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. H has two natural isotopes $_1H^1$ and $_1H^2$ and O has a molar mass of:has two isotopes O^{16} and O^{18}. Which of the following molar mass of H_2O will not be possible? **[4]**

   a) 22   b) 19

   c) 20   d) 24

2. Which substance is stored in contact with water to prevent it from reacting with air? **[4]**

   a) Mercury   b) Bromine

   c) Phosphorus   d) Lithium

3. The ionisation constant of NH_4^+ in water is 5.6×10^{-10} at 25°C. The rate constant for the reaction of NH_4^+ and OH⁻ to form NH_3 and H_2O at 25°C is 3.4×10^{-10} L mol⁻¹ s⁻¹. The rate constant for proton transfer from water to NH_3 is: **[4]**

   a) 6.07×10^5 s⁻¹   b) 1.07×10^{-5} s⁻¹

   c) 6.07×10^{-10} s⁻¹   d) 6.07×10^{10} s⁻¹

4. A kettle containing 1 kg of water is heated open to atmosphere untill evaporation is complete. The work done during this process is: **[4]**

   a) 126.09 kJ   b) 172.28 kJ

   c) 172.28 J   d) 126.09 J

5. An acid type indicator, HIn differs in colour from its conjugate base (In⁻). The human, eye is sensitive to colour differences only when the ratio [In-]/[HIn] is greater than 10 or smaller than 0.1. What should be the minimum change in the pH of the solution to observe a complete colour change ($K_a = 1.0 \times 10^{-5}$): **[4]**

   a) 4   b) 6

   c) 2   d) 1

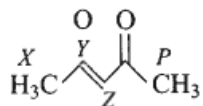6. In the balanced redox reaction for the disproportionation of bromine in the presence of a strong base, OH⁻ **[4]**

producing bromide ion and bromate ion, the coefficient of bromide ion is _____.

    a) 6   b) 3

    c) 5   d) 12

7. H_2O_2 on reaction with PbS gives: **[4]**

    a) PbO   b) PbO_2

    c) $PbSO_4$ d) $PbHSO_4$

8.   The abstraction of proton will be fastest in which carbon in the following compound?   **[4]**

    a) Z   b) Y

    c) P   d) X

9.   Which of the following is the major product when 1-butanol is heated with concentrated H_2SO_4?   **[4]**

    a) 1-butene   b) All of these

    c) Trans-2-butene   d) Cis-2-butene

10.   Solute A associates in water. When 0.7 g of solute A is dissolved in 42.0 g of water, it depresses the freezing   **[4]**
point by 0.2°C. The percentage association of solute A in water, is

[Given: Molar mass of A = 93 g mol^{-1}. Molal depression constant of water is 1.86K kg mol^{-1}].

    a) 50%   b) 60%

    c) 70%   d) 80%

11.   Water will boil at 101.5°C at which of the following pressure?   **[4]**

    a) 76 cm of Hg   b) 76 mm of Hg

    c) > 76 cm of Hg   d) < 76 cm of Hg

12.   The molecular conductivity and equivalent conductivity are same for the solution of: **[4]**

    a) 1 M $Ba(NO_3)_2$ b) 1 M $Th(NO_3)_4$

    c) 1 M NaCl   d) 1 M $La(NO_3)_3$

13.   A student has studied the decomposition of a gas AB_3 at 25°C. He obtained the following data.   **[4]**

p(mm Hg)	50	100	200	400
Relative $t_{\frac{1}{2}}(s)$	4	2	1	0.5

    a) 0.5   b) 2

    c) 1   d) 0(zero)

14.   Given $E^{\circ}_{Cr^{3+}/Cr}$ = -0.74 V; $E^{\circ}_{MnO_4^-/Mn^{2+}}$ = 1.51 V   **[4]**

$E^{\circ}_{CrO_7^{2-}/Cr^{3+}}$ = 1.33 V; E°_{Cl/Cl^-} = 1.36 V

Based on the data given above, the strongest oxidising agent will be:

a) Cl^- b) MnO_4^-

c) Cr^{3+} d) Mn^{2+}

15. Electron gain enthalpy with negative sign of fluorine is less than that of chlorine due to: **[4]**

     a) Bigger size of 2p orbital of fluorine   b) Smaller size of chlorine atom

     c) High ionization enthalpy of fluorine   d) Smaller size of fluorine atom

16. π-bonding is not involved in: **[4]**

     a) Grignard's reagent   b) ferrocene

     c) Dibenzenechromium   d) Zeise's salt

17. Amongst the following, which one is a halogen exchange reaction? **[4]**

     a) $R - Cl + NaI \xrightarrow{\Delta}$ b) $R - F + NaCl \xrightarrow{\Delta}$

     c) $R - CH_2 - F + KBr \xrightarrow{\Delta}$ d) $R - I + NaI \xrightarrow{\Delta}$

18. Aniline undergoes diazotization followed by hydrolysis and forms compound **X**, which after oxidation forms a pink colour compound **Y**. Compound **X** undergoes Kolbe's reaction and forms compound **Z.** Acylation product of compound **Z** is aspirin. Identify compounds X, Y and Z respectively. **[4]**

     a) p-Nitrophenol, Salicylic acid, Salicylaldehyde   b) Benzene, Salicylaldehyde, Salicylic acid

     c) Nitrobenzene, Phenol, Salicylaldehyde   d) Phenol, Benzoquinone, Salicylic acid

19. Which one of the following structures is D-Glyceraldehyde? **[4]**
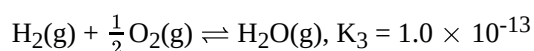

20. The decreasing order of basicity of the following amines is: **[4]**
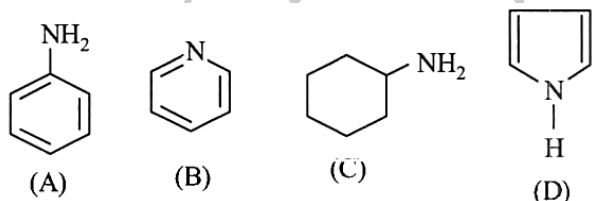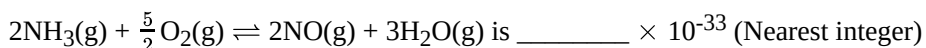

     a) (C) > (A) > (B) > (D)   b) (B) > (C) > (D) > (A)

     c) (C) > (B) > (A) > (D)   d) (A) > (C) > (D) > (B)

**CHEMISTRY (Section-B)**

21. At 298 K **[4]**

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$, $K_1 = 4 \times 10^5$

$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$, $K_2 = 1.6 \times 10^{12}$

$H_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons H_2O(g)$, $K_3 = 1.0 \times 10^{-13}$

Based on above equilibria, the equilibrium constant of the reaction,

$2NH_3(g) + \frac{5}{2}O_2(g) \rightleftharpoons 2NO(g) + 3H_2O(g)$ is _____ $\times 10^{-33}$ (Nearest integer)
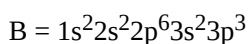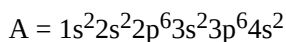
22. Ge(Z = 32) in its ground state electronic configuration has x completely filled orbitals with m_l = 0: The value of x is _____. **[4]**

23. $NaClO_3$ is used, even in spacecrafts, to produce O_2. The daily consumption of pure O_2 by a person is 492 L at 1 atm, 300 K. How much amount of $NaClO_3$, in grams, is required to produce O_2 for the daily consumption of a person at 1 atm, 300 K? _____. **[4]**
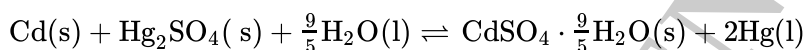
$NaClO_3(s) + Fe(s) \rightarrow O_2(g) + NaCl(s) + FeO(s)$ R = 0.082 L atm mol^{-1} K^{-1}
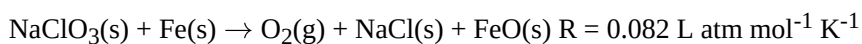
24. Two elements A and B have following electronic configuration **[4]**

A = $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

B = $1s^2 2s^2 2p^6 3s^2 3p^3$

If expected compound formed by A and B is A_xB_y then sum of x and y is:

25. Consider the following cell reaction: **[4]**

$Cd(s) + Hg_2SO_4(s) + \frac{9}{5}H_2O(l) \rightleftharpoons CdSO_4 \cdot \frac{9}{5}H_2O(s) + 2Hg(l)$

The value of E^o_{cell} 4.315 V at 25°C. If ΔH° = -825.2 kJ mol^{-1}, the standard entropy change ΔS^o in J K^{-1} is _____. (Nearest integer)