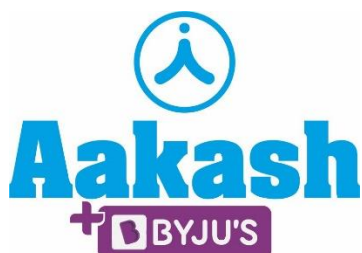


11/04/2023

Evening



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Memory Based Answers & Solutions

for

Time : 3 hrs.

M.M. : 300

JEE (Main)-2023 (Online) Phase-2

(Physics, Chemistry and Mathematics)

IMPORTANT INSTRUCTIONS:

- (1) The test is of **3 hours** duration.
- (2) The Test Booklet consists of 90 questions. The maximum marks are 300.
- (3) There are **three** parts in the question paper consisting of **Physics, Chemistry** and **Mathematics** having 30 questions in each part of equal weightage. Each part (subject) has two sections.
 - (i) **Section-A:** This section contains 20 multiple choice questions which have only one correct answer. Each question carries **4 marks** for correct answer and **-1 mark** for wrong answer.
 - (ii) **Section-B:** This section contains 10 questions. In Section-B, attempt any **five questions out of 10**. The answer to each of the questions is a numerical value. Each question carries **4 marks** for correct answer and **-1 mark** for wrong answer. For Section-B, the answer should be rounded off to the nearest integer.

PHYSICS

SECTION - A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer:

- Density (ρ) of a body depends on the force applied (F), its speed (v) and time of motion (t) by the relation $\rho = KF^a v^b t^c$, where K is a dimensionless constant. Then
 - $a = 1, b = -4, c = -2$
 - $a = 2, b = -4, c = -1$
 - $a = -1, b = -4, c = 2$
 - $a = 1, b = 4, c = -2$

Answer (1)

Sol. $[ML^{-3}] = [MLT^{-2}]^a [LT^{-1}]^b [T]^c$
 $= [M^a L^{a+b} T^{-2a-b+c}]$

$a = 1,$
 $a + b = -3,$
 $\Rightarrow b = -4,$
 also $-2a - b + c = 0$
 $c = -2$

- In which of the following process, the internal energy of gas remains constant.
 - Isothermal
 - Isochoric
 - Isobaric
 - Adiabatic

Answer (1)

Sol. $T = \text{constant} \Rightarrow U = \text{constant}$

- A particle is projected at an angle of 30° with ground with speed 40 m/s. The speed of particle after two seconds is (use $g = 10 \text{ m/s}^2$)
 - $20\sqrt{2} \text{ m/s}$
 - $20\sqrt{3} \text{ m/s}$
 - 20 m/s
 - $10\sqrt{3} \text{ m/s}$

Answer (2)

Sol. At $t = 2$ particle is at maximum height moving with $40\cos 30^\circ \text{ m/s}$.

- Potential at the surface of a uniformly charged non-conducting sphere is V . Then the potential at its centre is
 - 0
 - $\frac{V}{2}$
 - $2V$
 - $\frac{3V}{2}$

Answer (4)

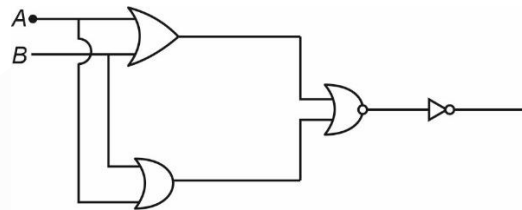
Sol. $V = \frac{KQ}{2R^3} (3R^2 - r^2)$ at $r = R \Rightarrow V = \left(\frac{KQ}{R}\right)$
 at $r = 0, V_0 = \frac{3KQ}{2R} = \left(\frac{3V}{2}\right)$

- If $\vec{A} = 2\hat{i} + 3\hat{j} + 2\hat{k}$ and $\vec{A} - \vec{B} = 2\hat{j}$, then find $|\vec{B}|$.
 - 3
 - $3\sqrt{3}$
 - 2
 - $\sqrt{3}$

Answer (1)

Sol. $(2\hat{i} + 3\hat{j} + 2\hat{k}) - \vec{B} = 2\hat{j}$
 $\Rightarrow \vec{B} = 2\hat{i} + \hat{j} + 2\hat{k}$
 $\Rightarrow |\vec{B}| = 3$

- The resultant gate is

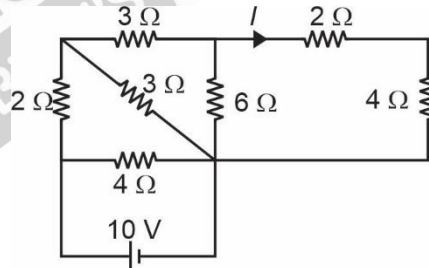


- NAND
- NOR
- OR
- AND

Answer (4)

Sol. $(A+B)(A \cdot B) = (A \cdot AB) + B \cdot (AB)$
 $= AB + AB$
 $= (AB)$

- For the given circuit diagram, find the current I .



- $\frac{5}{16} \text{ A}$
- $\frac{5}{48} \text{ A}$
- $\frac{5}{12} \text{ A}$
- $\frac{1}{16} \text{ A}$

Answer (3)

Sol. $i_{\text{battery}} = \frac{10}{2} = 5 \text{ A}$

$I = i_{\text{battery}} \times \frac{1}{2} \times \frac{1}{3} \times \frac{1}{2} = \frac{5}{12} \text{ A}$

- If a nucleus is divided in ratio of $1 : 2^{1/3}$, then find ratio of velocity of the parts is

- 2
- $2^{1/3}$
- $2^{2/3}$
- $2^{-1/3}$

Answer (2)

Sol. From conservation of momentum,

$$m_0 \vec{v}_1 + 2^{1/3} m_0 \vec{v}_2 = 0$$

$$\Rightarrow \left| \frac{\vec{v}_1}{\vec{v}_2} \right| = 2^{1/3}$$

9. If electric field (\vec{E}) at an instant is $6.6\hat{j}$ N/C and the EM wave is propagating along positive x-direction then \vec{B} at that instant is given by

- (1) $2.2 \times 10^{-8} \hat{k}$ T (2) $-2.2 \times 10^{-8} \hat{k}$ T
 (3) $-0.5 \times 10^{-8} \hat{k}$ T (4) $19.8 \times 10^8 \hat{k}$ T

Answer (1)

Sol. $|\vec{E}| = c|\vec{B}|$

$$|\vec{B}| = \frac{6.6}{3 \times 10^8} = 2.2 \times 10^{-8} \text{ T}$$

Also $\vec{E} \times \vec{B} = \hat{C}$

10. Find average speed of N_2 at 27°C .

- (1) 476 m/s (2) 470 m/s
 (3) 480 m/s (4) 490 m/s

Answer (1)

Sol. $\bar{v} = \sqrt{\frac{8RT}{\pi M}} = \sqrt{\frac{8 \times 8.314 \times 300}{3.14 \times 28 \times 10^{-3}}} = 476 \text{ m/s}$

11. A charge particle is projected inside along the axis of long solenoid, then

- (a) Path will be straight line
 (b) There is no effect of magnetic field on charge
 (c) Path will be parabolic
 (d) Path will be circular
 (1) a, d (2) a, b
 (3) b, d (4) a, b, d

Answer (2)

Sol. $\vec{F} = q\vec{v} \times \vec{B} = 0$

12. Six identical small liquid drops are mixed together to form a bigger drop. The terminal velocity of bigger drop if terminal velocity of small drop is 10 m/s, will be

- (1) $10 \times (6)^{\frac{1}{3}}$ m/s (2) $10 \times (6)^{\frac{2}{3}}$ m/s
 (3) $5 \times (3)^{\frac{2}{3}}$ m/s (4) $10 \times (6)^3$ m/s

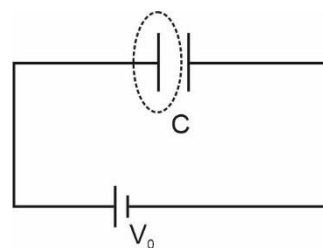
Answer (2)

Sol. $R = 6^{1/3}r$

Also, $\frac{v_b}{v_s} = \frac{R^2}{r^2}$ ($\because v_T \propto (\text{Radius})^2$)

$$V_b = 10 \times (6)^{2/3}$$

13. A parallel plate capacitor C connected with a battery of voltage V_0 . A close gaussian surface is shown by dotted boundary as shown. The electric flux through the surface is



- (1) $\frac{2CV_0}{\epsilon_0}$ (2) $\frac{CV_0}{\epsilon_0}$
 (3) $\frac{CV_0}{2\epsilon_0}$ (4) $\frac{3CV_0}{2\epsilon_0}$

Answer (2)

Sol. $\phi = \frac{Q}{\epsilon_0} = \frac{CV_0}{\epsilon_0}$

14. A satellite is moving around earth surface. How much minimum speed should be increased so that it escapes from earth surface? (g = acceleration due to gravity, R = radius of earth)

- (1) $2\sqrt{gR}$ (2) $(\sqrt{2} - 1)\sqrt{gR}$
 (3) $\sqrt{\frac{gR}{2}}$ (4) $(\sqrt{3} - 1)\sqrt{gR}$

Answer (2)

Sol. $v_{\text{circular}} = \sqrt{\frac{GM}{R}} = \sqrt{gR}$; $\Delta v = (\sqrt{2} - 1)\sqrt{gR}$

$$v_{\text{escape}} = \sqrt{\frac{2GM}{R}} = \sqrt{2gR}$$

15. **A** : Moving magnet in conducting pipe slows down.

R : Because eddy current is formed.

- (1) A is correct, R is wrong
 (2) A and R both are wrong
 (3) A and R both are correct
 (4) A is wrong, R is correct

Answer (3)

Sol. Moving magnet in conducting pipe causes change in flux and hence induced emf. This emf causes eddy current in conducting pipe in such a way that it tries to oppose the change in flux, therefore magnet slows down.

16. A source of sound is moving away from a stationary observer with constant velocity 40 m/s. Find frequency heard by observer, if original frequency of source is 400 Hz and speed of sound in air is 360 m/s

- (1) 330 Hz (2) 320 Hz
 (3) 360 Hz (4) 280 Hz

Answer (3)

Sol. $f = 400 \left(\frac{360}{360 + 40} \right) = 360 \text{ Hz}$

17. Find emf induces across the faces of given cube.

