PHYSICS

BOOKS - D MUKHERJEE PHYSICS (HINGLISH)

IIT QUESTIONS 3

Straight Objective Type

1. A siren placed at a railway platform is emitting sound of frequency $5kHz$. A

passenger sitting in a moving train A records a frequency of $5.5kHz$ while the train approaches the siren. During his return journey in a different train B he records a frequency of $6.0kHz$ while approaching the same siren. the ratio the velocity of train B to that of train A is

A. 242:252

B. $2:1$

C. $5:6$

D. $11:6$

Answer: B

Watch Video Solution

2. Two blocks of masses 10 kg and 4 kg are connected by a spring of negligible mass and placed on a frictionless horizontal surface. An impulse gives a velocity of $14m/s$ to the heavier block in the direction of the lighter block. The velocity of the centre of mass is

A. $30ms^{-1}$

B. $20ms^{-1}$

C. $10ms^{-1}$

D. $5ms^{-1}$

Answer: C

Watch Video Solution

3. A geostationary satellite orbits around the earth in a circular orbit of radius 36,000 km. then the time period of a spy satellite orbiting

a few hundred km (600 km) above the earth's surface (R=6400 km) will approximately be

A. $\frac{1}{2}h$

B. $1h$

C. 2 h

D. 4 h

Answer: C

Watch Video Solution

4. A sonometer wire resonates with a given tuning fork forming a standing wave with five antinodes between the two bridges when a mass of $9kg$ is suspended from the wire. When this mass is replaced by a mass 'M' kg, the wire resonates with the same tuning fork forming three antinodes for the same positions of the bridges. Find the value of M.

A. 25 kg

B. 5 kg

C. 12.5 kg

D. $\frac{1}{25}$ kg

Answer: A

Watch Video Solution

5. A particle of mass m and charge q moves with a constant velocity v along the positive x direction. It enters a region containing a uniform magnetic field B directed along the negative z direction, extending from $x = a$ to $x = b$. The minimum value of v required so

that the particle can just enter the region $x > b$ is

A. qbB/m

B. q(b-a)B/m

C. qaB/m

D. q(b+a)B/2m

Answer: B

 Watch Video Solution

6. A long straight wire along the z- axis carries a current I in the negative $z - direction$. The magnetic vector field $\vec{B}$ at a point having coordinates (x,y) in the $Z = 0$ plane is

A. $\left(\frac{\mu_0 I}{2\pi}\right) \frac{\left(y\,\vec{i} - x\,\vec{j}\right)}{(x^2 + y^2)}$

B. $\left(\frac{\mu_0 I}{2\pi}\right) \frac{\left(x\,\vec{i} + y\,\vec{j}\right)}{(x^2 + y^2)}$

C. $\left(\frac{\mu_0 I}{2\pi}\right) \frac{\left(x\,\vec{j} - y\,\vec{i}\right)}{(x^2 + y^2)}$

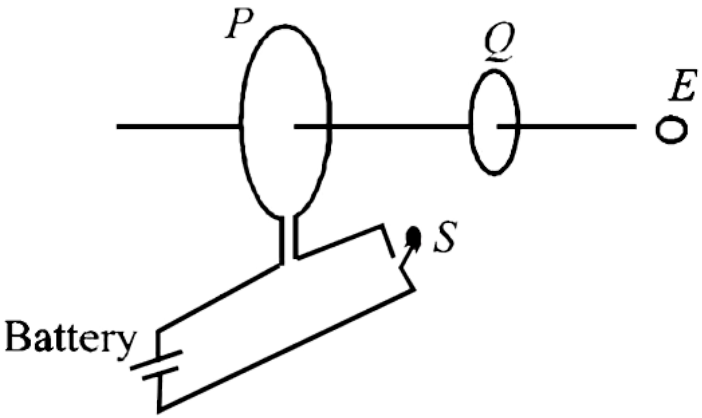
D. $\left(\frac{\mu_0 I}{2\pi}\right) \frac{\left(x\,\vec{i} - y\,\vec{j}\right)}{(x^2 + y^2)}$

Answer: A

Watch Video Solution

7. As shown in the figure, P and Q are two coaxial conducting loops separated by some distance. When the switch S is closed, a clockwise current I_P (as seen by E) and an induced current I_{Q1} flows in Q. The switch remains closed for a long time. when S is opened, a current I_{Q2} flows in Q. Then the

direction IQ_1 and IQ_2 (as seen by E) are



A. respectively clockwise and anticlockwise

B. both clockwise

C. both anticlockwise

D. respectively anticlockwise and clockwise

Answer: D

Watch Video Solution

8. Two identical capacitors, have the same capacitance C. One of them is charged to potential V_1 and the other V_2. The negative ends of the capacitors are connected together. When the poistive ends are also connected, the decrease in energy of the combined system is

A. $\frac{1}{4}C\left(V_1^2 - V_2^2\right)$

B. $\frac{1}{4}C\left(V_1^2 + V_2^2\right)$

C. $\frac{1}{4}C(V_1 - V_2)^2$

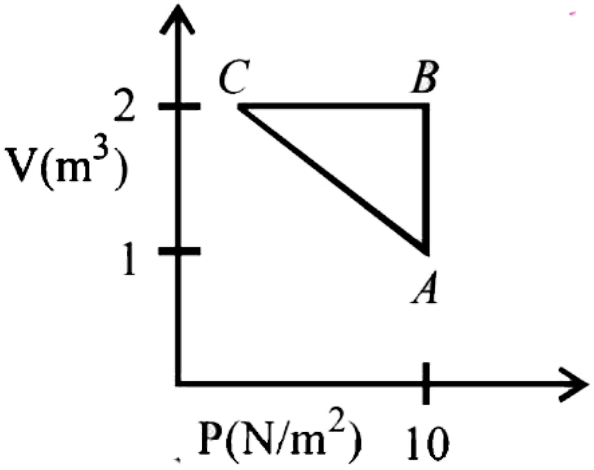
D. $\frac{1}{4}C(V_1 + V_2)^2$

Answer: C

Watch Video Solution

9. An ideal gas is taken through the cycle $A \to B \to C \to A$, as shown in the figure, If the net heat supplied to the gas in the cycle is 5J, the work done by the gas in the process

CtoA is



A. $-5J$

B. $-10J$

C. $-15J$

D. $-20J$

Answer: A

Watch Video Solution

10. An ideal Black-body at room temperature is thrown into a furnace. It is observed that

A. initially it is the darkest body and at later times the brightest

B. it is the darkest body at all times

C. it cannot be distinguished at all times

D. initially it is the darkest body and at later times it cannot be distinguished

Answer: D

Watch Video Solution

11. Which of the following process represents a $\gamma - decay$?

A. ${}_{X}^{A}X + \gamma \rightarrow {}_{Z-1}^{A}X + a + b$

B. ${}_{Z}^{A}X + {}_{0}^{1}n \rightarrow {}_{Z-2}^{A-3}X + c$

C. ${}_{Z}^{A}X \rightarrow {}_{Z}^{A}X + f$

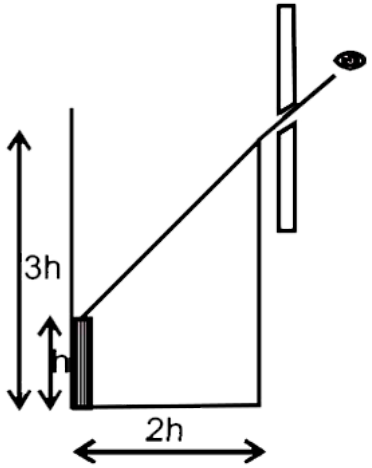
D. ${}_{Z}^{A}X + {}_{-1}^{0}e \rightarrow {}_{Z-1}^{A}X + g$

Answer: C

Watch Video Solution

12. An observer can see through a pin-hole the top end of a thin rod of height h, placed as shown in the figure. The beaker height is 3h and its radius h. When the beaker is filled with a liquid up to a height 2h, he can see the lower end of the rod. Then the refractive index of the

liquid is



A. $\frac{5}{2}$

B. $\sqrt{\frac{5}{2}}$

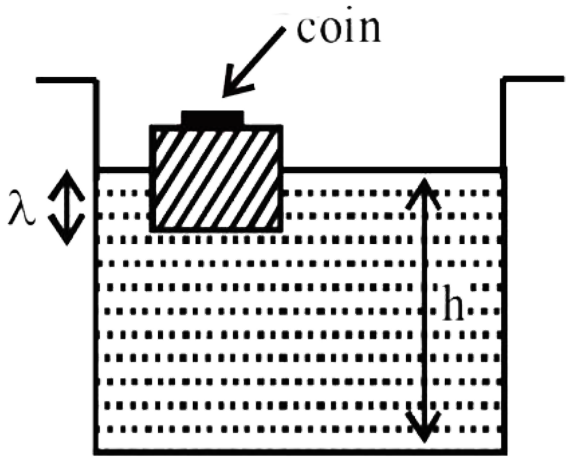
C. $\sqrt{\frac{3}{2}}$

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

Answer: B

Watch Video Solution

13. A wooden block, with a coin placed on its top, floats in water as shown in figure. The distance l and h are shown here. After some time the coin falls into water. Then



A. l decrease and h increases

B. l increases and h decreases

C. both l and h increases

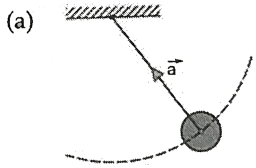
D. both l and h decrease

Answer: D

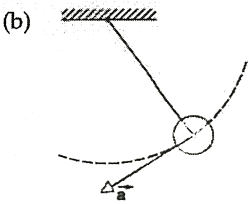
Watch Video Solution

14. A simple pendulum is oscillating without damiping, When the displacement of the bob is less than maximum, its acceleration vector $\overrightarrow{a}$ is correctly show in:

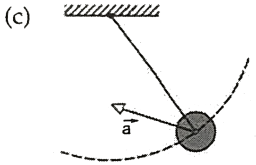
A.



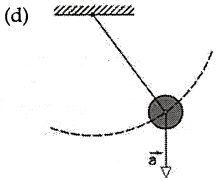
B.



C.



D.



Answer: C

Watch Video Solution

15. A cylinder rolls up an inclined plane, reaches some height, and then rolls down (without slipping throughout these motions). The directions of the frictional force acting on the cylinder are.

A. up the incline while ascending and down the incline while decending

B. up the incline while ascending as well as descending

C. down the incline while ascending and up the incline while descending

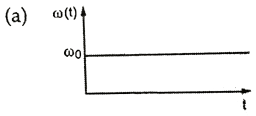
D. down the incline while ascending as well as descending

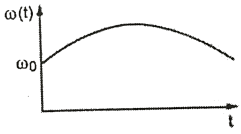
Answer: B

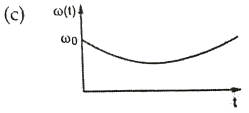
Watch Video Solution

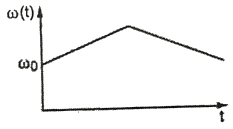
16. A circular platform is free to rotate in a horizontal plane about a vertical axis passing through its centre. A tortoise is sitting at the

edge of the platform. Now the platform is given an angular velocity ω_0. When the tortoise move along a chord of the platform with a constant velocity (with respect to the platform),

A. 

B. 

C. 

D. 

Answer: B

Watch Video Solution

Assertion Reason Type

1. STATEMENT -1 : For an observer looking out through the window of a fast moving train , the nearby objects appear to move in the opposite direction to the train , while the distant objects appear to be stationary .

STATEMENT - 2 : If the observer and the object

are moving at velocities $\overrightarrow{v}_1$ and $\overrightarrow{v}_2$ respecttively with refrence to a laboratory frame , the velocity of the object with respect to a laboratory frame , the velocity of the object with respect to the observer is $\overrightarrow{v}_2 - \overrightarrow{v}(1)$.

(a) Statement -1 is True, statement -2 is true , statement -2 is a correct explanation for statement -1

(b) Statement 1 is True , Statement -2 is True , statement -2 is NOT a correct explanation for statement -1

(c) Statement - 1 is True , Statement -2 is False

(d) Statement -1 is False, Statement -2 is True

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is not the correct explanation for statement-1

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true.

Answer: B

 Watch Video Solution

2. STATEMENT-1: It is easier to pull a heavy object than to push it on a level ground and STATEMENT-2: The magnitude fo frictional force depends on the nature of the two surfaces in contact.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation

for statement-1.

B. Statement-1 is true, statement-2 is true and statement-2 is not the correct explanation for statement-1

C. Statement-1 is true, statement-2 is false

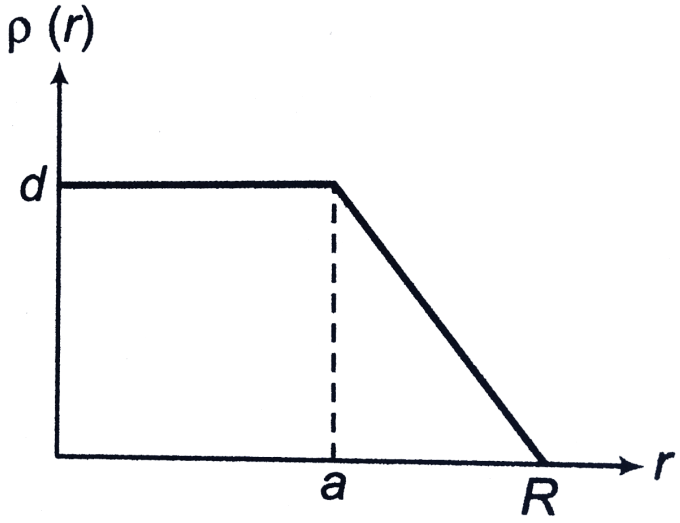
D. Statement-1 is false, statement-2 is true.

Answer: B

Watch Video Solution

Linked Comprehension Type

1. The nuclear charge (Ze) is non uniformlly distribute with in a nucleus of radius r. The charge density $\rho(r)$ (charge per unit volume) is dependent only on the radial distance r form the centre of the nucleus s shown in figure. The electric field is only along the radial direction.



The electric field at $r = R$ is

A. independent of a

B. directly proportional to a

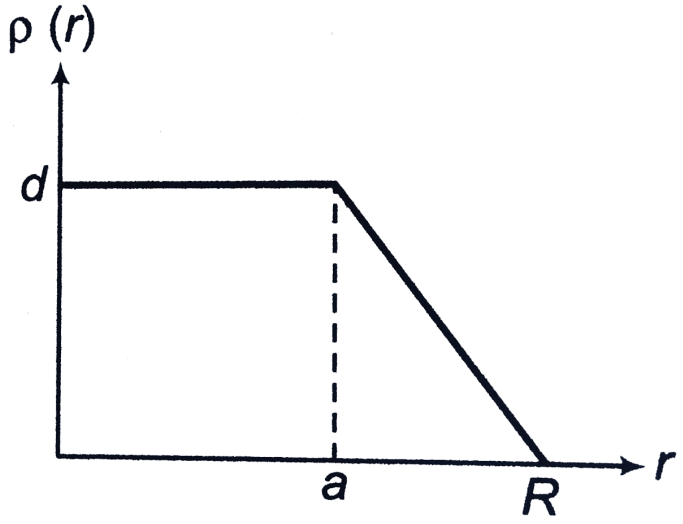
C. inversely proportional to a

D. none of these

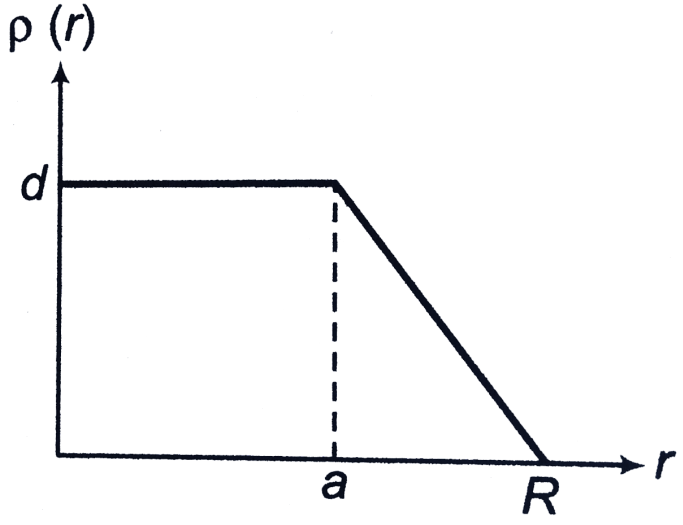
Answer: D

Watch Video Solution

2. The nuclear charge (Ze) is non uniformlly distribute with in a nucleus of radius r. The charge density $\rho(r)$ (charge per unit volume) is dependent only on the radial distance r form the centre of the nucleus s shown in figure. The electric field is only along the radial direction.



For a=0 the value of d (maximum value of ρ as shown in the figure) is



A. $\frac{3Ze}{4\pi R^3}$

B. $\frac{3Ze}{\pi R^3}$

C. $\frac{4Ze}{3\pi R^3}$

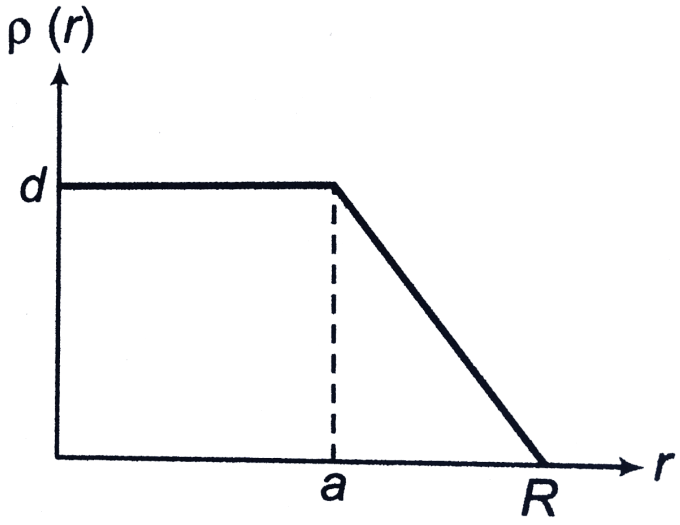
D. $\frac{Ze}{3\pi R^3}$

Answer: B

Watch Video Solution

3. The nuclear charge (Ze) is non uniformlly distribute with in a nucleus of radius r. The charge densilty $\rho(r)$ (charge per unit volume)

is dependent only on the radial distance r form the centre of the nucleus s shown in figure. The electric field is only along the radial direction.



The electric field within the nucleus is generaly observed to be linearly dependent on r. This implies

A. a=0

B. $a = \frac{R}{2}$

C. a=R

D. $a = \frac{2R}{3}$

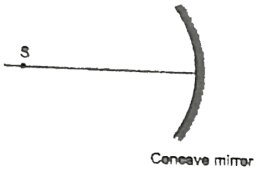
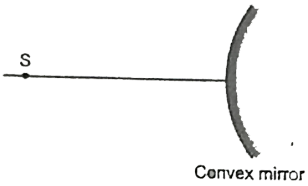
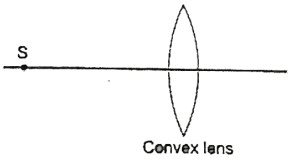
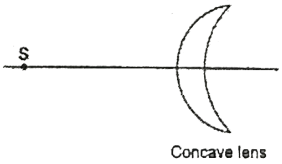
Answer: C

Watch Video Solution

Matrix Matching Type

1. Column A gives a list of possible set of parameters measured in some experiments . The variations of the parameters in the form

of graphs are shown in column B.

Column A	Column B
(i) 	(a) Real image
(ii) 	(b) Virtual image
(iii) 	(c) Magnified image
(iv) 	(d) Image at infinity

View Text Solution