

2019

**Engineering Chemistry-I**

**Q.1. Following questions have four alternatives, choose the correction.**

**(i) Atoms of different elements having same no. of nucleous but different no. of protons are called.**

- (a) Isotope (b) Isobar  
(c) Isotone (d) Isoelectronic

**Ans.(c)**

**(ii) Unit of electrochemical equivalent is:**

- (a) gram / coulombs (b) coulombs / gram  
(c) gram / ampere (d) ampere / gram

**Ans.(c)**

**(iii) Sulphides are are mainly concentrated by:**

- (a) gravity seperation (b) magnetic seperation  
(c) froth fluation process (d) Liquidation

**Ans.(c)**

**(iv) The process of heating up ore in presence of air below its meeting point is called.**

- (a) Calcination (b) Rusting  
(c) Leaching (d) Smelting

**Ans.(a)**

**(v) Which of the following alloy is used for making bearings?**

- (a) Monel metal (b) Babbitt metal  
(c) Gun metal (d) Woods metal

**Ans.(b)**

**(vi) The monomers of Buna-S rubber are:**

- (a) Styrene and butadiene (b) Styrene and phenol  
(c) Styrene and chloroprene (d) Styrene and isoprene

**Ans.(a)**

**(vii) Which of the following is a green house gas?**

- (a) CO<sub>2</sub> (b) SO<sub>2</sub> (c) CO (d) NO<sub>2</sub>

**Ans.(a)**

**(viii) Which of the following is a non-polar covalent compound?**

- (a) NaCl (b) NH<sub>3</sub> (c) AlCl<sub>3</sub> (d) C<sub>4</sub>H<sub>6</sub>

**Ans.**

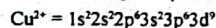
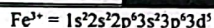
**Q2(a) Explain Bohr's model of atom and write down its limitations.**

**Ans. Refer to chapter 1 Q.no. 9.**

**Q2(b) Write down the electronic configuration of Cr, Fe<sup>3+</sup>, and CU<sup>2+</sup> in S, P, d, f notation.**

**Ans. Cr = 1s<sup>2</sup>2s<sup>2</sup>2p<sup>6</sup>3s<sup>2</sup>3p<sup>6</sup>3d<sup>5</sup>4s<sup>1</sup>**

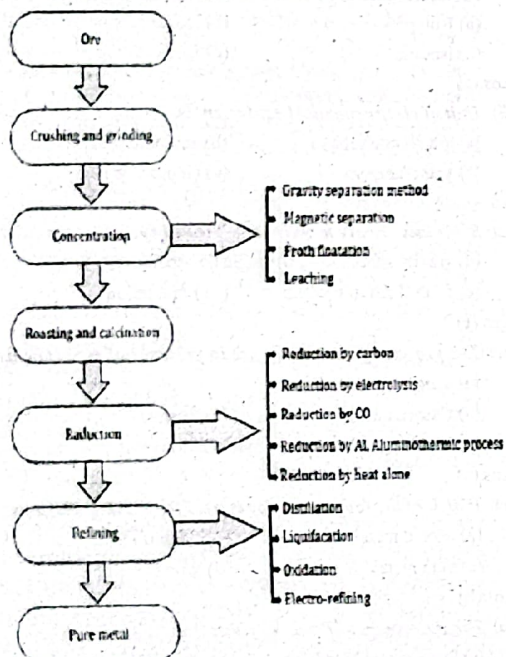




Q3(a) With the help of a flow diagram show the stages of extraction of metals from their ores.

Ans. The extraction of a metal from its ore depends on:

1. The type of ore being used.
2. The nature of the impurities present in the ore.
3. The degree of the reactivity of the metal that is to be extracted.



**Crushing and Grinding:** Ores are crushed into a fine powder in big jaw crushers and ball mills. This process is called pulverization.

**A. Concentration of Ores (Ore Dressing):** The process of removing gangue (earthly impurities) from an ore is known as concentration or dressing of ore.

**I. Gravity separation (Hydraulic washing):**

**Principle:** Separation of Ore and Gangue.

**Process:** The ore is poured over a vibrating sloped table with grooves and a jet of water is allowed to flow over it. The dense ore particles settle down in the grooves.

**II. Magnetic Separation:**

**Principle:** Separation of Magnetic ore and Non-magnetic ore.

**Process:**

B. The pulverized ore is placed on a conveyor belt.

C. The magnetic particles are attracted to the magnetic wheel and

fall separately apart from the non-magnetic particles.

**III. Froth Flotation**

**Principle:** Separation of ore and gangue by wetting with oil and water.

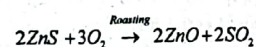
**Process:**

- i. The method is generally applied for sulphide ores.
- ii. The ore is taken in a large tank containing oil and water and is agitated with a current of compressed air. The ore is wetted by the oil and separates from the gangue in the form of froth.

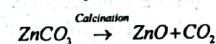
**D. Conversion of the concentrated ore into Metallic Oxide:** Concentrated ore is converted into metal oxide either by Roasting or Calcination.

**I. Roasting:** Process of heating the concentrated ore to a high temperature in the presence of excess air.

**Examples:**



**II. Calcination:** Process of heating the concentrated ore in the absence of air at a temperature not sufficient to melt the ore.



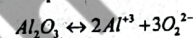
**E. Reduction of Metallic Oxides to Metal (Smelting):** The process of removing oxygen from a metallic oxide so as to convert it (metallic oxide) into a metal is known as reduction or smelting.

**I. Reduction by Electrolysis:** Reduction of highly electropositive (reactive) metals like K, Na, Ca, Mg, Al oxides/halides.

Electrolysis of fused metallic salts

Example: Extraction of Aluminium [ $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ ]

When electric current is passed through the concentrated ore, the reaction takes place as follows:



At Cathode:  $2\text{Al}^{3+} + 6e^- \rightarrow 2\text{Al}$

At Anode:  $3\text{O}^{2-} - 6e^- \rightarrow 3[\text{O}] \rightarrow 3\text{O}_2 \text{ (gas)}$

Product at cathode: Pure aluminium metal

Product at anode: Oxygen gas

**II. Reduction by Reducing agents:** In this process the metallic oxide is reduced to metal by using reducing agents like carbon (coke, charcoal), carbon monoxide, Hydrogen etc. Example: Reduction of Zn, Fe, Pb, Cu oxides.

**III. Reduction by thermal decomposition:** Oxides of metals like mercury and silver get reduced to their corresponding metals on heating above  $300^\circ\text{C}$ . They do not require reducing agent or electrolytic reduction for this purpose.

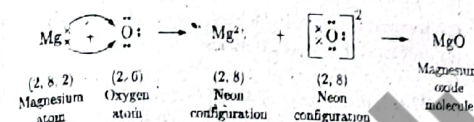
**F. Refining of Impure Metal:**

1. Distillation refining: For refining volatile metals e.g. zinc, mercury.
2. Liquation: For refining low melting point metals e.g. lead, tin.
3. Oxidation refining: For refining metals by oxidation of their impurities e.g. iron.
4. Electrolytic refining: For refining impure metals by electrolysis e.g. Cu, Al, Pb.

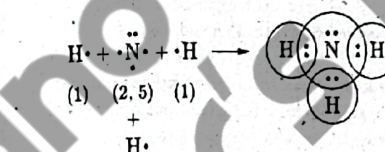
Q3(b) Show the formation of  $\text{MgO}$ ,  $\text{Na}_2\text{S}$ ,  $\text{NH}_3$  and  $\text{C}_2\text{H}_4$  by Lewis dot structure.

Ans.

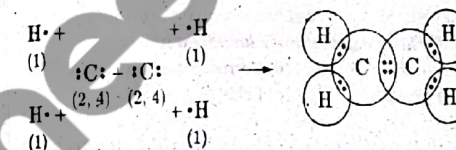
(i)  $\text{MgO}$



(ii)  $\text{NH}_3$



(iii)  $\text{C}_2\text{H}_4$



Q4(a) Write down Arrhenius theory of ionization.

Ans. Refer to chapter 2 Q.no. 2.

Q4(b) Explain the construction and working of dry cell.

Ans. Refer to chapter 2 Q.no. 17.

Q5(a) Define electrolysis. Explain the electrolysis of aqueous  $\text{CuSO}_4$  solution using platinum (Pt) electrode.

Ans. Refer to chapter 2 Q.no. 4 & 9.

Q5(b) Write down the composition, properties and application of duralumin and german silver.

Ans. Refer to chapter 2 Q.no. 9(x) & 9(x).

Q5(c) Explain powder metallurgy of alloy making.

Ans. Metal processing technology in which parts are produced from metallic powders. In the usual PM production sequence, the powders are compressed (pressed) into the desired shape and then heated (sintered) to bond the particles into a hard,

rigid mass

- Pressing is accomplished in a press-type machine using punch-and-die tooling designed specifically for the part to be manufactured.
- Sintering is performed at a temperature below the melting point of the metal.
- PM parts can be mass produced to net shape or near net shape, eliminating or reducing the need for subsequent machining
- PM process wastes very little material - about 97% of the starting powders are converted to product.
- PM parts can be made with a specified level of porosity, to produce porous metal parts.

Examples: filters, oil-impregnated bearings and gears.

Q6(a) Write down the properties and applications of glass wool and Asbestos.

Ans. Refer to chapter 4, Q.no. 10(a) & (b).

Q6(b) Explain compounding of plastics.

Ans. Refer to chapter 4, Q.no. 9(a).

Q7(a) What do you mean by water pollution? Explain the causes and remedial measure of water pollution:

Ans. Refer to chapter 5, Q.no. 5.

Q7(b) Discuss air pollution due to internal combustion engine.

Ans. Emission from petrol engine and diesel engine increased and cause a great threat to human health. I.C. engines convert heat energy into mechanical energy by burning the fuel in its combustion chamber called cylinder. Mostly, petrol and diesel oil are used as fuels for i.c. engines. During combustion of fuel water and carbon mono oxide are emitted. I.C. engines convert heat energy into mechanical energy by burning the fuel in its combustion chamber called cylinder. Mostly, petrol and diesel oil are used as fuels for i.c. engines. These fuels contain hydrogen and carbon in various combinations. During combustion, oxygen combines with hydrogen carbon to form water ( $\text{H}_2\text{O}$ ), carbon monoxide (co) and carbon dioxide ( $\text{CO}_2$ ). The nitrogen in the fuel combines with oxygen and forms nitrogen oxide ( $\text{NO}_2$ ). Remaining fuel goes unburnt resulting in smoke and ash. Exhaust gas constituents consist of partly burned petrol, carbon monoxide, nitrogen oxides and if sulphur in petrol, sulphur oxides, pollute the air. The oxides of nitrogen together with hydrocarbons react in the presence of sunlight and form petrochemical smog. As a result, smog is created, the atmosphere becomes dirty and breathing becomes



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difficult. Its bad effect includes crop damage, eye irritation, objectionable odour, decrease of visibility, cracking in rubber etc. Smog is a kind of fog mixed with other substances. The smog covers the cities like a blanket for days together during winter.

Q8 Write short notes on any four of the following.

- (a) Green house effect (b) BOD & COD  
(c) Tensile strength (d) E-waste  
(e) Electrochemical (f) Rusting

Ans.(a) Refer to chap-5 Q.no. 9(b).

Ans.(b) Refer to chap-5 Q.no. 10.

Ans.(c) Tensile strength: Tensile strength, maximum load that a material can support without fracture when being stretched, divided by the original cross-sectional area of the material. Tensile strengths have dimensions of force per unit area and in the English system of measurement are commonly expressed in units of pounds per square inch, often abbreviated to psi. When stresses less than the tensile strength are removed, a material returns either completely or partially to its original shape and size. As the stress reaches the value of the tensile strength, however, a material, if ductile, that has already begun to flow plastically rapidly forms a constricted region called a neck, where it then fractures.

Ans.(d) Refer to chap-5 Q.no. 11(c).

Ans.(e) An electrochemical cell is a device capable of either generating electrical energy from chemical reactions or using electrical energy to cause chemical reactions. The electrochemical cells which generate an electric current are called voltaic cells or galvanic cells and those that generate chemical reactions, via electrolysis for example, are called electrolytic cells. A common example of a galvanic cell is a standard 1.5 volt cell meant for consumer use.

Ans.(f) Rusting: Rusting of iron refers to the formation of rust, a mixture of iron oxides, on the surface of iron objects or structures. This rust is formed from a redox reaction between oxygen and iron in an environment containing water (such as air containing high levels of moisture). The rusting of iron is characterized by the formation of a layer of a red, flaky substance that easily crumbles into a powder.

This phenomenon is a great example of the corrosion of metals, where the surfaces of metals are degraded into more chemically stable oxides. However, the term 'rusting' is generally used to refer to the corrosion of objects made of iron or iron alloys.

## Basic Chemistry

Q1. Choose the correct answer from the four alternatives :

- (i)  $^{23}_{11}\text{Na}$  and  $^{24}_{12}\text{Na}$  are  
(a) Isotopes (b) Isobars  
(c) Isodiapheres (d) Isotones

Ans.(d)

(ii) What is the purpose of  $\text{MnO}_2$  in dry cell ?

- (a) As an oxidising agent (b) As an Reducing agent  
(c) As an antioxising agent (d) None of the above

Ans.(a)

(iii) Slag is formed by reaction between

- (a) impurities and coke (b) impurities and ore  
(c) impurities and flux (d) flux and coke

Ans.(c)

(iv) The process of vulcanisation of rubber makes it

- (a) hard (b) soft (c) less elastic (d) None of the above

Ans.(a)

(v) Most abundant water pollutant is

- (a) Detergents (b) Pesticides  
(c) Industrial wastes (d) Ammonia

Ans.(c)

(vi) The principal ore of Aluminium is

- (a) Bauxite (b) Corundum  
(c) Cryolite (d) Feldspar

Ans.(a)

(vii) In Gun-metal which metal have highest percentage?

- (a) Cu (b) Sn (c) Pb (d) Zn

Ans.(a)

(viii) BOD is a measure of

- (a) Organic pollutant in water  
(b) Oxides of S, P, N in air  
(c) Inorganic pollutant in water  
(d) Particle matter in water

Ans.(a)

Q2. (a) Define electrovalent and covalent compound with suitable examples and distinguish between them.

Ans. Refers to chapter 1 Q. no. 6 & 10

Q2.(b) Write electronic configuration to according to Aufbau principle of the following atom :

- (i)  $\text{Cu}^{2+}$  (ii) Cr (c) Cl (iv)  $\text{Ca}^{2+}$

Ans. Refers to chapter 1 Q. no. 16

Q3. Write short notes on:

- (a) Faraday's Law of electrolysis  
(b) Global warming and their effects  
(c) Biomedical Waste (d) BOD

Ans.(a) Faraday's Law of electrolysis: Refers to chapter 2 Q. no. 13

(b) Global warming and their effects: Refers to chapter 5 Q. no. 11(d)

(c) Biomedical Waste: Refers to chapter 5 Q. no. 11(b)

(d) BOD: Refers to chapter 5 Q. no. 10

Q4. (a) What are alloys? Describe briefly the method employed for the manufacture of alloys.

Ans. Refers to chapter 3 Q. no. 3 & 8

Q4. (b) What is air pollution? Discuss their sources. How do they effect man and environment?

Ans. Refers to chapter 5 Q. no. 3 & 7

Q5. (a) Write composition and uses of the following alloys :

- (i) Brass (b) German Silver (c) Gun metal

Ans. Refers to chapter 3 Q. no. 9

Q5.(b) Bring out the differences between thermoplastics and thermosetting plastics. Discuss Engineering Applications of plastic.

Ans. Refers to chapter 4 Q. no. 3 & 4

Q6. (a) Discuss briefly the process of vulcanization of rubber. Differentiate between natural rubber and synthetic rubber.

Ans. Refers to chapter 4 Q. no. 7 & 9(b)

Q6.(b) 0.1948 gm of copper is deposited by a current of 0.2 ampere in 50 minutes. What is the electrochemical equivalent of copper?

Ans. Refers to chapter 2 Q. no. 1 (solved example)

Q7. (a) Define Aufbau principle also write Hund's rule and their applications.

Ans. Refers to chapter 1 Q. no. 4 & 14

Q7.(b) Discuss Electro- Chemical series. What is its important applications and properties?

Ans. Refers to chapter 2 Q. no. 11

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## Basic Chemistry

Q1. Choose correct answer:

- (i) Isotones having same numbers of  
(a) Electrons (b) Protons (c) Neutrons (d) Masses  
Ans.(c)

(ii) Atomic No. and mass number of oxygen is

- (a) 7, 16 (b) 8, 16 (c) 6, 12 (d) 7, 14

Ans. (b)

(iii) The laws of Electrolysis were enunciated by

- (a) Dalton (b) Faraday (c) Kakule (d) Avagadro

Ans.(b)

(iv) One Faraday is equal to

- (a) 69,500 Coloumb (b) 96,500 Coloumb  
(c) 95,600 Coloumb (d) 73,500 Coloumb

Ans.(b)

(v) Substance react with gauge to give mobile fusible Product is called

- (a) Flux (b) Catalyst (c) Slag (d) Ore

Ans.(c)

(vi) Bell Metal is a alloy of

- (a) Gold (b) P<sup>um</sup> (c) Silver (d) Copper

Ans. (d)

(vii) Vulcanisation discovered by

- (a) CEAT (b) Good year (c) Dunlop (d) Mofel

Ans.(b)

(viii) Atmospheric temperature rising with the rate of

- (a) 0.5°C per year (b) 0.5°C per month  
(c) 0.05°C per year (d) 0.05°C per month

Ans.(a)

(ix) Which part of the body is effected by Particulate?

- (a) Hair (b) Skin (c) Lungs (d) Bone

Ans.(c)

(x) e-waste is because of

- (a) Domestic waste (b) Industrial waste  
(c) Electronic waste (d) Water pollution

Ans.(c)

Q2.(a) Differentiate between Electrovalent and covalent bonds and compound.

Ans. Refers to chapter 1 Q. no. 10

Q2.(b) Write electronic configuration of the atoms from 1 to 30 atomic numbers with respect to Inert gas symbol.

Ans. Refers to chapter 1 Q. no. 16

Q3.(a) What is Arrhenius theory of ionisation and Degree of Ionisation?

Ans. Refers to chapter 2 Q. no. 2 & 7

Q3.(b) Explain concept of Reduction potential and Oxidation potential.

Ans. Refers to chapter 2 Q. no. 6

Q4.(a) Explain pollution and types of pollution.

Ans. Refers to chapter 5 Q. no. 1

Q4.(b) Ennmerates causes and control of pollution.

Ans. Refers to chapter 5 Q. no. 3 & 5

Q5.(a) Write important ores of Iron. How cast Iron is extracted