JEE Main 11 April 2023 Shift 1 Memory-Based Questions

PHYSICS

1. A 2μF capacitor is charged with potential V and the energy stored in the capacitor is E_1. Now the capacitor is disconnected from the battery and connected with another identical capacitor in parallel. Now the energy in the capacitor is E_2. Find E_1/E_2.
2. A fixed charge P and another force charge Q having the same mass and charge arranged such that line PQ makes an angle θ with the horizontal. Find the maximum height (h) attained by charge in an equilibrium state on a smooth inclined plane of q = 2 μC, θ = 30°, and m = 20 g.
3. A material is placed in a toroid. Find the percentage change in the magnetic field of the toroid if the susceptibility of the material is $\chi = 2 \times 10^{-2}$.
4. A particle is kept at rest at 1 cm from the axis on the disc rotating with angular velocity ω. If angular velocity is reduced to half of its initial value, then find the distance from the axis where the particle again remains at rest.
5. A scale reads the melting point of ice -15°X and the boiling point as 65°X. Find 95°X temperature in Fahrenheit.
6. An antenna is required for LOS communication up to a distance of 4 km. Find the height (in m) of the antenna assuming the radius of the Earth to be 6400 km.
7. Find the change in voltage sensitivity in a moving coil galvanometer if its number of turns increases by 25%.
8. Find the current flowing in a 3 Ω resistor in the given circuit. (diagram given)
9. For a particle undergoing linear SHM, identify the graph showing the variation of kinetic energy (k) with position (x) of the particle.
10. Identify if the following statement(s) is/are correct/incorrect.
    Statement I: Light year, Parsec and AU are units for measuring distance.
    Statement II: (1 light year) > (1 Parsec) > (1 AU)
11. Identify the logic gate in the given circuit.
12. If a 10g bullet is fired at an initial velocity of 250 m/s, then the recoil force to keep the gun in position is 125 N. How many bullets per second can be fired through this pistol?
13. If an object of mass m is projected at an angle of 30° with the horizontal. If the height of the projectile at t = 3 seconds and t = 5 seconds is the same, then find the initial speed with which the particle was projected.
14. If the force acting on a particle moving along x-axis is given by F = (2 + 3x)i, then find the work done by this force from x = 0 to x = 4 m.

15. The equation of a progressive wave is $y = A \sin(160t - 0.5x)$. If the speed of the wave is10x, find x.
16. The stopping potential for a metal when illuminated with light of wavelength λ is V_0 and that for wavelength 2λ is $V_0/4$. Find the threshold wavelength of metal.
17. The variation of impedance (Z) with angular frequency (ω) for two electrical elements is shown in the graph given (A is a straight line passing through the origin and B is a parabolic curve). If X, X_C and R are inductive reactance, capacitive reactance and resistance respectively, then identify if A and B are inductor/capacitor/resistor.
18. The variation of the magnetic field through a coil of area 4 m^2 is shown in figure (B = 2mT at t = 1 sec). Find the EMF induced in the coil in mV.
19. Two coils, Coil A and Coil B, have radius R_A = 10 cm and R_B = 20 cm. The number of turns and current passing through them are N_A, I_A and N_B, I_B respectively. It is given that the magnetic moment of both Coil A and Coil B is equal, then find out the relation between N_AI_A and N_BI_B.
20. Two resistors of resistance R are connected in two separate circuits in series and parallel combination. The rate of dissipation of heat across the resistor combinations in the series circuit is H_1 and that in the parallel circuit is H_2. Find H_1/H_2.
21. Velocity of a particle is moving on a graph of velocity vs time as v_1 = 10 m/s at t_1 = 5 sec, v_2 = 10 m/s at t_2 = 10 sec, v_3 = 20 m/s at t_3 = 15 sec, v_4 = 0 m/s at t_4 = 20 sec and v_5 = -20 m/s at t_5 = 25 sec. Find the distance and displacement travelled by the particle.
22. What will be the speed of the wave if the light is passing through a medium of critical angle of 45°?

JEE Main 11 April 2023 Shift 1 Memory-Based Questions

CHEMISTRY

1. An L-isomer of a tetrose gives Schiff's test having two chiral carbon. Compound A in presence of Conc. HNO3 gives X (Optically active). Identify A.
2. Arrange Li, Be, C, B, N, O, F in the correct decreasing order of their first ionization energy.
3. Find out the increasing order of electrophilic aromatic substitution reaction for the given compounds.
4. Find the magnetic spin moment ratio for complexes $[Cr(CN)_6]^{3-}$ and $[Cr(H_2O)_6]^{+3}$.
5. Find the number of atoms per unit cell if the edge length is 408 PM, density= 3 g/cm^3, and molecular mass = 40 g. (calculate the answer to the nearest integer)
6. Find x if
   i. For Electrode Pb^{2+} | Pb, the Potential is M.
   ii. For Electrode Pb^{4+} | Pb, the Potential is N.
   iii. For Electrode Pb^{2+} | Pb^{4+}, the Potential is M - xN.
7. Identify if the following statement(s) is/are correct/incorrect.
   Statement I: A water sample having BOD = 4 ppm is of good quality.
   Statement II: If the concentration of Zn and NO^{3-} each is 5 ppm, then water is C of good quality.
8. Identify the correct order of the root mean square speed (v_{rms}) for Ne, Cl_2 and OF_6 at the same temperature.
9. Identify the correct statement about the compound $GaAICI_4$.
   i. The chlorine atom is bonded to both Ga and Al
   ii. Ga is a cationic part and less electronegative than Al
   iii. Chlorine atom forms a co-ordinate bond with Ga
   iv. The chlorine atom is bonded to Al
10. Identify the meridional isomer from the following:
    i. $[Pt(NH_3)_3Cl_3]^+$
    ii. $[Pt(en)_3]^{4+}$
    iii. $[Pt(en)_2Cl_2]^{2+}$
    iv. $[Pt(en)_2(NH_3)^2]^{4+}$
11. If 25% of 250g sugar solution and 40% of 500g sugar solution are mixed, then find out the mass percentage in the solution.
12. If x moles of CH_3MgBr and y moles of C_6H_5CHO react to give one mole of $C_6H_5CH_2OH$, then find x/y.

13. Match the following:
    Column I:
    A. N^{3-}, B. ClO^{2-}, C. SF_4, D. NH^{4+}
    Column II:
    i. Bent, ii. Sea-saw, iii. Tetrahedral, iv. Linear

14. o-Phenylenediamine reacts in the presence of HNO_2. Identify the product.

15. To 25 mL of 1 M $AgNO_3$, 1.05 M KI is added dropwise. In the colloidal sol formed, identify the constituents of the fixed and diffused layers. (AgNO3 is in excess)

16. Which of the following is not an ambidentate ligand?
    i. SCN^-, CN^-
    ii. $C_2O_4^{2-}$, H_2O
    iii. NO_2^-, SCN^-
    iv. $EDTA^{4-}$, NO_2^-

17. Which type of copper is formed by the following reactions?
    $2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$
    $2Cu_2O + Cu_2S \rightarrow 6Cu + SO_2$

JEE Main 11 April 2023 Shift 1 Memory-Based Questions

MATHEMATICS

1. A rectangle is drawn by lines x = 0, x = 2, y = 0 and y = 5. Points A and B lie on coordinate axes. If the line AB divides the area of the rectangle in 4:1, then find the locus of the mid-point of AB.
2. Consider the plane $2x + y - 3z = 6$. If (α, β, γ) is the image of the point (2,3,5) in the given plane, then find $\alpha + \beta + \gamma$.
3. Consider two sets A and B. Set A has 5 elements whose mean and variance are 5 and 8 respectively. Set B has also 5 elements whose mean and variance are 12 and 20 respectively. A new set C is formed by subtracting 3 from each element of set A and by adding 2 to each element of set B. Find the sum of the mean and variance of the set C.
4. Find the area bounded by the curves: $x^2 + (y - 2)^2 \leq 4$ and $y^2 \leq 2x$.
5. Find the mean of coefficients of x, x^2, x^3,...,x^7 in the binomial expansion of $(2 + x)^9$.
6. Find the number of solutions for $\cos^4\theta - 2\cos^2\theta + \sin^2\theta + 1 = 0$.
7. Find the number of rational terms in the expansion of $(3^{3/4} + 5^{3/2})^{60}$.
8. Five boys with allotted roll numbers and seat numbers are seated in such a way that no one sits on the allotted seat. Find out the number of all possible combinations of such seating arrangements.
9. If a and b are the roots of x2 - 7x -1 = 0, then find $[(a^{21} + b^{21} + a^{17} + b^{17})/(a^{19} + b^{19})]$.
10. If $f(x) = | x^2 - x | + \{ x \}$, then:
    i. f(x) is continuous at x = 0 x = 1
    ii. f(x) is continuous and differentiable at x = 0 and x = 1
    iii. f(x) is continuous but non-differentiable at x = 0 x = 1
    iv. f(x) is continuous at x = 1 but discontinuous at x = 0
11. If $\log_{x+7/2} [(x + 7)/(2x + 3)]^2 \geq 0$, then find the total number of integer solutions.
12. If $S = 109 + 108/5 + 107/5^2 + ... + 2/5^{107} + 1/5^{108}$, then find the value of $16S - (2S)^{-54}$.
13. If x + y + z = 17 and x, y, z are non-negative integers, then find the number of integral solutions.
14. It is given that $(p \vee q) \wedge (p \vee r) \Rightarrow (q \vee r)$. Find the number of triplets (p, q, r) such that it is true.
15. Let A be a 2 x 2 matrix such that $A^T = \alpha A + 1$ and $| A^2 + 2A | = 4$, then find a possible value of α.

16. Let the number of awards in event A be 48 and the number of awards in event B be 25 and the number of awards in event C be 18. If n(A U B U C) = 60 and n(A ∩ B ∩ C) = 5, then how many people got exactly two awards?

17. Let:
    p: I have fever
    q: I do take medicine
    r: I take rest
    Then, find the equivalent of: If I have fever then I take medicine and I take rest.

18. $M = [\ a_{ij}\ ]_{2x2}$, $0 \leq i, j \leq 2$, where $a_{ij} \in \{0, 1, 2\}$ and A is the event such that M is invertible. Find P(A).

19. The solution of a differential equation is $(1 - x^2y^2)dx = xdy + ydx$. If $y(2) = 4$, then find $[\ (5\ y(5) + 1\ ) / (\ 5\ y(5) - 1\ )\ ]$.

20. Two complex numbers w_1 and w_2 given by $w_1 = 3 + 5i$ and $w_2 = 3 + 4i$ are both rotated by 90° with respect to origin anticlockwise and clockwise directions respectively to get the new complex numbers w_3 and W_4. Find the principal argument of $w_3 - w_4$.