

Unit - I

Two mark Question with Answers

Water and its Treatment

1. What is BOD?

The amount of free oxygen required by bacteria for the biological oxidation of the organic matter under aerobic condition at 20°C for a period of 5 days.

2. Define COD.

The measure of amount of oxygen required to chemically oxidise all the oxidisable impurities.

3. What is breakpoint chlorination?

Breakpoint chlorination is the point at which all the impurities are removed and free chlorine begins to appear.

4. What is blow down operation?

It is the process of removing a portion of concentrated water by fresh water frequently from the boiler during steam production.

5. What is the principle involved in desalination of brackish water?

If pressure in excess of osmotic pressure is applied on the higher concentration side, the solvent flows from higher concentration side to lower concentration side. This process is called

6. What are scales and sludges?

Scales - If the ppte forms hard and adherent coating on the inner walls of the boiler, it is called scale.

Scale forming substances - $\text{Ca}(\text{HCO}_3)_2$, CaSO_4 , and MgCl_2 .

Sludges - If the ppte is loose and slimy it is called sludges.

Sludge forming substances - MgCl_2 , MgCO_3 , MgSO_4 etc.

7. List two disadvantages of using hard water in boilers.

1. Scale and sludge formation

2. Priming and foaming

3. Caustic Embrittlement.

8. What is meant by Caustic Embrittlement?

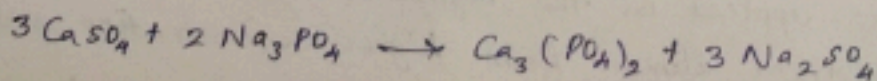
It means intercrystalline cracking of boiler metal.

9. Soft water is not DM water whereas, DM water is soft water - Justify.

The soft water produced by lime-soda and zeolite processes does not contain hardness producing Ca^{2+} and Mg^{2+} ions, but it will contain other ions like Na^+ , K^+ , SO_4^{2-} etc. On the other hand, DM water does not contain both cations and anions.

10. What is phosphate conditioning?

Scale formation can be avoided by adding sodium phosphate.



11. What is meant by priming and mention its causes.

Priming is the process of production of wet steam.

It is caused by

- (i) High steam velocity
- (ii) Very high water level in the boiler
- (iii) Sudden boiling of water
- (iv) Very poor boiler design.

12. Indicate the reasons for boiler corrosion.

- * dissolved oxygen
- * dissolved CO_2
- * dissolved salts.

13. What are the advantages of ion-exchange process.

* Highly acidic or alkaline water can be treated by this process.

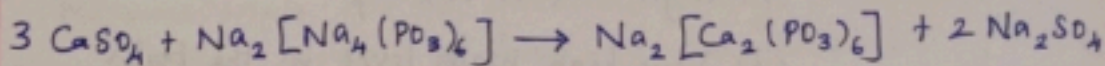
* The water obtained by this process will have very low hardness.

14. What is meant by internal conditioning of water?

Internal Conditioning is the process which involves the removal scale forming substance by adding chemicals directly into the boiler.

15. Write the chemical reaction involved in Calgon conditioning.

Calgon is sodium hexa meta phosphate $\text{Na}_2[\text{Na}_4(\text{PO}_3)_6]$.



Two mark Questions with AnswersNano chemistry

1. What are nano-materials?

Nanomaterials are the materials having components with size less than 100nm at least in one dimension.

2. What is nano-chemistry?

It deals with the chemical applications of nanomaterials. It also includes the study of synthesis and characterisation of nanomaterials.

3. Name some important physical methods of synthesizing nano-materials.

1. Laser ablation

2. Chemical Vapour deposition

3. Electro deposition.

4. What is CVD?

CVD is Chemical Vapour Deposition. It is the process of chemically reacting a volatile compound of a material with other gases, to produce a non-volatile solid that deposits automatically on a suitably placed substrate.

5. Define nano-wires.

Nano-wire is a material having an aspect ratio i.e., length to width ratio greater than 20. These are also referred as 'quantum wires'.

6. What is nano-rod?

Nanorod is two dimensional cylindrical solid material having an aspect ratio, i.e., length to width ratio less than 20.

7. What are nanoclusters?

Nanoclusters size ranges from 0.1 to 10 nm. These are smallest sized nanomaterials because of their close packing arrangement of atoms.

8. Mention some uses of CNT's.

- * In industries these are used as catalyst.
- * Used to protect electronic equipments.
- * Used in composites, I.e.s.

9. Mention some characteristic properties of nanomaterials.

- * Nanomaterials are very strong and withstand extreme strain and tension.
- * It possess very good electrical properties and thermal conductivity.

10. List any four nano-materials.

1. Carbon nanotubes
2. Nanowire
3. Quantum dots
4. Dendrimers

Two mark Questions with Answers

Phase Rule and Composites

1. State phase rule and explain the terms involved.

$$F = C - P + 2$$

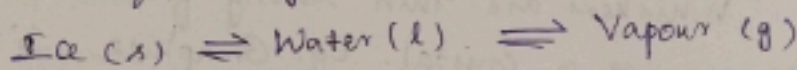
$F \rightarrow$ No. of degree of freedom

$C \rightarrow$ No. of Components

$P \rightarrow$ No. of Phases.

2. Define phase with suitable example.

"Any homogeneous physically distinct and mechanically separable portion of a system which is separated from other parts of the system by definite boundaries"



Here there are 3 phases.

3. What is triple point?

It is the point at which 3 phases namely solid, liquid and vapour are simultaneously at equilibrium.

4. What is metastable equilibrium?

Sometimes water can be cooled below 0°C without the formation of ice, this water is known as supercooled water. The equilibrium between supercooled water and the vapour is known as metastable equilibrium.

5. State reduced phase rule.

In solid-liquid equilibrium, it has no gaseous phase and hence the effect of pressure is negligible.

So pressure is kept constant and the phase rule becomes

$$F' = C - P + 1$$

This is called reduced phase rule.

6. Define a Composite.

"A material system consisting of mixture of two (or) more micronutrients, which are mutually insoluble differing in form or composition and forming distinct phases.

7. What is meant by reinforcement?

The characteristics of a matrix was improved by adding reinforcing agents. These reinforcing agents may be organic or inorganic in nature. They may be in the form of powder, flakes and fibres.

8. What are whiskers? Give example.

Whiskers are thin strong fibre like material made by growing a crystal. Eg. Graphite, SiC.

9. What are the characteristics of FRP?

- * Higher yield strength
- * Greater mechanical properties
- * High Corrosion resistance.

10. What are hybrid Composites?

Hybrid Composites are new class of materials composed of a suitable polymer matrix reinforced with two different fibres or fillers.

Unit 4
Two mark Questions with Answers

Fuels and Combustion

1. How is coke superior to coal?

* The percentage of fixed carbon and hence the calorific value of coke is high.

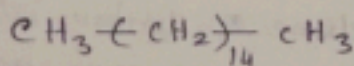
* percentage of moisture, volatile and ash contents are higher in coal, where as they are low in coke.

2. Define octane number.

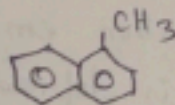
Octane number is defined as, "the percentage of iso-octane present in a mixture of iso-octane and n-heptane"

3. Define cetane number.

The percentage of cetane present in a mixture of cetane and α -methyl naphthalene.



n-cetane
(Cetane number = 100)



α -methyl naphthalene.

4. What is power alcohol?

When ethyl alcohol is blended with petrol at a concentration of 5-10%. it is called power alcohol.

5. What is leaded petrol?

When the petrol is mixed with Tetra-Ethyl Lead (TEL) it is called leaded petrol.

6. What is meant by Calorific value of fuel?

The calorific value of a fuel is defined as "the total amount of heat liberated, when a unit mass of fuel is burnt completely."

7. Define GCV and LCV of a fuel.

GCV - The total amount of heat produced, when a unit quantity of the fuel is completely burnt and the products of combustion are cooled at room temperature.

LCV - The net heat produced, when a unit quantity of a fuel is completely burnt and the products of combustion are allowed to escape.

8. What is ignition temperature?

The lowest temperature at which the fuel catches fire, so that it starts burning smoothly.

9. Define carbon emission.

It is defined as the release of carbon into the atmosphere. Since green house gas emissions are often calculated as carbon dioxide equivalents, they are often referred to as carbon emissions.

10. Define carbon footprint.

It is the total amount of green house gases (including CO_2 and CH_4) that are generated by our direct and indirect activities.

Energy sources and storage devices

1. Define mass defect.

The difference between the calculated and experimental masses of nucleus is called mass defect.

$$\Delta m = \left. \begin{array}{l} \text{Total mass of protons,} \\ \text{neutrons and electron} \end{array} \right\} - \left\{ \begin{array}{l} \text{Experimental mass} \\ \text{of the nucleus} \end{array} \right.$$

2. What is binding energy?

Binding energy is defined as the energy released when a given number of protons and neutrons combine to form nucleus.

3. Define nuclear energy.

The energy released by the nuclear fission (or) nuclear fusion is called nuclear energy.

4. What is breeder reactor?

Breeder reactor is the one which converts non-fissionable material (U^{238} , Th^{232}) into fissionable material (U^{235} , Pu^{239}).

5. What is photogalvanic cell?

Photogalvanic cell is the one which converts the solar energy directly into electrical energy. It consists of a p-type semiconductor and n-type semiconductor. They are in close contact with each other.

6. Define geo-thermal energy.

The energy harnessed from the high temperature present inside the earth is called geothermal energy.

7. What is a primary battery? Give an example.

These are cells in which the electrode and the electrode reactions cannot be reversed by passing an external electrical energy. They are not rechargeable.

Example. Leclanche's cell

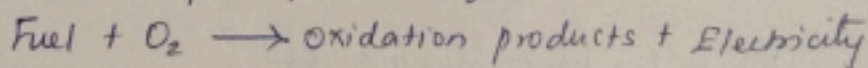
8. What are secondary cells?

Secondary cells are cells in which the electrode reactions can be reversed by passing an external electrical energy. They can be recharged.

Ex. Lead-acid battery.

9. What are fuel cells?

Fuel cell is a voltaic cell, which converts the chemical energy of the fuels directly into electricity without combustion. It converts the energy of the fuel directly into electricity. In these cells, the reactants, products and electrolytes pass through the cell.



10. What are supercapacitors?

Supercapacitor is the high capacity capacitor with capacitance value much higher than other capacitor. They store 10 to 100 times more energy per unit volume and deliver charge much faster than batteries.