

APPLIED CHEMISTRY

Time Allowed: 3 Hours

Full Marks: 60

Answer the following questions from Group A, B & C as directed.

GROUP-A

1. Choose the correct answer from the given alternatives (any ten): 10x1
- i) Which of the following ion is not present in naturally occurring zeolite?
a) Na^+ , b) Al^{3+} , ~~c) Ca^{2+}~~ , d) Si^{4+}
 - ii) How many atomic orbitals are present in the forth energy level of an atom? , 32, b) 16, c) 8, d) 4.
 - iii) Which one of the following is **NOT** a redox reaction?
~~a) $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$~~
b) $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
c) $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$
d) $2\text{MnCl}_3 \rightarrow 2\text{MnCl}_2 + 3\text{Cl}_2$
 - iv) pH of 10^{-10} (N) HCl solution at 25°C is-
a) higher than 7
b) equal to 7
~~c) lower than 7~~
d) All of the above
 - v) Which of the following statement is correct? -
~~a) Calorific value of water gas is higher than producer gas~~
b) Calorific value of water gas is lower than producer gas
c) Calorific value of water gas and producer gas is equal
d) None of the above
 - vi) The production of Portland cement contributes to about 10% of world _____ gas emission.
~~a) CO_2~~ , b) Cl_2 , c) O_2 , d) none of these
 - vii) A _____ is a polymer derived from more than one species of monomer.
a) biopolymer, ~~b) copolymer~~, c) tripolymer, d) octapolymer
 - viii) In the extraction of aluminium by electrolysis of molten aluminium oxide ore, the ore is dissolved in Cryolite-
a) to decompose the ore into aluminium and oxygen at a higher temperature
b) to lower the melting point of the aluminium ore for reduction of the temperature of the process
c) to help keep the aluminium molten at a higher temperature
d) to help stop the electrodes from corroding away at high temperature
 - ix) The product from blast furnace is called- a) Cast Iron, b) Pig Iron, ~~c) Steel~~, d) Wrought Iron,
 - x) Which of the following salt is not present in soft water? -
a) CaCl_2 , b) NaCl , c) KCl , d) None of these
 - xi) Which of the following statement is correct? -
a) Carbon-Carbon bond length in diamond and graphite is equal.
b) Carbon-Carbon bond length in graphite is greater than diamond
~~c) Carbon-Carbon bond length in diamond is greater than graphite~~
d) None of the above

- xii) A 250 mg toothpaste sample has 0.1 g fluoride concentration. The concentration of fluoride ion in terms of ppm level is- a) 100 ppm, b) 200 ppm, c) 300 ppm, ~~d) 400 ppm.~~
- xiii) Water sample 'A' contains 1.11 mg CaCl_2 per litre and water sample 'B' contains 0.95 mg MgCl_2 per litre. Which of the following statement is correct?
 a) Hardness of sample 'A' is greater than sample 'B'.
 b) Hardness of sample 'A' is less than sample 'B'.
 c) Hardness of sample 'A' and sample 'B' is equal.
 d) None of the above
- xiv) The rate of change of the viscosity with raise in temperature is measured by an arbitrary scale called as _____.
 a) Arbitrary constant
 b) Viscosity constant
~~c) Viscosity index~~
 d) Arbitrary index
- xv) Rutherford's experiment on scattering of α -particles showed for the first time that the atom has-
 a) electrons, b) protons, ~~c) nucleus~~, d) neutrons

2. Fill in the blanks (any ten):

1x10

- i. Principal quantum number of the electrons present in 3d orbital is _____.
- ii. Equimolar mixture of CO and H_2 is called _____ gas.
- iii. Shape of p_z orbital is _____.
- iv. Full form of TDS is _____.
- v. Permissible limit of Arsenic content in drinking water is _____ ppm.
- vi. Bauxite is an ore of _____.
- vii. Bronze is an alloy of copper and _____.
- viii. Full form of LPG is _____.
- ix. Fire point of a lubricant always _____ than the flash point.
- x. A solution of acetic acid and sodium acetate is an example of a _____ buffer.
- xi. Natural rubber is a polymer of cis- _____.
- xii. Full form of ppm is _____.
- xiii. A _____ cell is a portable voltaic cell that is not easily rechargeable.
- xiv. Petrol is an example of _____ liquid fuel.
- xv. Nylon 66 is _____ polymer.

3. Answer the following questions in one or two sentences (any ten):

1x10

- i. What is the value of magnetic quantum number for the valence electron of Sodium?
- ii. Why is Bohr's atomic theory not applicable for Cl^- ion?
- iii. What is the percentage of p character for sp^3 hybrid orbital?
- iv. What is the main difference between hard water and distilled water?
- v. Write the steps of municipal water treatment.
- vi. Define degree of polymerization.
- vii. Name one solid lubricant other than Graphite.
- viii. Give an example of ferrous alloy.
- ix. What is the oxidation number of carbon in $\text{C}_6\text{H}_{12}\text{O}_6$?
- x. Where is boundary lubrication used?
- xi. What is flux in metallurgy?
- xii. What is proximate analysis of coal?
- xiii. Give an example of homopolymer.
- xiv. Define cetane number.
- xv. What is the composition of carborundum?

GROUP-B

4. Answer the following questions (any six):

2x6

- i. Why Graphite is a good conductor of electricity?
- ii. Write the electronic configuration of Fe^{3+} ion.
- iii. What is the cause of hardness of water?
- iv. Explain the differences between cloud point and pour point of lubricating oil.
- v. Write the major components of bio-gas and Compressed Natural Gas.
- vi. Define saponification value of lubricating oil.
- vii. Write the differences between primary cell and secondary cell.
- viii. Define electrochemical corrosion with example.
- ix. What is the difference between sherardizing and galvanizing?
- x. How many lone pairs are in BeCl_2 ?

GROUP-C

5. Answer the following question (any one):

- i. State and explain Aufbau principle. Give one exception of Aufbau principle. (2+2)+2
- ii. A) Which chemical bond is strongest between ionic, covalent and metallic bonds, and why?
B) In CH_4 , NH_3 and H_2O , the central atom undergoes sp^3 hybridisation-yet their bond angles are different, why? (1+2)+3
- iii. A) Why hard water is not suitable for boiler?
B) 10 litres of hard water requires 0.28 gm of lime (CaO) for removing hardness. Calculate the temporary hardness of the water sample in ppm. 2+4

6. Answer the following question (any one):

- i. A) Write the principle including reactions to prepare water gas.
B) Mention source, composition and use of – (i) coal gas, and (ii) producer gas. 3+3
- ii. A) How is copper extracted from 'Copper Matte'?
B) What are the ingredients required to extract aluminium from pure Al_2O_3 ?
C) Write the composition and use of alloy – (i) Nichrome, (ii) Bell Metal. 2+2+2
- iii. A) State the differences between thermoplastics and thermosetting polymers.
B) What is refractory? Give two examples. 2+(2+2)

7. Answer the following question (any one):

- i. A) How is corrosion prevented by – (a) metal plating, and (b) alloy formation? Explain with example.
B) What is cathodic protection? Give example. 4+2
- ii. 3 ampere current was passed through an aqueous solution containing Pd^{2+} ion for 1 hour and 2.977 gm of Pd was deposited at cathode. Find the value of n. (Atomic weight of Pd- 106.4) 6
- iii. A) What is the oxidation number of oxygen atom in K_2O ? Oxidation and reduction processes occur simultaneously.-Explain with example.
B) Write the electrodes, electrolyte and reactions in lead storage cell. (1+2)+3