June 2021

APPLIED CHEMISTRY

Time Allowed: 3 Hours *Full Marks: 60*

Answer to Question No.1 is compulsory and Answer <u>any five</u> questions from Group-A, B & C, taking <u>at least one</u> from each group.

1. Choose the correct answer from the given alternatives (any twenty): 20x1

i) The maximum number of hydrogen bonds that a molecule of water can have is– a) 1 b) 2 c) 3 d) 4.

ii) _____ is the species with a bond angle of 120^0.- a) PH_3, b) NH_3, c) BCl_3, d) ClF_3.

iii) Which of the following quantum numbers governs the spatial orientation of an atomic orbital?- a) Principal quantum number, b) Azimuthal quantum number, c) Magnetic quantum number, d) Spin quantum number.

iv) According to Bohr's theory, the orbits in which electrons move are- a) elliptical, b) cylindrical, c) circular, d) oval.

v) If the mole fraction of 4.5 moles of solute is 0.5, what is the number of moles of solvent? – a) 9, b) 4.5, c) 1.5, d) 3.

vi) In the Zeolite softening process, the calcium and magnesium ions present in water are precipitated as- a) insoluble carbonates, b) insoluble zeolites, c) insoluble chlorides, d) insoluble sulphates.

vii) The pH of drinking water should be- a) 1 to 1.5, b) 6.5 to 8, c) 13 to 14, d) 4 to 5.

viii) The indicator used for determination of hardness of water by EDTA method is- a) Benzene, b) Phenopthalene, c) Ethylene diamine, d) Erichrome black T.

ix) Which of the following chemical is usually added in the process of coagulation and flocculation?- a) Aluminum sulphate, b) Aluminum oxide, c) Calcium chloride, d) none of these.

x) Sodium ions contribute to which characteristic of the water?- a) pH, b) Total Dissolved Solids, c) Colour, d) Suspended solids.

xi) Copper is extracted from sulphide ore using the method- a) Carbon reduction, b) Carbon monoxide reduction, c) Self reduction, d) Electrolytic reduction.

xii) An alloy which does not contain copper is- a) Bronze, b) Magnalium, c) Brass, d) Bell metal.

xiii) Carborandum is – (a) boron carbide, (b) silicon carbide, (c) sodium borate, (d) sodium silicate.

xiv) Natural rubber is a polymer of- a) Vinyl acetate, b) Propene, c) Isoprene, d) Styrene.

xv) Which is used as lubricant? – a) gas carbon b) coke c) diamond d) graphite.

xvi) Which of the following compound is considered for calculating the cetane number?- a) n-butane, b) n-hexane, c) iso-octane, d) cetane.

xvii) A gaseous fuel which is also used as a source of hydrogen is- a) water gas, b) producer gas, c) coal gas, d) natural gas.

xviii) In proximate analysis, which of the following can be determined?- a) % of hydrogen, b) % of moisture content, c) % of nitrogen, d) none of these.

xix) Viscosity index (VI) is a measure for the change of viscosity with change in- a) Temperature, b) Pressure, c) Volume, d) All of these.

xx) Nylon 6 is- a) Polyamide, b) Polyester, c) Polyphenol, d) None of these.

xxi) pH of Acetic acid at 25 ^{0}C is – a) less than 7, b) greater than 7, c) equal to 7, d) none of these.

xxii) Unit of electrochemical equivalent weight is – a) ampere/gm b) gm/coulomb c) coulomb d) coulomb/gm.

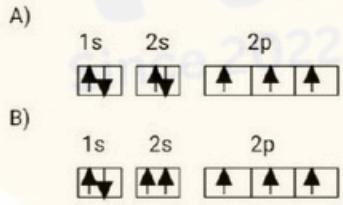
xxiii) In which of the following reaction, H_2SO_4 is not acting as an oxidising agent?-
a) $C + 2H_2SO_4 \rightarrow CO_2 + 2SO_2 + 2H_2O$,
b) $CaF_2 + 2H_2SO_4 \rightarrow CaSO_4 + 2HF$,
c) $S + 2H_2SO_4 \rightarrow 3SO_2 + H_2O$,
d) $Cu + 2H_2SO_4 \rightarrow CuSO_4 + SO_2 + 2H_2O$.

xxiv) The amount of electricity that can deposit 108 g of silver (equivalent weight 108) from $AgNO_3$ solution is- a) 1 ampere, b) 1 coulomb, c) 1 faraday, d) none of these.

xxv) Corrosion can be prevented by- a) alloying, b) tinning, c) galvanizing, d) all of these.

Group-A

2. a) State Bohr's postulates of atomic model.
b) Write the electronic configuration of $_{24}Cr$ and $_{29}Cu$.
c) Which of the following electronic configuration represents a violation of the Pauli exclusion principle? Explain your answer. 3+2+(1+2)



3. a) Why does graphite conduct electricity whereas diamond does not?
b) H_2O is liquid while H_2S is gas at room temperature. Explain
c) State three differences between ionic compounds and covalent compounds. 3+2+3

4. a) Write down the principle of removal of hardness of water by ion exchange process.
b) One litre water sample contains 12.6 mg $CaSO_4$ and 9.3 mg $Mg(HCO_3)_2$. Find the total hardness of the water sample.
c) What are the disadvantages of using hard water in a boiler? 3+3+2

Group-B

5. a) All ores are minerals but all minerals are not ores.-Explain
b) Give the reaction with temperature involved in a blast furnace for extraction of iron.
c) Why is aluminium extraction not possible by carbon reduction method?
d) Define alloy with example. 2+3+2+1

6. a) Write the chemical composition of Portland cement.
   b) What are the differences between thermoplastics and thermosetting plastics?
   c) How is Bakelite prepared?
   d) What is refractory? Give an example. 2+2+2+2

7. a) Briefly explain the principle and reactions (if any), to determine % of 'Carbon' in coal.
   b) Classify lubricants with examples.
   c) Define flash point and fire point of lubricating oil.
   d) Write the chemical composition of LPG and water gas. 2+2+2+2

Group-C

8. a) State Faraday's laws of electrolysis.
   b) A current of 2 ampere is passed through copper and silver voltameters connected in series. If 1.08 gm silver (equivalent weight 108) is deposited on cathode in silver voltameter then find the amount of copper deposited at cathode in copper voltameter. [Given: equivalent weight of Cu= 31.8)
   c) Identify the oxidising agent and reducing agent in the following redox reaction. Explain your answer.

$$KMnO_4 + Na_2SO_3 + H_2O \rightarrow MnO_2 + Na_2SO_4 + KOH$$

3+3+2

9. a) Differentiate between chemical corrosion and electrochemical corrosion with example.
   b) Which of the following is a buffer solution? Explain your answer.
   i) HCl+ NaCl
   ii) CH_3COOH+ NH_4Cl
   iii) CH_3COOOH + CH_3COONa
   c) Write the cell reactions that take place at each electrode of the Lead storage cell.

3+2+3