MHT-CET 2023 Question Paper - Chemistry

12th May 2023 (Shift – I)

1. Find $[OH^-]$ if a monoacidic base is 3% ionised in it's 0.04 M solution.
   (A) 3.1×10^{-2} mol L^{-1}
   (B) 4.5×10^{-3} mol L^{-1}
   (C) 9.0×10^{-2} mol L^{-1}
   (D) 1.2×10^{-3} mol L^{-1}

2. Calculate ΔG^o for the reaction
   $Mg_{(s)} + Sn^{++}_{(aq)} \longrightarrow Mg^{++}_{(aq)} + Sn_{(s)}$ if E^o_{cell} is 2.23V
   (A) –430.4 kJ (B) 215.2 kJ
   (C) 645.6 kJ (D) –860.8 kJ

3. If lattice enthalpy and hydration enthalpy of KCl are 699 kJ mol^{-1} and –681.8 kJ mol^{-1} respectively. What is the enthalpy of solution of KCl?
   (A) 8.20 kJ mol^{-1} (B) 10.25 kJ mol^{-1}
   (C) 13.80 kJ mol^{-1} (D) 17.20 kJ mol^{-1}

4. Which of the following compounds does not undergo Williamson's synthesis?
   (A) $C_2H_5 - Cl$
   (B) $CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_2 - Cl$
   (C) $C_6H_5 - Cl$
   (D) $CH_3 - CH_2 - CH_2 - Cl$

5. What is the expression for solubility product of silver chromate if it's solubility is expressed as S mol L^{-1} ?
   (A) $2S^2$ (B) $3S^3$
   (C) $4S^3$ (D) $27S^4$

6. Which from following is a non-ferrous alloy?
   (A) Nickel steel (B) Chromium steel
   (C) Stainless steel (D) Brass

7. What are the number of octahedral and tetrahedral voids in 0.3 mole substance respectively if it forms hcp structure?
   (A) 1.8066×10^{23} and 3.6132×10^{23}
   (B) 3.6132×10^{23} and 1.8066×10^{23}
   (C) 6.022×10^{23} and 12.044×10^{23}
   (D) 12.044×10^{23} and 6.022×10^{23}

8. Calculate the molar mass of an element having density 7.8g cm^{-3} that forms bcc unit cell.
   $[a^3.N_A = 16.2\ cm^3\ mol^{-1}]$
   (A) 63.18 g mol^{-1} (B) 61.23 g mol^{-1}
   (C) 59.31 g mol^{-1} (D) 65.61 g mol^{-1}

9. Which among the following compounds exhibits +2 oxidation state of oxygen?
   (A) H_2O (B) SO_2
   (C) OF_2 (D) H_2O_2

10. Identify substrate A in the following reaction.
    $A + AgOH \xrightarrow[ii)\ \Delta]{i)\ moist\ Ag_2O} CH_3CH_2N(CH_3)_2 + CH_2 = CH_2$
    (A) Diethyldimethyl ammonium halide
    (B) Ethyltrimethyl ammonium halide
    (C) Diethyldimethyl ammonium hydroxide
    (D) Ethyltrimethyl ammonium hydroxide

11. What volume of $CO_{2(g)}$ at STP is obtained by complete combustion of 6g carbon?
    (A) 22.4 dm^3 (B) 11.2 dm^3
    (C) 5.6 dm^3 (D) 2.24 dm^3

12. Identify the chiral molecule from the following.
    (A) 2-Iodopropane
    (B) 2-Iodo-2-methylbutane
    (C) 2-Iodo-3-methylbutane
    (D) 3-Iodopentane

13. Calculate the time needed for reactant to decompose 99.9% if rate constant of first order reaction is 0.576 $minute^{-1}$
    (A) 8 minute (B) 12 minute
    (C) 16 minute (D) 20 minute

14. What is the number of moles of sp^3 hybrid carbon atoms in one mole of 2-Methylbut-2-ene
    (A) Four (B) Three
    (C) Two (D) One

15. Identify major product A in following reaction.
    3-Bromo-2-methylpentane $\xrightarrow[\Delta]{alc.KOH}$ A
    (A) 2-Methylpentan-3-ol
    (B) 2-Methylpent-2-ene
    (C) 4-Methylpent-3-ene
    (D) 4-Methylpentan-3-ol

16. For reaction,
    $CO_{(g)} + \frac{1}{2}O_{2(g)} \longrightarrow CO_{2(g)}$
    Which of the following equations is correct at constant T and P?
    (A) $\Delta H < \Delta U$ (B) $\Delta H > \Delta U$
    (C) $\Delta H = \Delta U$ (D) $\Delta H = 0$

17. Identify the example of zero-dimensional nanostructure from following.
    (A) Nanotubes (B) Fibres
    (C) Thin films (D) Quantum dots

18. What is pH of solution containing 50 mL each of 0.1 M sodium acetate and 0.01 M acetic acid (pK_a $CH_3COOH = 4.50$)
(A) 2.5 (B) 3.5 (C) 4.5 (D) 5.5

19. Calculate amount of methane formed by liberation of 149.6 kJ of heat using following equation.
$C_{(s)} + 2H_{2(g)} \longrightarrow CH_{4(g)}$ $\Delta H = -74.8$ kJ/mol
(A) 16g (B) 24g
(C) 32g (D) 48g

20. Which from following polymers is used to obtain tyre cords?
(A) Nylon 6 (B) Polyacrylonitrile
(C) Bakelite (D) Terylene

21. Electrolytic cells containing Zn and Al salt solutions are connected in series. If 6.5g of Zn is deposited in one cell calculate mass of Al deposited in second cell (molar mass : Zn = 65, Al = 27) by passing definite quantity of electricity?
(A) 2.4g (B) 2.1g
(C) 2.7g (D) 1.8g

22. What type of glycosidic linkages are present in cellulose?
(A) β - 1, 6 (B) β - 1, 4
(C) α - 1, 6 (D) α - 1, 4

23. Calculate the rate constant of first order reaction if half life of reaction is 40 minute.
(A) 1.733×10^{-2} minute^{-1}
(B) 1.951×10^{-2} minute^{-1}
(C) 1.423×10^{-2} minute^{-1}
(D) 1.256×10^{-2} minute^{-1}

24. Identify product 'B' in following sequence of reactions.
2n Propanone $\xrightarrow{Ba(OH)_2}$ A $\xrightarrow[-H_2O]{\Delta}$ nB
(A) 4-Hydoxy-4-methylpentan-2-one
(B) 2-Methylpentan-3-one
(C) 2-Methylpent-2-en-4-one
(D) 4-Methylpent-3-en-2-one

25. Identify rate law expression for
$2NO_{(g)} + Cl_{2(g)} \rightarrow 2NOCl_{(g)}$ if the reaction is second order in NO and first order in Cl_2.
(A) Rate = k $[NO]^2$ $[Cl_2]$
(B) Rate = k $[NO]$ $[Cl_2]$
(C) Rate = k $[NO]^2$
(D) Rate = k $[Cl_2]$

26. Which among the following solutions has minimum boiling point elevation?
(A) 0.1m NaCl (B) 0.2m KNO_3
(C) 0.1m Na_2SO_4 (D) 0.05m $CaCl_2$

27. Calculate osmotic pressure of solution of 0.025 mole glucose in 100ml water at 300K.
[R = 0.082 atm dm^3 mol^{-1} K^{-1}]
(A) 1.54 atm (B) 2.05 atm
(C) 6.15 atm (D) 3.08 atm

28. Which from following is a neutral ligand?
(A) Aqua (B) Sulphato
(C) Carbonato (D) Bromo

29. How many isomers of $C_4H_{11}N$ are tertiary amines?
(A) One (B) Two
(C) Three (D) Four

30. Which element from following exhibits diagonal relationship with Mg?
(A) Be (B) Li (C) Na (D) B

31. Identify the good conductor of electricity from following band gap energy values of solids

Solid	E gap
A	5.47 eV
B	0.0 eV
C	1.12 eV
D	0.67 eV

(A) A (B) B (C) C (D) D

32. Identify the product obtained when ethoxybenzene reacts with hot and concentrated HI.
(A) Ethyl iodide and Phenol
(B) Ethyl alcohol and Phenol
(C) Ethyl alcohol and Iodobenzene
(D) Ethyl iodide and Iodobenzene

33. Identify thermosetting polymer from following.
(A) Urea formaldehyde resin
(B) Polythene
(C) Polystyrene
(D) Polyvinyls

34. Which from following phenomena is inversely proportional with adsorption?
(A) Critical temperature of gas
(B) Surface area of adsorbent
(C) Temperature of process
(D) Pressure of gas

35. Calculate the frequency of blue light having wavelength 440nm.
(A) 6.82×10^{14} Hz
(B) 7.5×10^{14} Hz
(C) 4.0×10^{14} Hz
(D) 5.26×10^{14} Hz

36. Which from following elements is NOT radioactive?
(A) At (B) Po (C) Rn (D) Ar

37. Which from following is strongest reducing agent?
(A) K (B) Al (C) Mg (D) Ag

38. What is the numerical value of spin only magnetic moment of copper in +2 state?
(A) 0.0 (B) 1.73
(C) 2.78 (D) 4.4

39. Identify the element having highest density from following.
(A) O (B) S (C) Se (D) Te

40. What is the shape of AB_4E type of molecule according to VSEPR?
(A) See saw
(B) Bent
(C) Trigonal pyramidal
(D) T shade

41. The molecular formula of hexachlorobenzene is
(A) $C_6H_6Cl_6$ (B) C_6Cl_6
(C) C_6H_5Cl (D) C_6H_6Cl

42. What is the value of specific rotation exhibited by fructose molecule?
(A) $+52.7^o$ (B) -92.4^o
(C) $+66.5^o$ (D) -40.3^o

43. Which of the following reactions is Rosenmund reduction?
(A) $R-\underset{\underset{O}{||}}{C}-Cl \xrightarrow[Pd-BaSO_4]{H_2} R-CHO + HCl$

(B) $R-CN \xrightarrow[H_2O]{SnCl_2.HCl} R-CHO + NH_4Cl$

(C) $R-CHO \xrightarrow[\Delta]{Zn-Hg,\,Conc.HCl} RCH_3 + H_2O$

(D) $R-\underset{\underset{O}{||}}{C}-R \xrightarrow[ii)\ KOH,\ HO-CH_2-CH_2-OH]{i)\ H_2N-NH_2,\ \Delta} R-CH_2-R$

44. Which from following complexes contains only anionic ligands?
(A) Tetraamminedibromoplatinum (IV) bromide
(B) Potassiumtrioxalatoaluminate (III)
(C) Pentaaquaisothiocyanatoiron (III) ion
(D) Pentaammineaquacobalt (III) iodide

45. A hot air balloon has volume of 2000 dm^3 at 99^oC. What is the new volume if air in balloon cools to 80^oC?
(A) 2428.9 dm^3 (B) 2656.9 dm^3
(C) 2814.9 dm^3 (D) 1897.8 dm^3

46. Identify the product obtained in following reaction.
$n\ CH_3MgI + H_2O \xrightarrow{\text{dry ether}}$ product
(A) n MgI and n CH_4
(B) $\frac{n}{2}C_2H_6$
(C) n CH_3OH and n MgI
(D) n CH_4 and n MgI(OH)

47. Which of following pairs is an example of isoelectronic species?
(A) O^{--}; Na^+ (B) O^{--}; F
(C) K ; Ca^{++} (D) Ar ; Al^{+3}

48. Which from following compounds is obtained when anisole is heated with dilute sulfuric acid?
(A) Phenol and ethanol
(B) Phenol and methanol
(C) Pyrogallol and methanol
(D) Phloroglucinol and ethanol

49. Calculate molality of solution of a nonvolatile solute having boiling point elevation 1.89K if boiling point elevation constant of solvent is 3.15K kg mol^{-1}.
(A) 0.4m (B) 0.8m
(C) 0.6m (D) 0.3m

50. What type of following phenomena does the Cannizzaro reaction exhibits?
(A) Nucleophilic addition
(B) Elimination
(C) Disproportionation
(D) Decomposition