JEE Main 30 January 2024 Shift 1 Question Paper

Chemistry

1. Find out the sum of the coefficients of all the species involved in the balanced equation:
   $2MnO4 + I^- \rightarrow$ (in the presence of a slightly alkaline medium) $\rightarrow$ Product
2. Find out the maximum number of hybrid orbitals formed when 2s and 2p orbitals are mixed.
3. Find out the work done in Joules for the cyclic process ABCA such that $P_A = 30$ kPa, $V_A = 10$ dm^3, $P_B = 10$ kPa, $V_B = 30$ dm^3, $P_C = 10$ kPa, $V_C = 10$ dm^3 (as per the given graph).
4. Identify the given reaction.
   $C_6H_6–C=O–Cl \rightarrow$ (in the presence of H_2, $Pd/BaSO_4$) $\rightarrow$ Product
   i. Etard Reaction
   ii. Stephen's Reaction
   iii. Wolff Kishner Reduction
   iv. Rosenmund Reaction
5. Which of the given compounds will not give the Fehling test?
   i. Lactose
   ii. Maltose
   iii. Sucrose
   iv. Glucose
6. Which of the following sets contain both diamagnetic ions?
   i. Ni^{2+}, Cu^{2+}
   ii. Eu^{3+}, Gd^{3+}
   iii. Cu^{+}, Zn^{2+}
   iv. Ce^{4+}, Pm^{3+}
7. Identify the halogen which has allylic halogen. (A diagrammatic representation of compounds was given).
8. Find the final product when $C_6H_6–Br$ reacts with i. Mg, Dry Ether, ii. CO_2, H^+, iii. NH_3, heat, and iv. Br_2, KOH
9. Identify the correct structure for the compound named "3-Methylpent-2-enal" as per IUPAC nomenclature.

10. Identify the most stable compound/ion among the given options.

11. Statement I: For hydrogen atoms, 3p and 3d are degenerate.
    Statement II: Degenerate orbitals have the same energy.
    i. Both statements I and II are correct.
    ii. Both statements I and II are incorrect.
    iii. Statement I is correct and statement II is incorrect.
    iv. Statement I is incorrect and statement Il is correct.

12. What is the geometry of Aluminium chloride in an aqueous solution?
    i. Square planar
    ii. Octahedral
    iii. Tetrahedral
    iv. Square pyramidal

13. The number of atoms in a silver plate having an area of 0.05 cm^2 and a thickness of 0.05 cm is m x 10^{19}. If the density of silver is 7.9 g/cm^3, find the value of m.

14. What is the group number of unununnium?

15. Match the following:
    Column I: i. BrF5, ii. H2O, iii. ClF3, iv. SF4
    Column II: a. Sea-Saw, b. T-Shape, c. Bent, d. Square Pyramidal

16. If a 250 mL solution of CH_3COONa of molarity 0.35 M is to be prepared, what is the mass of CH_3COONa required in grams? Round off the answer to the nearest integer.

17. The K_{sp} of $Mg(OH)_2$ is 1 x 10^{-12}. Find the limiting pH at 25 °C at which 0.01 M Mg^{2+} ions will precipitate.

18. Assertion (A): From N to P covalent radius increases significantly, but from As to Bi, only a small increase is observed.
    Reason (R): For a particular oxidation state, covalent radii and ionic radii increase down the group.
    i. Both (A) and (R) are correct and (R) is the correct explanation of (A).
    ii. Both (A) and (R) are correct but (R) is not the correct explanation of (A).
    iii. (A) is correct but (R) is incorrect.
    iv. (A) is incorrect but (R) is correct.

19. Find A and B if:
    $CH_3 - C \equiv CH \rightarrow$ (reacts with Na) $\rightarrow$ Product A $\rightarrow$ (reacts with B) $\rightarrow CH_3 - C \equiv C - CH_2 - CH_2 - CH_3$

20. Find A and B if:

    $C_6H_6–NH_2$ → (reacts with A) → $C_6H_6–N_2^+$ → (reacts with B) → Orange-Red Precipitate

21. Match the following:

    Column I: i. Mn^{2+}, ii. V^+, iii. Cr^+, iv. Fe^{2+}

    Column II: a. $3d^34s^1$, b. $3d^54s^0$, c. $3d^64s^0$, d. $3d^4s^1$

22. What happens to the freezing point of benzene, when a small amount of naphthalene is added to benzene?

23. A mixture is heated with dilute H_2SO_4 and the lead acetate paper turns black by the evolved gas. The mixture contains:

    i. Sulphite

    ii. Sulphide

    iii. Sulphate

    iv. Thiosulphate

24. A → P

    In a first-order reaction, the concentration of reactant A is 0.04 M at 10 mins and 0.03 M at 20 mins. Calculate the half-life of the first-order reaction in mins. [log2 = 0.3, log3 = 0.48]