JEE-Mains-11-04-2023 [Memory Based] [Evening Shift]

Physics

Question: If $\vec{A}=2\hat{i}+36\hat{j}+2\hat{k}$ is subtracted from $\vec{B}$ then it gives $2j$ then mag of $\left(\vec{B}\right)$?

Options:

(a) $\sqrt{21}$

(b) $\sqrt{33}$

(c) $\sqrt{47}$

(d) $\sqrt{51}$

Answer: (b)

Solution:

$\vec{B}-[2\hat{i}+3\hat{j}+2\hat{k}]=2\hat{j}$

$\vec{B}=2\hat{j}+5\hat{j}+2\hat{k}$

$\sqrt{2^2+5^2+2^2}=\sqrt{33}$

Question: In projectile motion **θ** = 30° Time of flight 4 sec find velocity at time 2 s

Options:

(a) $20\sqrt{3}$

(b) $2\sqrt{3}$

(c) $30\sqrt{3}$

(d) $20\sqrt{5}$

Answer: (a)

Solution:

$\frac{2u\sin\theta}{g}=4$

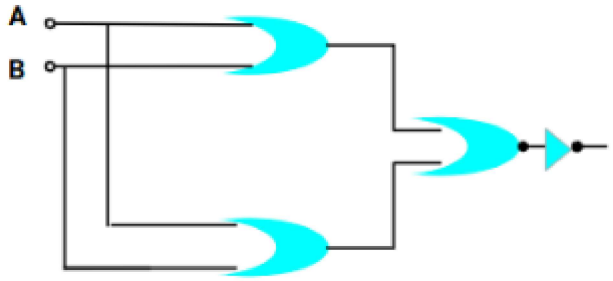
so $\frac{2u}{10}\times\frac{1}{2}=4$

$u=40$

Now at t = 2 particle is at p most point so

$V=u\cos\theta=\frac{40\sqrt{3}}{2}=20\sqrt{3}$

Question: The fact logic gate is:-



Options:
(a) AND
(b) NOR
(c) OR
(d) NAND
Answer: (a)
Solution:
$Y = AB(A + B)$

$Y = A \cdot A \cdot B + AB \cdot B$

$Y = AB + AB = AB$

Question: 8 identical drops are falling in viscous medium with constant velocity of 10 m/s all of them join to form bigger drop, find the velocity of bigger drop
Options:
(a) 10 m/s
(b) 20 m/s
(c) 30 m/s
(d) 40 m/s
Answer: (d)
Solution:
$V \propto r^2$
So
$8\frac{4}{3}\pi r^3 = \frac{4}{3}\pi R^3$

$R = 2r$

$\frac{V_1}{V_2} = \left(\frac{r}{R}\right)^2 = \left(\frac{r}{2r}\right)^2 = \frac{1}{4}$

So $V_2 = 4V_1 = 4 \times 10 = 40$

Question: Mass of 500 gm whose velocity is changing with displacement as v = 10√x. Find force experienced by body
Options:
(a) 15 N
(b) 25 N
(c) 35 N
(d) 45 N
Answer: (b)
Solution:

$$F = ma = mv\frac{dv}{dx}$$
$$= \frac{500}{1000} \times \left(10\sqrt{x}\right) \times \frac{d}{dx}\left(10\sqrt{x}\right)$$
$$= \frac{1}{2} \times 10\sqrt{x} \times 10 \times \frac{1}{2\sqrt{x}}$$
$$= 5 \times 5 = 25\,\text{N}$$

Question: If force, velocity, and time are treated as fundamental quantities then write the dimensional formula of density in terms of F, V, T

Options:

(a) $F^4\ V^4\ T^{-2}$

(b) $F^1\ V^{-4}\ T^{-2}$

(c) $F^{-1}\ V^{-4}\ T^{-2}$

(d) $F^1\ V^4\ T^2$

Answer: (b)

Question: In EM wave that wave moves in +x axis, E = $6.6\,\hat{j}$. Find B

Options:

(a) $-2.2 \times 10^{-8}\ \hat{k}$

(b) $2.2 \times 10^{-8}\ \hat{i}$

(c) $-2.2 \times 10^{-8}\ \hat{i}$

(d) $2.2 \times 10^{-8}\ \hat{k}$

Answer: (d)

Solution:

$$\frac{E}{B} = C$$
$$B = \frac{E}{C}$$

Question: Gravitational potential on the surface of solid sphere V find gravitational potential at the centre of solid sphere

Options:

(a) V/2

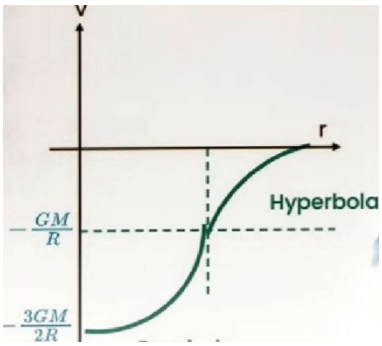
(b) V

(c) 3V/2

(d) 2V

Answer: (c)

Solution:



Question: Ratio of de broglie wavelength of proton and electron if kinetic energy is same ($m_p = 1849m_e$)

Options:

(a) 1/43

(b) 1/107

(c) 1/25

(d) 1/100

Answer: (a)

Solution:

$$\lambda = \frac{h}{\sqrt{2mKE}}$$

$$\text{so } \frac{\lambda_e}{\lambda_p} = \sqrt{\frac{m_p}{m_e}} = \sqrt{\frac{184gm_e}{m_e}} = \sqrt{1849} = 43$$

So 1 : 43

Question: If energy of Hydrogen atom in ground state is -13.6 eV find energy of He+ in first excited state

Options:

(a) –3.4 eV

(b) –9.6 eV

(c) –13.6 eV

(d) None of these

Answer: (c)

Solution:

$$E = \frac{-13.6}{n^2}\left(Z^2\right) \text{ for } H^+$$

E for (n = 2)

$$E = \frac{-13.6}{2^2} \times \left(2^2\right) = -13.6$$

Question: Ray of light strikes a plane mirror with angle of incidence 30° find the deviation produced

Options:

(a) 60°

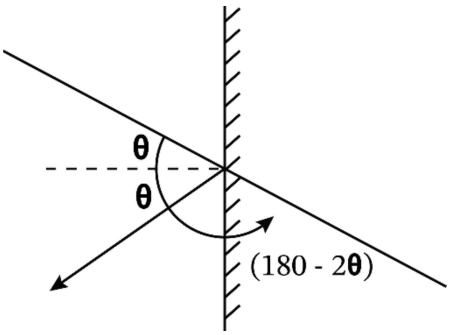
(b) 90°

(c) 120°

(d) 150°

Answer: (c)

Solution:



$=(180-2\times30)=120°$

Question: In which process internal energy is constant
Options:
(a) isothermal
(b) isochoric
(c) isobaric
(d) Adiabatic
Answer: (a)

Question: A nucleus breaks in two nuclei of radius ratio 1: $2^{1/3}$ find the ratio of their velocities
Options:
(a) 2 : 1
(b) 2 : 5
(c) 1 : 2
(d) 3 : 2
Answer: (a)
Solution:

$$V_{ms}=\sqrt{\frac{3kT}{m}}=\sqrt{\frac{3\times1.4\times10^{-23}\times300}{4.6\times10^{-26}}}=523\,\text{m/s}$$

$$m_1v_1=m_2v_2$$

$$\rho\cdot\frac{4}{3}\pi R_1^3v_1=\rho\frac{4}{3}\pi R_2^3\cdot v_2$$

$$\frac{v_1}{v_2}=\left(\frac{R_2}{R_1}\right)^3=\left(\frac{2^{1/3}}{1}\right)^3=\frac{2}{1}$$

Question: RMS velocity of nitrogen molecule at 27°C, k = 1.4 × 10^{-23} and mass of N_2 = 4.6 × 10^{-26} Kg (in m/s)
Answer: 523.00
Solution:

$$V_{ms}=\sqrt{\frac{3kT}{m}}=\sqrt{\frac{3\times1.4\times10^{-23}\times300}{4.6\times10^{-26}}}=523\,\text{m/s}$$

Question: S1 : when bar magnet falls in conducting ring is slows down whereas it does not slows down when it falls through a non-conducting ring.
S2 : Eddie currents are induced in conducting ring.

Options:
(a) S1 - True, S2 - False
(b) S1 - False, S2 - False
(c) S1 - True, S2 - True
(d) S1 - False, S2 - True
Answer: (c)

Question: A body is rotating with kinetic energy E. If angular velocity of body is increased to three times of initial angular velocity then kinetic energy become nE. Find n.
Answer: 9.00
Solution:

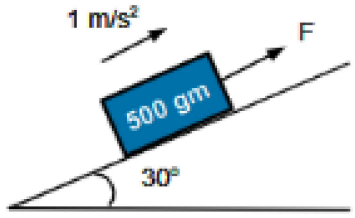
$$KE = \frac{1}{2} I\omega^2$$

$$KE \propto \omega^2$$

$$\text{So } \frac{KE_1}{KE_2} = \left(\frac{\omega_1}{\omega_2}\right)^2 = \left(\frac{1}{3}\right)^2 = \frac{1}{9}$$

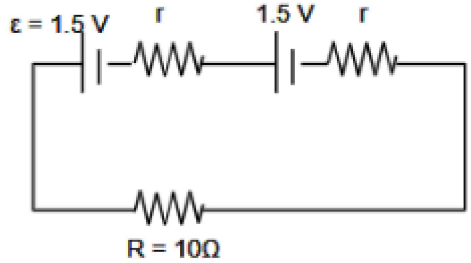
So $KE_2 = 9KE_1$

Question: Find power delivered by F at t = 10 s. If body starts from rest.



Options:
(a) 5 watt
(b) 7.5 watt
(c) 10 watt
(d) 12.5 watt
Answer: (b)
Solution:

Question: If P.D across R is 1.5 volts find internal resistances of cells.



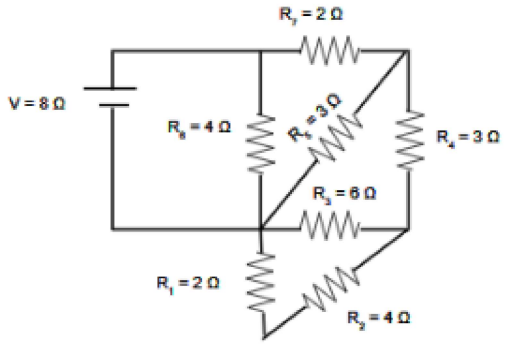
Answer: 5.00
Solution:

Question: A capacitor of capacity C is charged to potential V find the flux through the surface enclosing positive plate of capacitor
Options:
(a) $CV/8\varepsilon_0$

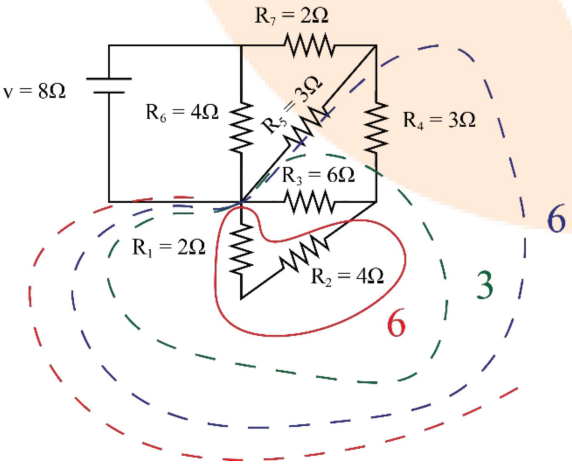
(b) $CV/4\varepsilon_0$
(c) $CV/2\varepsilon_0$
(d) CV/ε_0
Answer: (d)
Solution:

Question: In satellite communication, frequency for uplink is
Answer: 3.7 GHz–4.2 GHz
Solution:
Ground wave propagation - 500 KHz - 1500 KHz
Sky wave propagation - 5 MHz - 100 MHz
Space wave propagation - 100 MHz - 200 MHz
Satellite communication - 3.7 GHz - 4.2 GHz

Question: Current in R_2 resistance is



Options:
(a) ½ A
(b) ¾ A
(c) 3/2 A
(d) ¼ A
Answer: (a)
Solution:



$$\frac{3}{3+6}\times 2=\frac{6}{9}$$

$$=\frac{2}{3}A$$

$$I=\frac{V}{\mathrm{R_{eq}}}=\frac{8}{2}=4\mathrm{A}$$