JANUARY 2024

APPLIED CHEMISTRY

Time Allowed: 2.5 Hours *Full Marks: 60*

Answer to Question No. 1 of Group A must be written in the main answer script. In Question No. 1, out of 2 marks for each MCQ, 1 mark is allotted for right answer and 1 mark is allotted for correct explanation of the answer.
Answer any Five (05) Questions from Group-B.

Group A

1. Choose the correct answer from the given alternatives and explain your answer (any ten) 2×10=20

i. The (v/v) % of a solution containing 5 mL of alcohol in 40 mL of water is (a) 14.29% (b) 12.5% (c) 11.11% (d) 10%
ii. Unit of electro chemical equivalent is (a) gm (b) Coulomb (c) gm/Coulomb (d) Coulomb/gm
iii. Cu is extracted from Copper Pyrites ore by (a) Electrolytic reduction method (b) Thermit process (c) Self reduction method (d) Carbon reduction method
iv. The salt which is not responsible for hardness, is (a) $MgSO_4$ (b) $CaCl_2$ (c) Na_2SO_4 (d) $Ca(HCO_3)_2$
v. Anti-knocking quality of diesel is indicated by (a) Heptane number (b) Octane number (c) Cetane number (d) none of them
vi. Hybridisation of C in CH_4 is (a) sp^2 (b) sp (c) sp^3d (d) sp^3
vii. The oxidation number of Cl in $KClO_3$ is (a) 7 (b) 5 (c) 3 (d) 1
viii. The monomers of Buna-S rubber are (a) styrene and butadiene (b) isoprene and butadiene (c) vinyl chloride and sulphur (d) butadiene
ix. The amount of electricity that is required to deposit 24 gm of Na from fused NaCl is (a) 0.5 F (b) 1F (c) 2F (d) 3F. (At. Wt. of Na is 24)
x. Natural rubber is the polymer of (a) Styrene (b) iso-Butylene (c) Isoprene (d) Propylene
xi. Maximum number of electrons that can be accommodated in d sub-shell is (a) 5 (b) 10 (c) 20 (d) 2.
xii. Which of the following pH represents acidic solution? (a) 7 (b) 9 (c) 3 (d) 14
xii. Which one of the following is weak electrolyte? (a) NaCl (b) H_2SO_4 (c) KCl (d) HCOOH
xiii. Formula for gypsum is: (a) $CaSO_4 + CaCO_3$ (b) $CaSO_4.1/2\ H_2O$ (c) $CaSO_4.2\ H_2O$ (d) none of these
xiv. For Copper plating on a Iron nail, cathode, anode and electrolyte will be (a) Cu, Fe, $FeSO_4$ (b) Fe, Cu, $CuSO_4$ (c) Fe, Cu, $FeSO_4$ (d) Cu, Fe, $CuSO_4$
xv. Hardness of distilled water is (a) 0 ppm (b) 1 ppm (c) 10 ppm (d) 100 ppm

GROUP-B

2 a) State Pauli's Exclusion Principle. What are the values of four Quantum numbers of the two electrons, present in the valance shell of $_{20}Ca$?
b) Calculate the molarity of a solution, prepared by dissolving 0.4 gm of NaOH in 250 mL solution.
c) State the hybridisation of central atoms of following molecules:
BF_3, NH_3, $BeCl_2$, and CH_4. (1+3)+2+2

3. a) 500 ml of water sample contains 2.4 mg of $MgSO_4$ and 11.1 mg of $CaCl_2$. Find out the total hardness of the water sample. (Mol. Wt. of $MgSO_4$ = 120, Mol. Wt. of $CaCl_2$ = 120)
b) What is Zeolite? How water is softened using Zeolite process? (Use chemical reactions)
c) How an exhausted Zeolite bed can be revived? 3+(1+2)+2

4. a) Explain – H_2O is liquid but H_2S is gas.
b) State Aufbau Principle. Write down the electronic configuration of $_{26}Fe^{2+}$.
c) The hardness of a water sample is 450 ppm. Calculate the amount of 0.01 (M) EDTA solution required to neutralize 20 ml of such water sample. 2+(1+2)+3

5. a) Write the name and formula of one Al alloy. How Al is extracted from Alumina?
b) State the differences between thermoplastic plastic and thermosetting plastic. Write down the name(s) of monomer(s) and one use of bakelite and teflon. (1+3)+(2+2)

6. a) What is proximate analyses of coal?
b) Write down the composition of Portland cement. What are the composition of carborundum and bell metal?
c) Why graphite is used as lubricant? 2+(2+2)+2

7. a) A coal sample of HCV 4800 kCal/kg contains 5% H in it. Calculate LCV of the coal sample.
b) Write down the composition and two applications of LPG and producer gas.
c) Define oiliness of a lubricating oil. 3+(2+2) +1

8. a) Write down the electrodes, electrolytes and chemical reactions for Lead storage battery during discharging.
b) Calculate the pH of 0.01(M) HCl solution. Give one example of basic buffer.
c) Compare between electrochemical corrosion and chemical corrosion with examples. 3+(2+1)+2

9. a) How does the rusting of iron occur?
b) Explain oxidation and reduction electronically with suitable example.
c) 0.75 ampere of electricity is passed through an aqueous solution of a divalent metal salt for 45 minutes. As a result, the weight of cathode is increased by 0.6662 gm. Determine the equivalent weight and atomic weight of the metal. 3+2+3