JEE Mains 2024 Question Paper Shift 2 (27 Jan)

Physics Question Paper

1. If $(p - a/V^2)(V - b) = nRT$ where P, V, R, & T are pressure, volume, universal gas constant, and temperature, then a/b^2 has the same dimensional formula as that of:
    i. R
    ii. PV
    iii. RT
    iv. P

2. A ring and solid sphere of the same mass and radius slide down an inclined plane of the same angle θ. Find the ratio of their kinetic energies.

3. If two bodies with masses 4 kg and 5 kg have the same kinetic energy, then find the ratio of their linear momentum.

4. If the work function of a metal is 6.63 eV, then find the threshold frequency for the photoelectric effect.

5. Statement 1: Positive zero error is added to the measured value.
    Statement 2: Defects may occur during the manufacturing of measuring instruments
    i. Statement 1 is true while statement 2 is false
    ii. Statement 1 is false while Statement 2 is true
    iii. Both statements are true
    iv. Both statements are false

6. Find the total kinetic energy of 1 mole of oxygen gas at 27°C. Take R = 25/3 J/(mol-K).

7. A particle loses 1/3rd of its velocity when it strikes a block and covers a distance of 4 cm inside the fixed block. Then find D, if D is the distance covered by the particle inside the block and comes at rest.

8. A train moving at a speed of 12 m/s takes a circular turn of radius 500 m. The rails are 1.5m apart, then by what height the outer rail should be raised with respect to the inner rail?

9. There exists a uniform electric field of 20 î N/C. A dipole of dipole moment |P| = 15c - m is placed at an angle of 30° with the electric field, then find the torque on the dipole.

10. If a man is carrying the weight of a rod with mass m leaning against his head such that the rod forms an angle of 60° with the horizontal, then find the weight of the rod experienced by him.

11. A bullet is fired into a fixed target. It loses 1/3rd of its velocity after 3 travelling for 4 cm. It penetrates further $p \times 10^{-3}$ m before coming to rest. Find p.

12. If the primary side of a transformer is connected with 230 V, 50 Hz AC supply and the ratio of the number of turns of primary to the secondary winding is 10:1. The load resistance at the secondary coil is 46 Ω then find the power of the secondary winding output.

13. Three voltmeters (V_1, V_2, V_3) are connected in a circuit such that V_1 and V_2 are in series with each other and both are in parallel with V_3. Find the correct relation among their readings.

14. In an adiabatic process, the pressure of a gas is proportional to the cube of absolute temperature, then the ratio of C_p/C_v is?
15. A ball suspended by a thread swings in a vertical plane so that its acceleration in the extreme position and lowest position are equal. The angle 0 of thread deflection in the extreme position will be?
16. A particle moves 80 m in the last 2 seconds of free fall of height h, then find the height h.
17. If a current of 200 µA deflects the coil of a moving galvanometer through 60°, then what is the current required to cause deflection through π/10 radians?
18. A uniform ring and uniform solid sphere roll down the same inclined plane at the same distance. If the ratio of their translational kinetic energies is 7/x then find x. It is given that the mass and radius of the ring and sphere are equal and the situation is pure rolling.

Memory-based Math questions for JEE Main 27 Jan 2024 Shift 2

1. If A is a 2 x 2 matrix and I is an Identity matrix of order 2 & $|A - \lambda*I| = 0$ gives values of λ as -1 & 3. Then, the trace of A^2 is equal to?
2. $\int_0^\pi dx / (1 - 2a \cos x + a^2) = ?$
3. If the line x + y = 0 is tangent to the circle $(x - \lambda)^2 + (y - \beta)^2 = 50$, then $(\lambda + \beta)^2 = ?$
4. If the mean of 15 observations is 12 and the standard deviation is 3. If 12 is replaced by 10 in data, then the new mean is µ and variance is σ^2 then what is the value of $15(\mu + \mu^2 + \sigma^2) = ?$
5.
6. Considering the principal values of inverse trigonometric functions, find the positive real values of x satisfying $\tan^{-1}(x) + \tan^{-1}(2x) = \pi/4$.
7. Let R be the interior region between the lines 3x - y + 1 = 0 and x + 2y - 5 = 0 containing the origin. The set of all values of a for which points $(a^2, a + 1)$ lie is?
8. The position vectors of vertices A, B, C of a triangle are $i + 2j + 3k$, $i + j + 3k$, $2i + j + 3k$ respectively. Let x is the length of the angle bisector of angle BAC, then the value of x^2 is?
9. If $2\tan^2\theta - 5\sec\theta = 1$ has exactly 7 solutions in $[\theta, n\pi/2]$ for the least value of $n \in N$, then $\sum_{k=1}^n (k/2^n)$ is equal to?
10. If dy/dx = (x + y - 2) / (x - y), and y(0) = 2, then find y(2).
11. Find the 20th term from the end of the progression:
    20, 19(1/4), 18(1/2), 17(3/4), ..., -129(1/4)
12. The area bounded by $0 \le y \le \min\{2x, 6x - x^2\}$ and x-axis is A. then 12A is:

Memory-based Chemistry questions for JEE Main 27 Jan 2024 Shift 2

1. Find the magnetic moment of complex $[Pd(NH_3)_2Cl_2]$.
2. When 9.3 g of aniline is reacted with acetic anhydride, mass of acetanilide obtained is m grams. Find out the value of 2m.
3. Which structure of protein is intact after coagulation of egg white on boiling?
4. What is the molecular formula of the second homologue in the homologous series of monocarboxylic acid?

5. In which of the options do all the elements have a d^{10} configuration in their ground state?
    i. Cu, Zn, Cd, Ag
    ii. Cd, Au, Hg, Ni
    iii. Sc, Ti, Fe, Zn
    iv. Fe, Cr, Co, Ni

6. If X is the major product obtained when Ph - CH = CH2 reacts in the presence of (1) B_2H_6/THF/H_2O_2/O^-, (2) HBr, (3) Mg, Dry Ether, and (4) HCHO, then find F.

7. Which of the following quantity changes with the temperature?
    i. Mole Fraction
    ii. Mass Percentage
    iii. Molarity
    iv. Molality

8. Which of the following can not act as an oxidising agent?
    i. MnO_4^-
    ii. SO_4^{2-}
    iii. N^{3-}
    iv. BrO_3^-

9. What is the technique used for the purification of steam volatile water-immiscible substance?

10. Which of the following statements is correct:
    i. Ce+4 is an oxidising agent
    ii. Ce+4 is a reducing agent
    iii. Ce+3 has a noble gas configuration
    iv. Ce has a stable configuration

11. The phenolic group can be identified by a positive result by which of the following tests?
    i. Lucas test
    ii. Carbylamine test
    iii. Phthalein test
    iv. Tollen's test

12. The reduction potential at pH = 3 for a hydrogen electrode of a standard half cell is?

13. Compare the stability of resonating structures. (A diagrammatic representation of three compounds was given.)

14. How many compound(s) given below have chiral carbon? (A diagrammatic representation of four compounds was given.)

15. Identify the following species in which d^2sp^3 hybridization is shown by central atom.
    i. BrF_5
    ii. SF_6
    iii. $[Co(NH_3)_6]^{3+}$
    iv. $[PtCl_4]^{2-}$

16. For a first-order reaction, $t_{99.9\%} = xt_{50\%}$ Find out the value of x.

17. If the longest wavelength for the Paschen Series in H-atom is α, Find $\alpha/7R$.

18. Which of the following will not give SN_1?
    i. CH_2=CH-CH_2-Cl
    ii. Ph-CH_2-Cl

iii. CH_3-CH=CH-Cl

iv. $(H_3C)C$-Cl