$

$$\Rightarrow P_2 = 1.1P_1 \Rightarrow P_2 = P_1 + 0.1P_1 = P_1 + 10\% \text{ of } P_1$$

So the momentum will increase by 10%

The radius of the orbital of electron in the hydrogen atom 0.5 Å. The speed of the electron is $2 \times 10^6\ m/s$. Then the current in the loop due to the motion of the electron is

- ◉ 1 mA
- ○ 1.5 mA
- ○ 2.5 mA
- ○ 1.5*10^{-2} mA

EXPLANATIONS Report

38 % were correct!

Time period of revolution of electron $T = \frac{2\pi}{\omega} = \frac{2\pi r}{v}$

Hence corresponding electric current $i = \frac{e}{T} = \frac{ev}{2\pi r}$

$$\Rightarrow i = \frac{1.6 \times 10^{-19} \times 2 \times 10^6}{2 \times 3.14 \times 0.5 \times 10^{-10}} = 1mA$$

The phase difference between two waves represented by

$y_1 = 10^{-6}\sin[100t + (x/50) + 0.5]m$
$y_2 = 10^{-6}\cos[100t + (x/50)]m$

where *x* is expressed in metres and *t* is expressed in seconds, is approximately

- ○ 0.5 *rad*

- [x] 1.07 *rad*
- [ ] 1.5 *rad*
- [ ] 2.07 *rad*

EXPLANATIONS Report

39 % were correct!

$y_1 = 10^{-6}\sin[100t + (x/50) + 0.5]$

$y_2 = 10^{-6}\sin\left[100t + \left(\frac{x}{50}\right) + \left(\frac{\pi}{2}\right)\right]$

Phase difference ϕ
$= [100t + (x/50) + 1.57] - [100t + (x/50) + 0.5]$
$= 1.07$ radians.

Two capillaries made of the same material with radii $r_1 = 1mm$ and $r_2 = 2mm$. The rise of the liquid in one capillary is 30 *cm*, then the rise in the other will be

- [ ] 7.5 *cm*
- [x] 15 *cm*
- [ ] 60 *cm*
- [ ] 120 *cm*

EXPLANATIONS Report

73 % were correct!

Capillary rise (h) $= \frac{2T}{rdg}$

$h \propto \frac{1}{r}$

$\therefore \frac{h_2}{h_1} = \frac{r_1}{r_2} = \frac{1}{2} \Rightarrow h_2 = \frac{30}{2} = 15\text{cm}$

$$\int \frac{1}{x\log x}dx =$$

- [ ] log x
- [ ] x log x

- (●) log(log x)
- ( ) none of these

EXPLANATIONS Report

75 % were correct!

$$\frac{d}{dx}\log x = \frac{1}{x}$$

So,

$$\int \frac{1}{x \log x} dx = \log(\log x)$$

The direction cosines of the line $x = y = z$ are

- (●) $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$
- ( ) $\frac{1}{3}, \frac{1}{3}, \frac{1}{3}$
- ( ) 1, 1, 1
- ( ) None of these

EXPLANATIONS Report

73 % were correct!

The line passes through points $(0, 0, 0)$ and $(1, 1, 1)$.

So direction ratios are $1, 1, 1$.

And hence the direction cosines are $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$

If $A = \emptyset$, then, the cardinality of $2^{P(A)}$ is:

- ( ) 0
- ( ) 1
- (●) 2
- ( ) can't be determined

EXPLANATIONS Report

35 % were correct!

The empty set's power set, i.e, $P(A)$ has $2^0 = 1$, i.e, one element, the empty set itself.

So, $P(A) = \{\emptyset\}$

But, its power set, $2^{P(A)}$ will have $2^1 = 2$ elements.

The subsets are the empty set and the set itself.

So, $2^{P(A)} = \{\emptyset, \{\emptyset\}\}$

NOTE: The cardinality of n^{th} power set of the empty set, i.e,the caardinality of $P(P(P(\ldots \text{n times}(\emptyset))\ldots)$ is 2^{n-1}

$$\int \sin^2 x \cos x dx =$$

- $\frac{1}{3}\cos^3 x + c$
- $\sin^3 x + c$
- $\frac{1}{3}\sin^3 x + c$
- none of these

EXPLANATIONS Report

70 % were correct!

Since the derivative of $\sin x$ is $\cos x$,

$$\int \sin^2 x \cos x dx = \frac{1}{3}\sin^3 x + c$$

The first term of a harmonic progression is 1/7 and the second term is 1/9. The 12^{th} term is

- 1/19
- 1/29
- 1/17
- 1/27

EXPLANATIONS Report

82 % were correct!

Here first term of A.P. be 7 and second be 9, then 12^{th} term will be $7 + 11 \times 2 = 29$. Hence 12^{th} term of the H.P. be $\frac{1}{29}$.

The position vectors of A and B are $2i - 9j - 4k$ and $6i - 3j + 8k$ respectively, then the magnitude of $\overrightarrow{AB}$ is

- 11
- 12
- 13
- 14 ✓

EXPLANATIONS Report

78 % were correct!

$\overrightarrow{AB} = (6-2)\mathbf{i} + (-3+9)\mathbf{j} + (8+4)\mathbf{k} = 4\mathbf{i} + 6\mathbf{j} + 12\mathbf{k}$

$$|\overrightarrow{AB}| = \sqrt{16 + 36 + 144} = 14.$$

$\sqrt{-2} \times \sqrt{-3} =$

- $\sqrt{6}$
- $-\sqrt{6}$ ✓
- $i\sqrt{6}$
- none of these

EXPLANATIONS Report

59 % were correct!

$\sqrt{-2}\sqrt{-3} = i\sqrt{2}i\sqrt{3} = i^2\sqrt{6} = -\sqrt{6}$

$\lim_{x \to 1} \frac{1}{|1-x|} =$

- 0
- 1
- 2
- infinity ✓

EXPLANATIONS Report

49 % were correct!

$\lim_{x\to 1-} \frac{1}{1-x|} = \lim_{h\to 0} \frac{1}{1-(1-h)} = \infty$

And, $\lim_{x\to 1+} \frac{1}{1-x|} = \lim_{h\to 0} \frac{1}{1+h-1} = \infty$

Hence $\lim_{x\to 1} \frac{1}{1-x|} = \infty$

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