SATISH SCIENCE ACADEMY

DHANORI PUNE-411015

CHEMISTRY

JEE main - Chemistry

Time Allowed: 1 hour **Maximum Marks: 100**

General Instructions:

- All questions are compulsory.
- There are 25 questions where the first 20 questions are MCQs and the next 5 are numerical.
- You will get 4 marks for each correct response and 1 mark will be deducted for an incorrect answer.

CHEMISTRY (Section-A)

1. The difference between the radii of 3rd and 4th orbits of Li^{2+} is ΔR_1. The difference between the radii of 3rd and 4th orbits of He^{+} is ΔR_2. Ratio $\Delta R_1 : \Delta R_2$ is: **[4]**

   a) 8 : 3 b) 2 : 3

   c) 3 : 8 d) 3 : 2

2. The correct order of the ionic radii of O^{2-}, N^{3-}, F^{3-}, Mg^{2+}, Na^{+} and Al^{3+} is: **[4]**

   a) $Al^{3+} < Mg^{2+} < Na^{+} < F^{-} < O^{2-} < N^{3-}$ b) $N^{3-} < F^{-} < O^{2-} < Mg^{2+} < Na^{+} < Al^{3+}$

   c) $Al^{3+} < Na^{+} < Mg^{2+} < O^{2-} < F^{-} < N^{3-}$ d) $N^{3-} < O^{2-} < F^{-} < Na^{+} < Mg^{2+} < Al^{3+}$

3. When the hydrogen ion concentration $[H^{+}]$ changes by a factor of 1000, the value of pH of the solution _____. **[4]**

   a) increases by 1000 units b) decreases by 2 units

   c) increases by 2 units d) decreases by 3 units

4. Two blocks of the same metal having same mass and at temperature T_1 and T_2 respectively, are brought in contact with each other and allowed to attain thermal equilibrium at constant pressure. The change in entropy, ΔS, for this process is **[4]**

   a) $^{2}C_p \ln\left[\frac{T_1+T_2}{4T_1T_2}\right]$ b) $^{2}C_p \ln\left[\frac{(T_1+T_2)^{1/2}}{T_1T_2}\right]$

   c) $C_p \ln\left[\frac{(T_1+T_2)^2}{4T_1T_2}\right]$ d) $^{2}C_p \ln\left[\frac{T_1+T_2}{2T_1T_2}\right]$

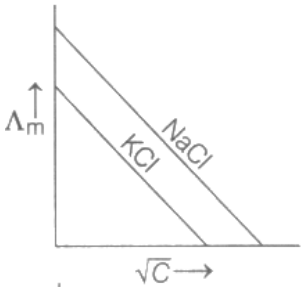
5. What is the pH of a 10^{-4} M OH^{-} solution at 330K, if K_w at 330 K is $10^{-13.6}$? **[4]**

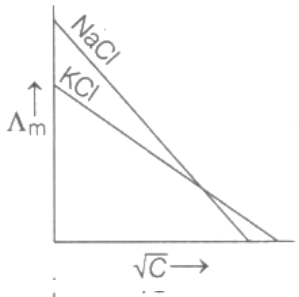
   a) 4 b) 9.6

   c) 10 d) 9.0

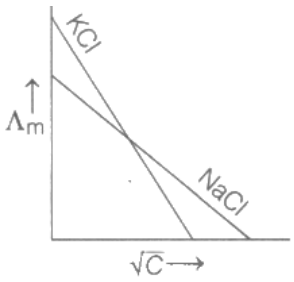
6. Which one of the following graphs between molar conductivity ($\wedge_m$) versus $\sqrt{C}$ is correct? **[4]**

   a) b)

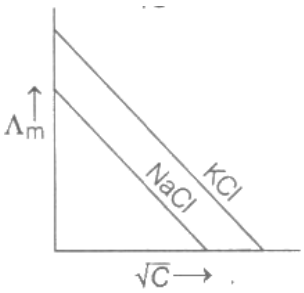




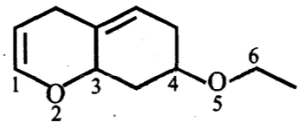
c)



d)



7. On the treatment of the following compound with a strong acid, the most susceptible site for bond cleavage is: **[4]**



a) O5-C6 b) C4-O5

c) O2-C3 d) C1-O2

8. Among the following, identify the species with an atom in +6 oxidation state: **[4]**

a) CrO_2Cl_2 b) NiF_6^{2-}

c) MnO_4^- d) $Cr(CN)_6^{3-}$

9. In the following sequence of reactions **[4]**

Toluene $\xrightarrow{KMnO_4}$ A $\xrightarrow{SOCl_2}$ B $\xrightarrow[BaSO_4]{H_2/Pd}$ C, the product C is

a) C_6H_5COOH b) C_6H_5CHO

c) $C_6H_5CH_3OH$ d) $C_6H_5CH_3$

10. Freezing point of a 4% aqueous solution of X is equal to freezing point of 12% aqueous solution of Y. If molecular weight of X is A, then molecular weight of Y is **[4]**

a) A b) 3A

c) 4A d) 2A

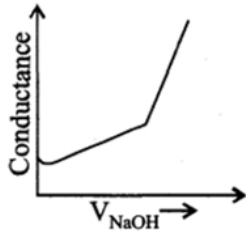
11. The mass of non-volatile, non-electrolyte solute (molar mass = 50 g mol^{-1}) needed to be dissolved in 114 g octane to reduce its vapour pressure to 75%, is _____. **[4]**

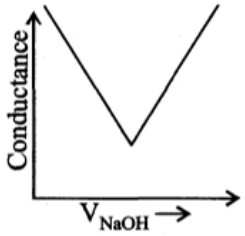
a) 37.5 g b) 50 g

c) 75 g d) 150 g

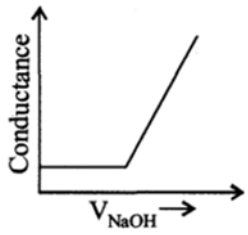
12. Choose the correct representation of conductometric titration of benzoic acid vs sodium hydroxide. **[4]**

a) b)

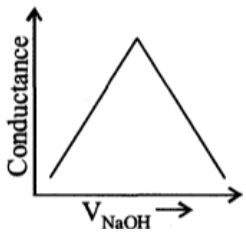




c)



d)



13. For the equilibrium, A(g) $\rightleftharpoons$ B(g), ΔH is -40 kJ/mol. If the ratio of the activation energies of the forward (E_f) and reverse (E_b) reactions is $\frac{2}{3}$ then: **[4]**

a) E_f = 80 kJ/mol; E_b = 120 KJ/mol

b) E_f = 30 kJ/mol; E_b = 70 KJ/mol

c) E_f = 60 kJ/mol; E_b = 100 KJ/mol

d) E_f = 70 kJ/mol; E_b = 30 KJ/mol

14. The standard Gibbs energy for the given cell reaction in kJ mol^{-1} at 298 K is: **[4]**

$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$, $E° = 2V$ at 298K

(Faraday's constant, F = 96000 C mol^{-1})

a) 384

b) -192

c) 192

d) -384

15. If the boiling point of H_2O is 373 K, the boiling point of H_2S will be: **[4]**

a) less than 300 K

b) greater than 300 K but less than 373 K

c) more than 373 K

d) equal to 373 K

16. The set which does not have ambidentate ligand(s) is **[4]**

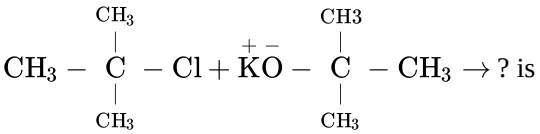
a) $C_2O_4^{2-}$, NO_2^-, NCS^-

b) $EDTA^{4-}$, NCS^-, $C_2O_4^{2-}$

c) NO_2^-, $C_2O_4^{2-}$, $EDTA^{4-}$

d) $C_2O_4^{2-}$, ethylene diammine, H_2O

17. The major product in the reaction **[4]**



$$CH_3-\overset{CH_3}{\underset{CH_3}{C}}-Cl+\overset{+}{K}\overset{-}{O}-\overset{CH3}{\underset{CH_3}{C}}-CH_3 \rightarrow ?\text{ is}$$

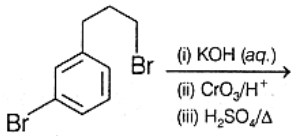
a) 2, 2-Dimethyl butane

b) t-Butyl ethyl ether

c) 2-Methyl pent-1-ene

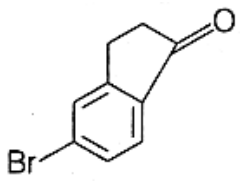
d) 2-Methyl prop-1-ene

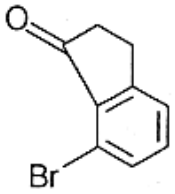
18. Major product of the following reaction will be **[4]**



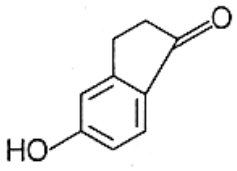
a)

b)

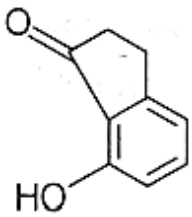




c)



d)



19. In the following sequence of reactions: **[4]**

Toulene $\xrightarrow[\Delta]{KMnO_4, H^+}$ A $\xrightarrow{SOCl_2}$ B $\xrightarrow[BaSO_4]{H_2/Pd}$ C, the product C is _____.

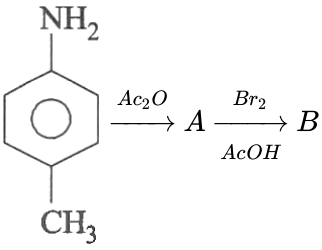
a) C_6H_5COOH

b) C_6H_5CHO

c) $C_6H_5CH_3$

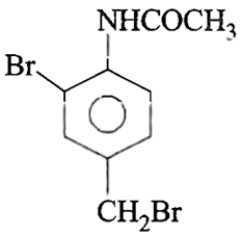
d) $C_6H_5CH_2OH$

20. In the following reaction sequence, **[4]**

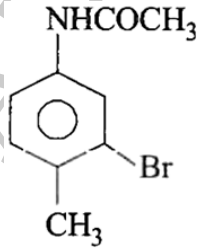


the major product B is:

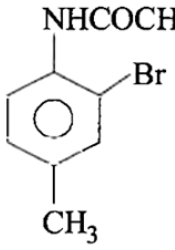
a)



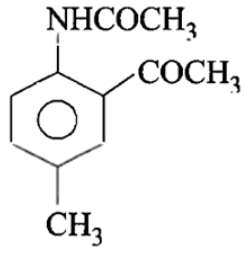
b)



c)



d)



CHEMISTRY (Section-B)

21. The wavelength of electrons accelerated from rest through a potential difference of 40 kV is $x \times 10^{-12}$ m. The value of x is _____. (Nearest integer) **[4]**

Given: Mass of electron = 9.1×10^{-31} kg

Charge on an electron = 1.6×10^{-19} C

Planck's constant = 6.63×10^{-34}Js

22. If compound A reacts with B following first order kinetics with rate constant 2.011×10^{-3} s^{-1}. The time taken by A (in seconds) to reduce from 7 g to 2 g will be _____. (Nearest Integer) **[4]**

23. The ratio of spin-only magnetic moment values $\mu_{eff}[Cr(CN)_6]^{3-}$ / $\mu_{eff}[Cr(H_2O)_6]^{3+}$ is _____. **[4]**

24. The complete combustion of 0.492 g of an organic compound containing 'C', 'H' and 'O' gives 0.793g of CO_2 and 0.442 g of H_2O. The percentage of oxygen composition in the organic compound is _____. (nearest integer) **[4]**

25. For the disproportionation reaction **[4]**

$2Cu^+$ (aq) $\rightleftharpoons$ Cu(s) + Cu^{2+} (aq) at 298 K, In K (where K is the equilibrium constant) is _____ $\times$ 10^{-1}. Given ($E^0_{Cu^{2+}/Cu^+}$ = 0.16 V; $E^0_{Cu^+/Cu}$ = 0.52V; $\frac{RT}{F}$ = 0.025)