# JEE Main 30 January 2023 Shift 1 Memory-Based Questions

1. $\lim_{x \to 0} 48 \int_0^x \frac{\frac{t^3}{1+t^6}}{x^4} dx$ = ?
2. Find the coefficient of $x^{301}$ in the binomial equation: $x^0 (1 + x)^{500} + x^1 (1 + x)^{499} + x^2 (1 + x)^{498} + ... + x^{500}$
3. If $\tan 15^0 + 1/\tan 169^0 + 1/\tan 105^0 + \tan 195^0 = 2a$, then find the value of a + 1/a.
4. Match the equations with their graphs.
5. Match the following ions with their lone pair of electrons.
   $IF_7$, $ICl_4^-$, $XeF_2$, $XeF_4$
6. Arrange the following ligands in the increasing order of their field strength: $S_2^-$, CO, Ethylenediamine, $C_2O_4^{2-}$
7. Caprolactam when heated at high temperature gives which product?
8. The molarity of $CO_2$ in a soft drink is 0.01 M. The volume of a soft drink is 300 ml. Find the mass of $CO_2$ in the soft drink.
9. During the qualitative analysis of $SO^{3-}$ using dilute $H_2SO_4$, the $SO_2$ gas evolved turns the $K_2CrO_7$ solution into which colour?
10. Which of the following is water soluble?
    $BeSO_4$, $MgSO_4$, $CaSO_4$, $SrSO_4$, $RaSO_4$
11. What is the shape of the $OF_2$ molecule?
12. Which of the following compound acts as an inhibitor for cancer growth?
13. Bob P is released from its horizontal position of rest at the moment. If it collides elastically with an identical bob Q hanging freely, then what will be the velocity of bob Q after the collision? Take g = 10 $m/s^2$ and the length of the strings to which the bobs P and Q are attached as 20 cm.
14. Which of the following is an Antacid?
    Answer - Ranitidine
15. Two conducting solid spheres A and B are placed at a very large distance $Q_1$ and $Q_2$. The radius of A is R and the radius of B is 2R. When the key connecting the charges is closed, find the ratio of the final charge densities.
16. $NO_2$ in sunlight (UV) gives rise to A+B
    $A+O_2$ gives rise to C
    B + C gives rise to $NO_2 + O_2$
    Name the compounds A, B, and C.

17. For a system undergoing an isothermal process, heat energy is supplied to the system. Then, which of the following are the correct statements?
    Statement 1: Internal energy will increase.
    Statement 2: Internal energy will decrease.
    Statement 3: Work done by the system is positive.
    Statement 4: Work done by the system is negative.
    Statement 5: Internal energy remains constant.

18. Match the pairs.

| **Block** | **Atomic Number** |
|---|---|
| s-block | 37 |
| p-block | 52 |
| d-block | 78 |
| f-block | 64 |

19. Which of the following can be used to prepare $LiAlH_4$?

20. The heat passing through the cross-section of the conductor varies with time as $Q(t) = at - bt^2 + ct^3$ where a, b, c are positive constants. What is the minimum heat current through the conductor?

21. If the position-time graph of a particle is parabolic, what would be its corresponding velocity-time graph? (Graph images given as options).

22. How many moles of electrons are required to reduce 1 mole of permanganate ion into manganese oxide?

23. The speed of an electron in the 7th orbit is $3.6 \times 10^6$ m/s. What will be its speed in the 3rd orbit?

24. If frequency = $2 \times 10^{12}$ Hertz, calculate the energy for one mole.

25. Match the reactions with the diagrammatic representations of their products.
    i. Wurtz Reaction
    ii. Fittig Reaction
    iii. Wurtz-Fittig Reaction
    iv. Sandmeyer Reaction

26. The correct order of acidic strength of $H_a$, $H_b$, $H_c$ and $H_d$. (A diagram of a compound was given and the students will have to identify $H_a$, $H_b$, $H_c$ and $H_d$ to find the order of the acidic strength.)

27. If the volume of an ideal gas is increased isothermally, then how will its internal energy change?

28. If $z = 1 + i$ and $z_1 = \{ [ i + z( 1 - i )] / [z ( 1 - z )]$. Then find the value of $[ (12/\pi) \arg(z_1) ]$.

29. Assertion: Ketose gives seilwanoff test.
    Reason: Ketose undergoes beta elimination to form furfural.

30. Let P(h, k) be any two points on $x^2 = 4y$ which is at the shortest distance from Q(0, 33), then what is the difference of distances of P (h, k) from the directrix of $y^2 = 4 (x + y)$?

31. If the coefficient of the expansion of $x^{15}$ in expansion of $\left(ax^3 + \frac{1}{bx^{1/3}}\right)^{15}$ is equal to the coefficient of $x^{-15}$ in the expansion of $\left(ax^{1/3} + \frac{1}{bx^3}\right)^{15}$, then | ab – 5 | = ?

32. If $a_n = \frac{-2}{4n^2 - 16n - 15}$ and $a_1 + a_2 + a_3 + ... + a_{25} = m/n$, where m and n are coprime numbers, then find the value of m + n.

33. If the height of capillary rise is 5 cm for a liquid, What is the rise in height if the surface tension and density is doubled?

34. Capacitor of 400 uF is connected to a 100 V battery. Now the batter is removed and the identical capacitor is connected. Find the change in the potential energy.

35. A particle moving in unidirectional motion travels half of the total distance with a constant speed of 15 m/s. Now, it travels at 10 m/s for the first half of the remaining journey and it travels at 5 m/s for the remaining half. What is the average speed of the particle?

36. Electromagnetic wave beam of power 20 mW is incident on a perfectly absorbing body for 300 ns. Find the total momentum transferred by the beam to the body.

37. If an insulator with an inductive reactance of $X_L = R$ is connected in series with resistance R across an AC voltage, the power factor comes out to be $P_1$. Now if a capacitor with a capacitive reactance of $X_C = R$ is also connected in series with the inductor and resistor in the same circuit, the power factor comes out to be $P_2$. Find $P_1/P_2$.

38. A bullet strikes a stationary ball of mass 200 g kept at a height of 20 m. After the collision, the range of the bullet is 120 m and that of the ball is 30 m. Assuming that the collision is along the horizontal direction and the $g = 10 m/s^2$, find the initial velocity of the bullet.

39. A coil A of radius 10 cm has $N_A$ number of turns and $I_A$ is the current flowing through it. Another coil B is of radius 20 cm has $N_B$ number of turns and $I_B$ is the current flowing through it. Assuming that the magnetic dipole moments of both coils is same, find the value of $I_AN_A$ in terms of $I_B$ and $N_B$.

40. An ideal gas undergoes a thermodynamic process following $PT^2$ = Constant. The symbols have their usual meaning. Find the volume expansion coefficient of gas.

41. 600 ml of 0.04 M HCl is mixed with 400 ml of 0.02 M $H_2SO_4$. Find the pH of the resulting solution.

42. What is the role of $SiO_2$ in Cu extraction?

43. A solution of 2 g of a non-electrolyte solute and 20 g of water has a boiling point of 373.52 K. If $K_b$ =0.52 K kg/mole, find the molecular mass of the solute.

44. For first order kinetic rate constant $2.303 \times 10^{-3}$ $sec^{-1}$. The time taken for the decomposition of substance from 7 g to 2 g will be how much? Use log7 = 0.845 and log2 = 0.301

45. If Set A = {a, b, c}, R:A → A, R = {(a, b), (b, c)}. How many elements should be added for making it symmetric and transitive?
46. If the area bounded by the larger part in the first quadrant by $x = 4y^2$, x = 2, and y = x is A, then find the value of 3A.
47. A die with the points (2, 1, 0, -1, -2, 3) is thrown 5 times. The probability that the product of outcomes on all throws is positive is?
48. Let S = {1, 2, 3, 4, 5}. If f:S → P(S), where P(S) is the power set of S. Then the number of one-one function f can be made is?
49. A line is cutting x-axis and y-axis at two points A and B respectively where OA = a, OB = b. A perpendicular is drawn from O (origin) to AB at an angle of $\pi/6$ from positive x-axis. If the area of triangle OAB = $\frac{98\sqrt{3}}{3}$ sq. units, then $\sqrt{3a} + b$ is equal to?
50. The mean and variance of 7 observations are 8 and 16 respectively. If number 14 is omitted, then a & b are the new mean and variance