JEE Main 29 January 2023 Shift 2 Memory-Based Questions

1. What is the rank of TOUGH with respect to GHOTU?

2. $\int_{1/2}^{2} \frac{tan^{-1}x}{x} dx = ?$

3. Find the shortest distance between the lines:
    (x-1)/2 = (2y-2)/3 = (z-3)/1 and (x-2)/3 = (y-1)/2 = z+2)/4

4. If f(1) + 2f(2) + 3f(3) + ... + nf(n) = n(n+1)f(n) and it is given that n is greater than or equal to 2 and the value of f(1) = 1, then find 1/f(2024) + 1/f(2028).

5. $2cos^2 2x - 2sin^4 x - cos^2 x = ?$

6. Excluding rearrangement, dehydrohalogenation of the following molecules form the maximum number of isomers. Various arrangements of Bromine were provided as options.

7. Which of the following complexes has zero spin magnetic moment?
    $[FeF_6]^{3-}$, $[CoF_6]^{3-}$, $[Co(C_2O_4)_3]^{3-}$, $[Fe(H_2O)6]^{3+}$

8. Which of the following diseases can be cured by equanil drug?
    Pain, Stomach Ulcer, Depression, Hyperacidity

9. If Bohr's radius of H atom in ground state is 0.6A°. What is the Bohr's radius of He⁺ ion in the third orbit?

10. Arrange the following molecules in the decreasing values of their bond order.
    O_2^{2-}, NO, CO

11. How many of the given oxides are acidic in nature?
    NO, NO_2, N_2O_3, Cl_2O_7, CO, SO_2, SO_3, N_2O

12. Which of the following ores contain sulphide ions?
    Malachite, Calamite, Sphalerite, Siderite

13. Assertion: Ionization enthalpy difference from B to Al is more than that of Al to Ga.
    Reason: Ga has completely filled d-orbital.

14. Which of the following relations is correct?
    i. $\Delta G = \Delta H + T\Delta S$ (at constant temperature and pressure)
    ii. $\Delta U = \Delta H + nRT$ (for n moles of ideal gas)
    iii. $P\Delta V = (\Delta n)RT$
    iv. All of these

15. What are the products formed when $LiNO_3$ is thermally decomposed?

16. BOD value of drinking water ranges between?

17. A 1:1 (by mole) mixture of A and B is passed to a container. Molar mass of A is 16 g. Molar mass of B is 32 g. Half-life of A is 1 day. Half-life of B is ½ day. After 2 days, find the average molar mass of the remaining mixture.

18. What is the product when propanamide is treated with Br_2 in presence of KOH.

19. What is the number of voids in 0.02 moles of a solid which forms HCP lattice? Take $N_A = 6 \times 10^{23}$

20. Match the pairs.

Thermosetting	Neoprene
Thermoplastic	Polyester
Elastomer	Polystyrene
Fibre	Urea formaldehyde resin

21. Find the equivalent of (~A) V B.

22. R = {(a, b) : 2a + 3b is divisible by 5 and a, b belong to N} is
    i. Transitive but not symmetric
    ii. Equivalence relation
    iii. Symmetric but not transitive
    iv. Not equivalence

23. $\int_{1/2}^{2} \left(\frac{t^4+1}{t^6+1}\right) dt = ?$

24. Find the number of the 3-digit numbers which are divisible by 3 and 4 but not by 48.

25. A force F = -40x acts on a mass of 1 kg. x is the position of the mass. If the maximum speed of the mass is 4 m/s, find the amplitude of the mass.

26. Consider two inclined planes of the same height. Plane 1 has smooth surface and an angle of inclination of 45^0. Plane 2 has rough surface and an angle of inclination of 60^0. If the ration of the time taken for a mass to slide from the top to bottom is n (Plane 2 : Plane 1). Find the coefficient of friction of the rough incline plane.

27. At 300K, the RMS speed of a gas molecule is $[(a + 5)/a]^{1/2}$ times the average speed of a gas molecule, then what is the value of a? Take $\pi = 22/7$.

28. An alpha particle and a proton are accelerated through the same potential difference and the ratio of the de-Broglie wavelength of the alpha particle to that of the proton is equal to $1/x^{1/2}$. Assuming the mass of the alpha particle as four times the mass of the proton, find x.

29. The time period for the rotation of a planet is 24 hours. If the radius of the planet decreases to 1/4th of its original value, then the new time period is x hours. Find 2x.

30. If $(x - At)^2 + (y - t/B)^2 = a^2$ and if the dimensions of [t] = T^{-1}, then find the dimensions of [A] and [B].

31. A projectile is fired with a velocity of 54 kmph such that it makes an angle of 45^0 with horizontal. Angular momentum of this particle of mass 1 kg about the point of projection one second into the motion will be $5N/2^{1/2}$ in SI units. Take $g = 10m/s^2$ and find the value of N.

32. In a communication system, the maximum voltage is 14 mV and the minimum voltage is 6 mV. Find the modulation index.

33. A particle is undergoing a uniform circular motion about the origin. At a certain instant when x = 2 m, v = -4j m/s. Then find the velocity and the acceleration at x = -2 m.

34. A man pulls a block of mass m hanging over a pulley. Consider the following statements and state which of them are true.
Statement 1: Work done by the gravity on the block is positive.
Statement 2: Work done by the gravity on the block is negative.
Statement 3: If the man pulls the block with a constant speed, then the tension in the string equals to the weight of the block.

35. How to improve the resolving power of the compound microscope?
i. Increase the diameter of the eyepiece.
ii. Change the material of the glass.
iii. Reduce the focal length of the eyepiece.
iv. Increase the focal length of the eyepiece.