

# JEE Main 2024 Question Paper Jan 31 Shift 1 (B.E./B.Tech)

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## JEE Main Physics Questions

**Ques 1.** Stopping potential is 8 V if wavelength of incident light is  $\lambda$  and it is 2 V for  $3\lambda$ . Find threshold wavelength.

**Ans.**  $9\lambda$

**Ques 2.** Two charges  $Q$  and  $3Q$  are kept in a line separated by a distance  $R$ . Electric field is zero at a distance  $x$  from  $Q$ . Find the value of  $x$ .

**Ans.**  $(\sqrt{3}-1R)/2$

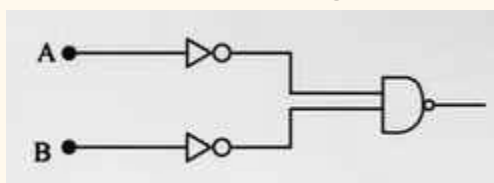
**Ques 3.** If the mass defect in a nuclear reaction is 0.4gm then find the  $Q$  value of the reaction.

**Ans.**  $3.6 \times 10^{13} \text{ J}$

**Ques 4.** Find minimum deviation in a thin prism if refractive index  $\mu = \cot(A/2)$ . Here  $A$  represents the angle of prism.

**Ans.**  $\delta = \pi - 2A$

**Ques 5.** Output of given circuit represents which logic gate :

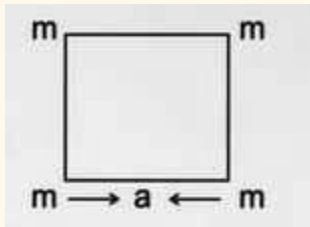


- A. NAND
- B. NOR
- C. AND
- D. OR

Ans. D

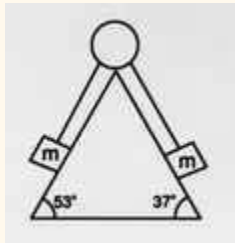
Ques 6. Four equal masses  $m$  are kept at corners of a square of side

a. If net gravitational force on a mass is given by  $\left(\frac{2\sqrt{2}+1}{32}\right) \frac{Gm^2}{L^2}$ . Find the value of  $a$  in the terms of  $L$ .



Ans.  $a = 4L$

Ques 7. Find the value of  $m$  if  $M = 10$  kg. All the surfaces are rough.



- A. 2.5kg
- B. 7.5kg
- C. 12.5kg
- D. 5kg

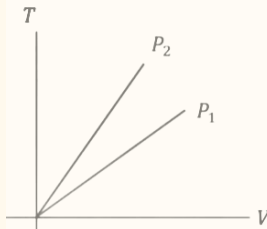
Ans. B

Ques 8. If the percentage error in measuring length and diameter of a wire is 0.1% each, then the percentage error of the resistance of the wire is :

- A. 0.3%
- B. 0.2%
- C. 0.1%
- D. 0.4%

Ans. A

Ques 9. T-V graph is given for two different pressures  $P_1$  and  $P_2$ , Then :



- A.  $P_2 > P_1$
- B.  $P_1 = P_2$
- C.  $P_2 < P_1$
- D.  $P_2 \leq P_1$

Ans. A

Ques 10. For a 1-D motion, relation between position  $x$  and time  $t$  is  $t = \alpha x^2 + \beta x$  Find the relation between velocity  $v$  and acceleration  $a$ .

- A.  $a = \alpha v$
- B.  $a = -2\alpha v$
- C.  $a = -2\alpha v^3$
- D.  $a = 2\alpha v^2$

Ans. C

Ques 11. Two resistances having coefficient of variation of resistivity  $\alpha_1$  and  $\alpha_2$  are having equal resistance. Equivalent temperature coefficient of resistivity in series and parallel combinations are:

- A.  $(\alpha_1 + \alpha_2)/2, \alpha_1 + \alpha_2$

- B.  $\alpha_1 + \alpha_2, \alpha_1 + \alpha_2$
- C.  $\alpha_1 + \alpha_2, (\alpha_1 + \alpha_2)/2$
- D.  $(\alpha_1 + \alpha_2)/2, (\alpha_1 + \alpha_2)/2$

Ans. D

Ques 12. An artillery of mass  $M_1$ , fires a shell of mass  $M_2$ . At the time of firing the ratio of kinetic energy is.

- A.  $M_2/M_1$
- B.  $(M_1 + M_2)/M_1$
- C.  $(M_1 + M_2)/M_2$
- D.  $M_1/(M_1 + M_2)$

Ans. A

Ques 13. The fundamental frequency of closed organ pipe is equal to the frequency of first overtone of open organ pipe of length 60 cm. The length of closed organ pipe is

- A. 45 cm
- B. 30 cm
- C. 15 cm
- D. 60 cm

Ans. C

Ques 14. Force  $F$  depends on distance  $x$  and time  $t$  as  $F = ax^2 + bt^{1/2}$ . Final dimension of  $b^2/a$  is

- A.  $M^{-1} L^2 T^{-3}$
- B.  $M^1 L^{-3} T^3$
- C.  $M^1 L^3 T^{-3}$
- D.  $M^2 L^2 T^1$

Ans. C

**Ques 15.** Two charges  $q$  and  $3q$  are placed at a distance  $r$  from each other. Find the distance from  $q$  where the electric field is zero.

- A.  $r/\sqrt{3}+1$
- B.  $r/2$
- C.  $r/\sqrt{3}-1$
- D.  $2r/3$

**Ans. A**

**Ques 16.** In single electron atom/ion, first member of Lyman series is  $\lambda$ , then wavelength of second member of their series shall be

- A.  $5/27\lambda$
- B.  $5/32\lambda$
- C.  $27/32\lambda$
- D.  $15/23\lambda$

**Ans. C**

**Ques 17.** In YDSE, intensity at two sources are in ratio of 1: 9. if source are incoherent then intensity at central point is  $I_1$ , and if sources are coherent (and phase differs by  $60^\circ$ ) then intensity at central point is 12 then  $I_1/I_2$  is

- A.  $10/13$
- B.  $5/13$
- C.  $8/13$
- D.  $7/11$

**Ans. A**

**Ques 18.** Calculate the average energy density of an electromagnetic wave whose electric field is oscillating with amplitude  $50 \text{ V/m}$  and frequency  $5 \times 10^{10} \text{ Hz}$  :

- A.  $2 * 10^{-6} \text{ J / (m}^3\text{)}$

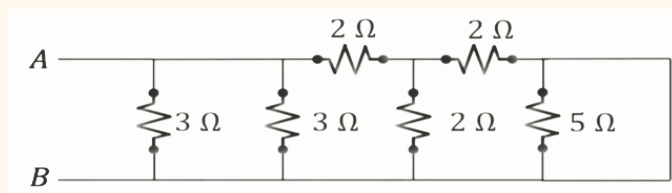
B.  $1.1 \times 10^{-8} \text{ J / (m}^3\text{)}$

C.  $3 \times 10^{-7} \text{ J / (m}^3\text{)}$

D.  $1.6 \times 10^{-7} \text{ J / (m}^3\text{)}$

Ans. B

Ques 19. Find equivalent resistance between A and B for given circuit in \_\_\_ohms.



Ans. 1

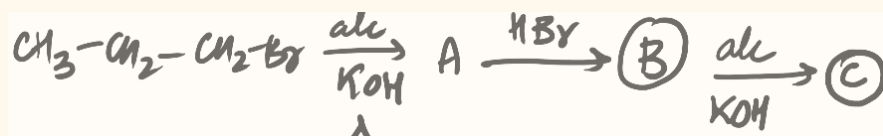
Ques 20. A uniform disk of mass 50 kg is rolling without slipping with speed of 0.4 m/s. Find minimum energy required to bring the disk to rest (in J).

Ans. 6J

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### JEE Main Chemistry Questions

Ques 1. Find out the final product C.



A. Propan-1-ol

B. Propan-2-ol

C. Propene

**D. Propane**

**Ans. B**

**Ques 2. Which of the following options contain amphoteric oxide(s) only?**

- A. SnO<sub>2</sub> and SiO**
- B. SiO<sub>2</sub>**
- C. SnO<sub>2</sub> and PbO<sub>2</sub>**
- D. CO and SiO**

**Ans. C**

**Ques 3. How many of the following compounds have sp<sup>3</sup> hybridized central atoms?**

**H<sub>2</sub>O, NH<sub>3</sub>, SiO<sub>2</sub>, SO<sub>2</sub>, CO, CH<sub>4</sub> and BF<sub>3</sub>**

**Ans. 4**

**Ques 4. Color of PbI<sub>2</sub>**

**Ans. Yellow**

**Ques 5. Magnetic behavior of Ni<sup>2+</sup> with strong ligand**

**Ans.  $\mu = 0$**

**Ques 6. On which factor, electrical conductivity of electrolytic cell does not depend**

- A. Concentration of electrolyte**
- B. Amount of electrolyte added**
- C. Temperature**
- D. Nature of electrode**

**Ans. D**

**Ques 7. Decreasing order of electron gain enthalpy of the following elements (magnitude only)**

**Sulphur - A, Bromine - B, Fluorine - C, Argon - D**

**A. A>B>C>D**

**B. D>C>B> A**

**C. C>B>A>D**

**D. A>B>D>C**

**Ans. C**

**Ques 8. Moles of CH<sub>4</sub> required for formation of 22 g of CO<sub>2</sub> is  $m \times 10^{-2}$  The value of m is:**

**Ans. 50**

**Ques 9. The total number of different alkanes formed when the following mixture is subjected to electrolysis: CH<sub>3</sub>COONa (aq) and C<sub>2</sub>H<sub>2</sub>COONa (aq) is (do not consider disproportionation reaction)**

**Ans. 3**

**Ques 10. If one faraday of electricity is used in the discharging of Cu<sup>2+</sup>, then find the mass (ing) of Cu deposited (nearest integer)**

**Ans. 32**

**Ques 11. The spin only magnetic moment of complex ion [Ni(NH<sub>3</sub>)<sub>6</sub>]<sup>2+</sup> is  $X \times 10^{-1}$  BM. The value of X is**

**Ans. 28**



**Ques 12. Which of the following solution shows positive deviation from Raoult's law?**

- A.  $\text{CHCl}_3 + \text{C}_6\text{H}_6$
- B.  $\text{CH}_3\text{COCH}_3 + \text{CS}_2$
- C.  $\text{CH}_3\text{COCH}_3 + \text{CHCl}_3$
- D.  $\text{CH}_3\text{COCH}_3 + \text{C}_6\text{H}_5\text{NH}_2$

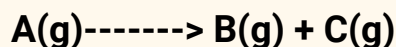
**Ans. B**

**Ques 13. Species having carbon with sextet of valence electron and acts as an electrophile is:**

- A. Carbanion
- B. Carbocation
- C. Free Radical
- D. Nitrene

**Ans. B**

**Ques 14. Find the rate constant for first order gaseous reaction:**



A. 
$$k = \frac{2.303}{t} \log \frac{p_i}{2p_i - p_t}$$

B. 
$$k = \frac{2.303}{t} \log \frac{2p_i}{p_i - p_t}$$

C. 
$$k = \frac{2.303}{t} \log \frac{p_i - p_t}{2p_i}$$

D. 
$$k = \frac{2.303}{t} \log \frac{2p_t}{2p_i - p_t}$$

Ans. A

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### JEE Main Mathematics Questions

Ques 1. In the expansion of  $(1 + x)(1 - x^2) (1 + 3/x + 3/x^2 + 1/x^3)^5$  the sum of coefficients of  $x^3$  and  $x^{-13}$  is

Ans. 118

$$f(x) = \begin{vmatrix} x^3 & 2x^2 + 1 & 1 + 3x \\ 3x^2 + 2 & 2x & x^3 + 6 \\ x^3 - x & 4 & x^2 - 2 \end{vmatrix}$$

Ques 2. If  $f(x) = \begin{vmatrix} x^3 & 2x^2 + 1 & 1 + 3x \\ 3x^2 + 2 & 2x & x^3 + 6 \\ x^3 - x & 4 & x^2 - 2 \end{vmatrix}$  for all  $x \in \mathbb{R}$ , then  $2f(0) + f'(0)$  is equal to

Ans. 42

Ques 3. let 's' be the set of positive integral values of a for which

$$\frac{ax^2 + 2(a+1)x + 9a + 4}{x^2 + 8x + 32} < 0, \forall x \in \mathbb{R}.$$

Then, the number of elements in 's' is

Ans. 0

Ques 4. If  $f(x) = \frac{4x+3}{6x-4}, x \neq \frac{2}{3}$  and  $(f \circ f)(x) = g(x)$ , where  $g: \mathbb{R} - \left\{\frac{2}{3}\right\} \rightarrow \mathbb{R} - \left\{\frac{2}{3}\right\}$  then  $(g \circ g \circ g)(4)$  is equal to

Ans. 4

Ques 5. If the system of linear equations  $x - 2y + z = -4$ ;  $2x + \alpha y + 3z = 5$  and  $3x - y + \beta z = 3$  has infinitely many solutions then  $12\alpha + 13\beta$  is equal to

Ans. 104.28

Ques 6. Sum of the series

$\frac{1}{1-3 \cdot 1^2+1^4} + \frac{2}{1-3 \cdot 2^2+2^4} + \frac{3}{1-3 \cdot 3^2+3^4} + \dots$  upto 10 terms is \_\_\_\_\_.

- A. -55/109
- B. 55/109
- C. 45/109
- D. - 45/109

Ans. A

Ques 7. If one of the diameters of the circle  $x^2 + y^2 - 10x + 4y + 13 = 0$  is a chord of another circle and whose center is the point of intersection of the lines  $2x + 3y = 12$  and  $3x - 2y = 5$  then the radius of the circle is

- A. 6
- B.  $3\sqrt{2}$
- C.  $\sqrt{20}$
- D. 4

Ans. A

Ques 8. An urn contains 15 red, 10 white, 60 orange balls, 15 green balls. 2 balls are taken with replacement. Find the probability 1 ball is red and the other ball is white.

- A.  $2/27$
- B.  $3/22$
- C.  $1/33$
- D.  $1/29$

Ans. C

Ques 9.  $\lim_{x \rightarrow 0} \frac{e^{2 \sin x} - 2|\sin x| - 1}{x^2}$  is

- A. Doesn't exist
- B. 2
- C. 1
- D. -1

Ans. B

Ques 10. Let  $\vec{a} = 3\hat{i} + \hat{j} - 2\hat{k}$ ,  $\vec{b} = 4\hat{i} + \hat{j} + 7\hat{k}$  and  $\vec{c} = \hat{i} - 3\hat{j} + 4\hat{k}$  be 3 vectors. If a vector  $\vec{p}$  satisfies  $\vec{p} \times \vec{b} = \vec{c} \times \vec{b}$  and  $\vec{p} \times \vec{a} = \vec{0}$  then  $\vec{p} \cdot (\hat{i} - \hat{j} - \hat{k})$  is equal to

- A. 32
- B. 23
- C. 16
- D. 61

Ans. A

Ques 11. The solution of differential equation  $y \frac{dx}{dy} = x(\log_e x - \log_e y + 1)$ ,  $x > 0$ ,  $y > 0$  and passing through  $(e, 1)$  is

A.  $|\log_e(y/x)| = y^2$

B.  $2|\log_e(x/y)| = y$

C.  $|\log_e(y/x)| = x$

D.  $|\log_e(x/y)| = y$

**Ans. D**

**Ques 12.**  $A = \{1, 2, 3, 4\}$ ,  $R = \{(1, 2), (2, 3), (2, 4)\}$   $R \subseteq S$  and  $S$  is an equivalence relation then the minimum number of elements to be added to  $R$  is  $n$ , then the value of  $n$  is?

**Ans. 13**