Dr. N.G.P INSTITUTE OF TECHNOLOGY, COIMBATORE – 48

DEPARTMENT OF CHEMISTRY

CHEMISTRY QUESTION BANK FOR- PART A

UNIT – I

WATER TECHNOLOGY

1. Define hardness of water.

Hardness is the property or characteristics of water which does not produce lather with soap.

Hardness can be detected by treating water with soap.

$2C_{17}H_{35}COONa + CaCl_2$ --------- $(C_{17}H_{35}COO)_2Ca + 2NaCl$

(Soap) (Hardness causing Substance) (Hard soap)

2. What are the salts responsible for carbonate and non-carbonate hardness of water?

Carbonate hardness: $Ca(HCO_3)_2$ and $Mg(HCO_3)_2$

Non- Carbonate hardness: $CaCl_2$, $CaSO_4$, $MgCl_2$, $MgSO_4$.

3. What are the constituents that cause hardness in water? (or) Explain the terms Carbonate hardness and non- carbonate hardness.

$CaCl_2$, $CaSO_4$, $MgSO_4$, $Ca(HCO3)_2$, $Mg(HCO_3)_2$

Carbonate hardness: This is due to the presence of bicarbonates of calcium and magnesium.

Non- Carbonate hardness: This is due to the presence of chlorides and sulphates of calcium and magnesium.

4. Explain what is meant by soft water and hard water.

a) Hard water

Water which does not produce lather with soap solution but produces white precipitate (scum) is called hard water.

This is due to the presence of dissolved Ca and Mg salts.

$2C_{17}H_{35}COONa + Ca^{2+}$ ---------> $(C_{17}H_{35}COO)_2Ca + 2Na^+$

Sodium Soap (Water soluble) Hardness causing ion Calcium soap (Water insoluble)

b) Soft water.

Water which produces lather readily with soap solution is called soft water.

This is due to the absences of dissolved Ca and Mg salts.

5. Distinguish between hard and soft water.

S.No	Hard water	Soft water
1	Hard water does not produce lather with soap solution.	Soft water produces very good lather with soap solution.
2	It gives wine red colour with EBT indicator.	It does not give wine red colour with EBT indicator.

6. Distinguish between Carbonate (Temporary) hardness (CH) and non - Carbonate (permanent) hardness (NCH).

S.No	**Carbonate hardness (or) Temporary hardness**	**Non carbonate hardness (or) Permanent hardness**

$Al(OH)_3$. The gelatinous precipitate, $Al(OH)_3$, entraps the finely divided and colloidal impurities , settles to the bottom and can be removed easily.

35. What is carbonate conditioning for, what type of boilers it is used?

Scale formation can be avoided by adding Na_2CO_3 to the boiler water. It is used only in low pressure boilers. The scale forming salt like $CaSO_4$ is converted into $CaCO_3$, Which can be removed easily.

$$CaSO_4 + Na_2CO_3 \text{----------} CaCO_3 + Na_2SO_4$$

36. What is the role of phosphates in the internal treatment of water?

Scale formation can be avoided by adding sodium phosphate. It is used in high pressure boilers. The phosphate reacts with Ca^{2+} and Mg^{2+} salts to give soft sludges of Calcium and Magnesium phosphates.

$$3CaSO_4 + 2Na_3PO_4 \text{----------} Ca_3(PO_4)_2 + 3Na_2SO_4$$

37. What are boiler compounds? Mention two different boiler compounds and their actions.

Scale forming substances can be removed by adding chemicals directly to the boiler. These chemicals are called boiler compounds.

Examples:

Sodium carbonate and Sodium phosphate.

1. $CaSO_4 + Na_2CO_3 \text{----------} CaCO_3 + Na_2SO_4$
2. $3CaSO_4 + 2Na_3PO_4 \text{----------} Ca_3(PO_4)_2 + 3Na_2SO_4$

38. What is calgon conditioning? How is it functioning in water treatment?

Or

What is calgon? What is its use in water technology?

Calgon is sodium hexa Meta phosphate $Na_2[Na_4(PO_3)_6]$. This substance interacts with calcium ions forming a highly soluble complex and thus prevents the precipitation of scale forming salt.

$$CaSO_4 + Na_2[Na_4(PO_3)_6] \longrightarrow Na_2[Na_4(CaSO_4)(PO_3)_6] + 2Na_2SO_4$$

39. Mention requires of potable water.

1. It should be clear, colourless and odourless.
2. It should be cool and pleasant to taste.
3. It should be free from harmful bacteria and suspended impurities.
4. It should be free from dissolved gasaes like CO_2, H_2S, NH_3 etc., and poisonous minerals like lead, arsenic, manganese, etc.,
5. Hardness should be less than 500 ppm.

40. Write briefly on disinfection of water by UV treatment.

Or

How is UV light useful for achieving disinfection of water.

When the water containing bacteria is irradiated by UV light, all the bacteria's are killed out. This process is known as disinfection. This is useful for sterilizing water in swimming pool.

41. What are the various stages in the treatment of water for domestic supply?

Sources of water → screening ------→ Aeration ------→ sedimentation -------→coagulation -----

→ Filtration --------→ sterilization (or) Disinfection

42. Explain the function of bleaching powder as a germicide.

When bleaching powder is added to water, it produces hypochlorous acid (HOCl). HOCl is a powerful germicide.

Sludges	Scales
It is a soft loose and slimy precipitate	Scales are hard and adherent deposits.
Sludges are formed by the substances like $MgCl_2$, $CaCl_2$	Scales are formed by the substances like $Ca(HCO_3)_2$,$CaSO_4$
It is a poor of heat .Hence the excess of sludge formation decreases the efficiency of boiler.	It is thermal insulator. Hence efficience of the boiler is decreased. Any crack in the boiler scale leads to explosion
Sludges formation can be prevented by using soft water.	Scales formation can be prevented by using acids.
Sludges can be removed by scrapping off with a wire brush.	Scales may be removed by giving thermal shocks, scrapping, and chemical reaction.

62. What are internal and external treatments?

Removal of scale forming substance by adding chemicals directly in the boiler is called internal treatment.

Removal of hardness producing salts from the water before feeding into the boiler is called external treatment.

63. What is carbonate conditioning?

Scale formation in this method can be prevented by adding Na_2CO_3 to the boiler water. Any scale forming salt like $CaSO_4$ present in the water is precipitated in the form of insoluble $CaCO_3$ by the addition of Na_2CO_3

$$CaSO_4 + Na_2CO_3 \longrightarrow Na_2SO_4 + CaCO_3$$

64. What are boiler compounds? Mention two different boiler compounds and their action?

The removal of scale forming susbstance by adding chemicals directly into the boiler is called internal treatment. The chemicals used for this purpose is called boiler compounds.

The boiler compounds kerosene tannin, gelatin, agar agar, etc. these substance get coated over the scale forming particles and convert them into non sticky, non adherent, and loose precipitate in boilers.

$$3CaSO_4 + 3Na_3PO_4 \longrightarrow 3Na_2SO_4 + Ca_3(PO_4)_2$$
$$CaSO_4 + Na_2CO_3 \longrightarrow Na_2SO_4 + CaCO_3$$

UNIT-II
POLYMERS

1. **Define polymers and monomers.**

Polymers are macro molecules (giant molecules of higher molecular weight) formed by the repeated linking of large number of small molecules called monomers.

Monomers is a micro molecule (small molecule) which combines with each other to form a polymer.

2. **What is degree of polymerization?**

The number of repeating units (n) in a polymer chain is known as the degree of polymerization. It is represented by the following relationship.

$$\text{Degree of polymerization (n)} = \frac{\text{molecular weight of the polymeric network}}{\text{molecular weight of the repeating unit}}$$

3. **Explain functionality of a monomer with suitable example.**

The number of bonding sites or reactive sites or functional groups present in a monomer is known as its functionality.

S.No	Example	Functionality
1.	$CH_2=CH_2$ (ethylene)	-2 (Two bonding sites are due to the presence of one double bond in the monomer. Therefore ethylene is a bifunctional monomers)

15. What is fissile nuclides and fertile nuclides?

(i) The fissionable nuclides such as U^{235} & Pu^{239} are called fissile nuclides.
(ii) The non- fissionable nuclides such as U^{238} &Th^{232} are called fertile nuclides.

16. Mention any two difference s of a nuclear reaction and a chemical reaction.

S.No	Nuclear reaction	Chemical reaction
1	Rabid exothermic reaction	Slow reaction
2	Initiate by neutrons	Initiated by heat (or) cold

17. What are the general components of a nuclear reactor?

1. Fuel rods, 2.Control rods, 3.Coolents, 4, Moderators, 5.Pressure vessel, 6. Protective shield 7. Turbine.

18. What is Breeder reactor?

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

19. What is meant by solar energy conversion? How is it done?

Solar energy conversion is the process of conversion of direct sunlight into more useful forms. This solar energy conversion occurs by the following two mechanisms.

1. Thermal conversion.
2. Photo conversion.

20. What is thermal conversion?

Thermal conversion involves absorption of thermal energy in the form of IR radiation .Solar energy is an important source for low –temperature heat (temperature below 100 °C), which is useful for heating buildings, water and refrigeration.

21. Define photo conversion.

Photo conversion involves conversion of light energy directly into electrical energy.

22. What is photo galvanic cell (or) Solar cell?

Photo galvanic is the one which converts the solar energy (energy obtained from the sun) directly into electrical energy.

It consists of a p-type semiconductor (such as Si doped with B) and n-type semiconductor (such as Si doped with P) They are in closed contact with each other.

23. Explain the application of solar cells.

1. Solar cells are used in calculators, electronic watches, radios and TVs.
2. Solar cells are superior to other type of cells, because these are non- polluting and eco-friendly
3. Solar energy can be stored in Ni- Cd batteries and lead-acid batteries.
4. Solar cells can be used to drive vehicles.
5. Solar cells, made of silicon, are used as a source of electricity in space craft and satellite.

24. 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 cell, the reactants, product and electrolytes pass through the cell.

Fuel + Oxygen ------→ Oxidation products + Electricity.

25. What are the electrodes used in the fuel cells porous?

Compressed carbon containing a small amount of catalyst like Pt, Pd, Ag, are used in the fuel cells porous

26. What are the applications of H_2-O_2 fuel cell?

1. H_2-O_2 fuel cells are used as auxiliary energy source in space vehicles, submarines or other military- vehicles.
2. In case of H_2-O_2 fuel cells, the product of water is proved to be a valuable source of fresh water by the astronauts.

27. What is wind energy? How is it obtained?

5. What is reversible battery? Describe the principle, construction and working of Lead – storage battery with reaction
6. Give a brief notes on lithium battery.
7. Explain the construction and working of Ni - Cd battery with cell reaction
8. Give an account of solar cells and its application.
9. Explain the following terms: Wind energy, Nuclear fusion and primary battery
10. State the principle and application of solar batteries
11. Describe the conversion of solar energy into electrical energy.
12. Discuss the characteristics of the reaction when uranium undergoes nuclear fission.
13. Explain the construction and working of any one secondary battery with cell reaction

UNIT- V – ENGINEERING MATERIALS

1. indicate the preparation and uses of lithium grease.
2. How are Alumina bricks, Magnesia bricks manufactured?
3. What are abrasives? How are they classified? Give examples for each category with their important properties.
4. Discuss the structure, properties and uses of Graphite.
5. Define and signify flash, fire point.
6. Give a brief account of PCE test
7. Discuss the following properties of lubricants: pour point and cloud point.
8. Discuss the structure, properties and uses of MoS_2
9. Give an account of the important properties of lubricating oil.
10. Explain the properties and applications of carbon nanotubes (CNTs)
11. Explain the preparation, properties and uses of carbon nanotubes(CNTs)
12. Name the additives for lubricating oils. Indicate their function
13. Explain the mechanism of lubrication.
14. Explain the terms: viscosity index, dimensional stability and Porosity
15. Discuss the properties and uses of high alumina and zirconia bricks
16. Explain the general methods of manufacture of refractories.