

JEE Main 15 April 2023 Shift 1 Memory-Based Questions

PHYSICS

1. A particle is released from a height equal to the radius of Earth. Find its velocity when it strikes the ground.
2. A variable force $F = 5Kx$ N acts on a body moving along the x-axis. Find the work done by this force in displacing the body from $x = 2$ m to $x = 5$ m (K is a constant).
3. If a particle's position changes with time as $r = t^2 - 2t$ (m). Find the velocity at $t = 2$ sec.
4. If the position vector of a particle is given by $(t) = 8t\hat{i} + 5t^2\hat{j} + 6k$, then the correct statement about the acceleration of the particle is
 - i. It is along the positive y-axis
 - ii. It is along the positive x-axis
 - iii. It is equally inclined to the x and y-axis
 - iv. It is along the positive z-axis
5. If the de-Broglie wavelength when the kinetic energy is E is λ . Find the wavelength at $E/4$.
6. In a single slit diffraction experiment $\lambda = 600$ nm, if at $\theta = 30^\circ$, the first minima is formed. Find the width of the slit (α) in μm .
7. Match the pairs.
Column I:
A. Microwaves, B. Ultraviolet rays, C. X-rays, D. Infrared waves
Column II:
i. 1 nm to 400 nm, ii. 1 nm to 1 pm, iii. $2.5 \mu\text{m}$ to 750 nm, iv. $1 \mu\text{m}$ to 1 mm.
8. The height of receiving and transmitting antennae in the communication of a signal are 245 m and 180 m respectively. Find the maximum distance between the two antennae for proper communication.
9. Three capacitors of capacitance $3 \mu\text{C}$, $x \mu\text{C}$ and $2 \mu\text{C}$ are connected in parallel across a 10 V source. Find the value of x.
10. Two identical particles each of mass m, move in a circular path due to their own mutual gravitational force. Find the velocity of the particle if the radius of the circular path is a.

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CHEMISTRY

- $C_6H_5NH_2 \rightarrow$ (in presence of $NaNO_2 + HCl$ at $0-5^\circ C$) $\rightarrow A \rightarrow$ (in presence of N,N -Dimethylaniline) $\rightarrow B$. Identify B.
- Calculate the number of P-O-P bonds in H_3PO_4 , P_4O_{10} , and $(HPO_3)_3$.
- Calculate the ratio of the radii of the second and third Bohr's orbits in H-atom.
- Find the lowering of vapour pressure in mm Hg of 30% of an aqueous solution of glucose. Assume $P_{H_2O} = 760$ mm of Hg.
- How many of the following have 10 electrons?
 O^{2-} , O , Al^{3+} , Al , F , F^- , Mg^{2+} , Mg , N^{3-}
- How many of the following statements are correct :
 - Conductivity (K) decreases with an increase in dilution, for both strong and weak electrolytes.
 - Molar conductivity increases with an increase in dilution for both strong and weak electrolytes.
 - Molar conductivity increases with an increase in 'a' for a weak electrolyte.
 - Change in molar conductivity is the same for both strong and weak electrolytes with the increase in dilution.
- Identify if the following statement(s) is/are correct/incorrect.
Statement I: According to Bohr's Model, the angular momentum is Quantized for stationary orbits.
Statement II: Bohr's Model doesn't follow Heisenberg's Uncertainty Principle.
- Identify the major product when C_6H_5Cl reacts in presence of CH_3COCl and anhydrous $AlCl_3$.
- In which of the following cities, the photochemical smog is found to be minimum?
 - Mumbai
 - New Delhi
 - Jammu & Kashmir
 - Kolkata
- What is the oxidation state of Cr in Chromyl Chloride?
- What will be the change in the oxidation state of Mn when $KMnO_4$ and KI react in acidic medium?

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MATHEMATICS

- $f(x) = \log(4x^2 + 11x + 9) + \sin^{-1}(4x + 3) + \cos^{-1}((10x + 6)/3)$
If the domain of $f(x) = [\alpha, \beta]$, then find $|10(\alpha - \beta)|$.
- Find the equivalent statement of $p \wedge (q \wedge (p \wedge q))$.
 - Tautology
 - Fallacy
 - Contingency
 - None of these
- Find the number of solutions of the equation:
 $x|x| + 5|x + 2| + 6 = 0$
- Find the orthocentre of the triangle having vertices as A(1,2), B(3, -4), and C(0,6).
- How many three-digit numbers can be formed which are divisible by 3 using the digits 1,3,5, and 8? Repetition is allowed.
- If $n \in [10, 100]$ and $n \in \mathbb{N}$, then how many values of such n are possible where $3^n - 3$ is divisible by 7?
- Matrix A having an order of m has the value of its determinant as m^{-n} . Find the value of $\det(n \operatorname{adj}(\operatorname{adj}(mA)))$.
- The mean and variance of 15 observations is 20 and 64 respectively. If 55 is wrongly read as 40 as one of the observations, then find the correct variance.
- The value of the area bounded by the curve $2y^2 = 3x$ and the line $x + y = 3$ outside the circle $(x - 3)^2 + y^2 = 2$ and above X-axis is A. Find the value of $4(\pi + 44)$.
- There are 5 black and 3 white balls in a bag. A die is rolled and the balls picked are as per the number appearing on the die. What is the probability that all balls are white?