



Aakash

Medical | IIT-JEE | Foundations

06/04/2024

Evening

Corporate Office : Aakash Tower, 8, Pusa Road, New Delhi-110005 | Ph.: 011-47623456

Memory Based Answers & Solutions

Time : 3 hrs.

for

M.M. : 300

JEE (Main)-2024 (Online) Phase-2

(Physics, Chemistry and Mathematics)

IMPORTANT INSTRUCTIONS:

- (1) The test is of **3 hours** duration.
- (2) This test paper consists of 90 questions. Each subject (PCM) has 30 questions. The maximum marks are 300.
- (3) This question paper contains **Three Parts**. **Part-A** is Physics, **Part-B** is Chemistry and **Part-C** is **Mathematics**. Each part has only two sections: **Section-A** and **Section-B**.
- (4) **Section - A** : Attempt all questions.
- (5) **Section - B** : Attempt any 05 questions out of 10 Questions.
- (6) **Section - A (01 – 20)** 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.
- (7) **Section - B (21 – 30)** contains 10 **Numerical value** based questions. The answer to each question should be rounded off to the **nearest integer**. Each question carries **+4 marks** for correct answer and **-1 mark** for wrong answer.

Aakashians Conquer JEE (Main) 2024 SESSION-1



Perfect Score!
300/300

100
Percentile

RISHI S SHUKLA
TWO YEAR CLASSROOM PROGRAM

**
143
100 PERCENTILERS
(PHY. OR CHEM. OR MATHS)

**
936 99+ PERCENTILERS

**
4155 95+ PERCENTILERS
& Counting

*As per student response sheet and NTA answer key.

Our Stars



Chirag Falor
4 Year Classroom
1 AIR
JEE (Adv.)
2020



Tanishka Kabra
4 Year Classroom
1 AIR-16 crl.
JEE (Adv.)
2022

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:

1. There are two fixed charged spheres P and Q repelling each other with force of 16 N. A third neutral sphere is placed between the charged spheres. The new force between spheres is (assuming all three spheres are insulating spheres)

- (1) 8 N
- (2) 32 N
- (3) 16 N
- (4) 4 N

Answer (3)

Sol. Electric force between two charges doesn't depend on intervening medium.

2. A tree branch holds a weight of 200 N by a uniform chain of mass 10 kg. The force applied by branch to hold this weight is (take $g = 10 \text{ m/s}^2$)

- (1) 150 N
- (2) 100 N
- (3) 200 N
- (4) 300 N

Answer (4)

Sol. $F = 200 + 100 = 300 \text{ N}$

3. If kinetic energy of a block of mass m increases 36 times. By what percentage will the momentum increase?

- (1) 6%
- (2) 600%
- (3) 60%
- (4) 500%

Answer (4)

Sol. $k = \frac{P^2}{2m}$

$$36k = \frac{P_1^2}{2m} \Rightarrow \boxed{P_1 = 6P} \text{ (Increased by 500\%)}$$

4. A ball is projected vertically upward from a building. Time taken to reach ground is T_1 . Another ball is projected downward from the same building with same speed. Time taken to reach ground is T_2 . If a third ball is released from the building, time taken to reach ground is

- (1) $\sqrt{T_1 T_2}$
- (2) $\sqrt{T_1^2 + T_2^2}$
- (3) $\sqrt{T_1^2 - T_2^2}$
- (4) $2\sqrt{T_1 T_2}$

Answer (1)

Sol. $-H = v_0 T_1 - \frac{1}{2} g T_1^2$

$$-H = -v_0 T_2 - \frac{1}{2} g T_2^2$$

$$H = \frac{1}{2} g \left(\frac{T_1 + T_2}{2} \right)^2 - \frac{1}{2} g \left(\frac{T_1 - T_2}{2} \right)^2$$

$$T = \sqrt{\frac{2H}{g}}$$

$$\Rightarrow T = \sqrt{T_1 T_2}$$

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5. The weight of an object measured on the surface of earth is 300 N. What will be weight of the same object at depth $\frac{R}{4}$ inside the earth?

(R = radius of earth)

- (1) 220 N
- (2) 225 N
- (3) 200 N
- (4) 210 N

Answer (2)

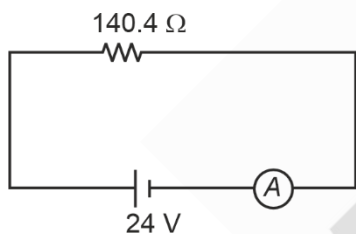
Sol. $W_1 = mg = 300 \text{ N}$

$$W_2 = mg' = mg \left(1 - \frac{d}{R} \right)$$

$$= mg \left(\frac{3}{4} \right)$$

$$= 225 \text{ N}$$

6. An ammeter consists of 240Ω galvanometer and 10Ω shunt resistance is connected in circuit as shown. Reading of ammeter is



- (1) 0.18 A
- (2) 0.16 A
- (3) 0.32 A
- (4) 3.2 A

Answer (2)

Sol. $R_A = \frac{10 \times 240}{250} = 9.6 \Omega$

$R = 140.4 + 9.6 = 150 \Omega$

$i = \frac{24}{150} = 0.16$

7. An isolated system contains one mole of helium, given a heat of 48 J. If the temperature of system changes by 2°C , then find work done. (take $R = 8.35/\text{mole-K}$)

- (1) 32.20 J
- (2) 37.34 J
- (3) 40.74 J
- (4) 41.74 J

Answer (4)

Sol. $Q = 48 \text{ J}$

$\Delta Q = \Delta V + \Delta W$

$48 = 1 \times \frac{3R}{2} (2) + W$

$W = 48 - \frac{3}{4} (8.35)$
 $= 41.74$

8. Find the longest wavelength of Paschen series for hydrogen atom. (Rydberg constant = $10^7/\text{m}$)

- (1) $2.06 \mu\text{m}$
- (2) $20.6 \mu\text{m}$
- (3) $4.86 \mu\text{m}$
- (4) $48.6 \mu\text{m}$

Answer (1)

Sol. $\frac{1}{\lambda} = R \left(\frac{1}{3^2} - \frac{1}{4^2} \right)$

$\lambda = \frac{144}{7 \times 10^7} = 20.57 \times 10^{-7}$

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9. Find net kinetic energy (maximum possible) associated with 20 diatomic molecules (Here k_B is Boltzmann constant and T is absolute temperature of diatomic gas).

- (1) $35 k_B T$
- (2) $70 k_B T$
- (3) $60 k_B T$
- (4) $30 k_B T$

Answer (2)

Sol. $E_i = (5 + 2) \frac{1}{2} kT$

$$= \frac{7}{2} kT$$

$$E_T = 20 \times \frac{7}{2} kT$$

$$= 70 k_B T$$

10. **Statement-I** : Dimensions of specific heat capacity is $[L^2 T^{-2} K^{-1}]$

Statement-II : Dimensions of universal gas constant is $[ML^2 T^{-1} K^{-1}]$

- (1) Both statements are incorrect
- (2) Both statements are correct
- (3) Statement-I is correct but statement-II is incorrect
- (4) Statement-I is incorrect but statement-II is correct

Answer (3)

Sol. $S = \frac{Q}{m \Delta T} = \frac{ML^2 T^{-2}}{mK} = [L^2 T^{-2} K^{-1}]$

$$R = \frac{ML^2 T^{-2}}{K} = [ML^2 T^{-2} K^{-1}]$$

11. The displacement (x) of a particle vary as $x^2 = 1 + t^2$ and acceleration is given function of x as x^{-n} , then find n .

- (1) 1
- (2) 3
- (3) 4
- (4) 2

Answer (2)

Sol. $x = \sqrt{1 + t^2}$

$$v = \frac{1}{2} (1 + t^2)^{-\frac{1}{2}} (2t)$$

$$= \frac{t}{\sqrt{1 + t^2}}$$

$$a = \frac{1}{x^3} = x^{-3}$$

- 12.
- 13.
- 14.
- 15.
- 16.
- 17.
- 18.
- 19.
- 20.

SECTION - B

Numerical Value Type Questions: This section contains 10 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

21. A convex lens has a focal length of $f = 20$ cm, $R_1 = 15$ cm, $R_2 = 30$ cm. The refractive index of the lens is $\frac{x}{2}$. The value of x is _____.

Answer (3)

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Sol. $\frac{1}{f} = (\mu - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$

$\Rightarrow \frac{1}{20} = (\mu - 1) \left(\frac{1}{15} + \frac{1}{30} \right) = (\mu - 1) \frac{3}{30}$

$\Rightarrow \mu - 1 = \frac{1}{2} \Rightarrow \mu = 1.5$

22. For a device, power consumed = 110 W and voltage supplied is 220 V. The number of electrons that flow in 1 s is $\frac{x}{4} \times 10^{17}$. Find x.

Answer (125)

Sol. $P = VI$

$\Rightarrow I = 0.5 \text{ A}$

\Rightarrow Number of electrons

$= \frac{0.5 \times 1}{1.6 \times 10^{-19}}$

$= \frac{1000}{32} \times 10^{17}$

$= 31.25 \times 10^{17}$

23. In a photoelectric setup, work function of the material is 2.13 eV, wavelength used is 300 nm. If $hc = 1240 \text{ eV}\cdot\text{nm}$, stopping potential for the set-up is _____ V.

Answer (2)

Sol. $\frac{hc}{\lambda} - \phi = eV_s$

$\Rightarrow (4.13 - 2.13) \text{ eV} = eV_s$

$\Rightarrow V_s = 2 \text{ Volts}$

24. A car of mass 800 kg is moving in a circular path of radius 300 m on a banked road with angle 30° . Coefficient of friction between the car and road is 0.2. Find the maximum safe speed (to the nearest integer in m/s) with which the car can travel.

(Take $\sqrt{3} = 1.7$)

Answer (52)

Sol. $V_{\max} = \sqrt{\frac{rg(\mu + \tan\theta)}{1 - \mu \tan\theta}} = \sqrt{\frac{300 \times 10(0.2 + \tan 30)}{1 - 0.2 \tan 30}}$

$V_{\max} = \sqrt{2680} = 51.76 \text{ m/s}$

25. Two sources produce, individually, intensities of I and $4I$ at a location. If they are coherent, then difference between I_{\max} and I_{\min} is nI . Find n .

Answer (8)

Sol. $I_{\max} = (\sqrt{I_1} + \sqrt{I_2})^2 = 9I$

$I_{\min} = (\sqrt{I_1} - \sqrt{I_2})^2 = I$

$\Rightarrow n = 8$

26. An object of mass 30 kg and relative density 5 is immersed inside water. The weight of the object inside water is $10x \text{ N}$. Find the value of x .

Answer (24)

Sol. $W = mg - V_{\text{object}} \times \rho_{\text{water}} \cdot g$

$W = 300 - \frac{m_{\text{object}}}{\rho_{\text{object}}} \rho_{\text{water}} \cdot g$

$W = 300 - \frac{30}{5} \times 1 \times 10$

$W = 240 \text{ N}$

27.

28.

29.

30.

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