CHAPTER

8

Energetics and Colloids

Thermodynamics

- Thermodynamics is the study of heat and energy changes occurring in physical and chemical processes.
- An **open system** can exchange matter as well as energy with its surroundings. A **close system** can exchange energy but not matter with its surroundings.
- An **isolated system** can change neither matter nor energy with its surroundings.

Thermodynamic Processes

Isothermal process The process in which temperature of the system remains constant i.e.,

$$dT = 0$$

- Maximum work done during the isothermal expansion of 'n' moles of an ideal gas is given as

$$W_{max} = -2.303nRT\log\frac{V_2}{V_1}$$

Adiabatic process The process in which no heat enters or leaves the system during any step of process i.e.,

$$dq = 0$$

Isobaric process The process which takes place at constant pressure i.e.,

$$dp = 0$$

Isochoric process The process in which volume of system remains constant i.e.,

$$dV = 0$$

Cyclic process In cyclic process, a system in a given state goes through a series of different processes, but in end returns to its initial state.

Spontaneous process A process which can proceed by itself under given set of conditions once it has been properly initiated, if necessary, is known as spontaneous process.

- They are also called feasible and probable process.
- The process is spontaneous if free energy change ΔG is negative.

Colloids

- In a colloid, the size of solute particles is bigger than that of true solution but smaller than that of suspension.
- These are quite stable, and particles cannot be seen even with a microscope.
- A colloid scatters a beam of light passing through it i.e., it exhibits **Tyndall effect**.
- Colloids are heterogeneous in nature, have colligative properties, undergo Brownian motion, electroosmosis, and electrophoresis.
- Colloidal solutions are purified by dialysis.
- **Emulsions** are those colloidal systems in which the dispersed phase as well as the dispersion medium are both liquids e.g., milk, cod liver oil. *These are of two types*
  (a) Oil in water type emulsions (O/W type) e.g., milk, lysol and vanishing cream.
  (b) Water in oil type emulsions (W/O type) e.g., cold creams and cod liver oil.
- **Gel** is a colloidal system in which dispersed phase is liquid and dispersion medium is solid.
- When a gel is allowed to stand for sometime, it loses the dispersed phase (liquid), this phenomena is called syneresis or **weeping of the gel**.
- Butter is a gel.
- Fog is a colloid of liquid in gas.
- Smoke is a colloidal system of carbon (solid) in air (gas).
- Foams are the colloidal systems in which a gas is dispersed in liquid e.g., alcohol, castor oil etc.
- Cheese is an example of gel.
- **Coagulation** is the process of precipitation of a colloids when it is shaked with some electrolyte. Its applications are
  (a) Purification of muddy water by alum.
  (b) Ferric chloride and alum are applied to wound to stop bleeding.

Points to be Remember

- Blue colour of sky is due to scattering of light by dust particles present in air
- The order of energy is 1 calorie > 1 joule > 1 erg.

Exercise

1. A system which can exchange energy with the surroundings but no matter is called
   (a) a heterogeneous system (b) an open system
   (c) a closed system (d) an isolated system

2. Which one is true?
   (a) 1 calorie > 1 erg > 1 joule
   (b) 1 erg > 1 calorie > 1 joule
   (c) 1 calorie > 1 joule > 1 erg
   (d) 1 joule > 1 calorie > 1 erg

3. When a gas is subjected to adiabatic expansion, it gets cooled due to
   (a) no change in entropy (b) loss in kinetic energy
   (c) decrease in velocity (d) energy spent in doing work

4. If a refrigerator's door is kept open, then
   (a) room will be cooled
   (b) room will be heated
   (c) may get cooled or heated depending upon the weather
   (d) no effect on room

5. When ammonium chloride is dissolved in water, the solution becomes cold. The change is
   (a) endothermic (b) exothermic
   (c) supercooling (d) None of these

6. Which of the following is a closed system?
   (a) Jet engine
   (b) Tea placed in steel kettle
   (c) Pressure cooker
   (d) Rocket engine during propulsion

7. Water loving colloids are known as
   (a) hydrophobic (b) hydrophilic
   (c) lyophobic (d) lyophilic

8. The solution of rubber is an example of
   (a) lyophobic colloid (b) multimolecular colloid
   (c) associated colloid (d) macromolecular colloid

9. When a strong beam of light is passed through a colloidal solution, the light is
   (a) reflected (b) scattered
   (c) both (a) and (b) (d) None of these

10. Colloidal solution commonly used in the treatment of eye disease is
    (a) colloidal silver (b) colloidal gold .
    (c) colloidal antimony (d) colloidal sulphur

11. The bleeding of a wound is stopped by the application of ferric chloride because
    (a) blood starts flowing in the opposite direction
    (b) ferric chloride seals the blood vessels
    (c) blood reacts and a solid is formed which seals the blood vessels
    (d) blood is coagulated and the blood vessels are sealed

12. Dialysis can separate which of the following in addition to the glucose from human blood?
    (a) Fructose (b) Starch
    (c) Protein (d) Sucrose

13. Scattering of light takes place in
    (a) electroplating (b) electrolysis
    (c) solutions of electrolyte (d) colloidal solution

14. Which of the following colloidal solution is commonly used as germ killer?
    (a) Colloidal sulphur (b) Colloidal gold
    (c) Colloidal silver (d) Colloidal antimony

15. In which of the following Tyndall effect is not observed?
    (a) Gold sol (b) Sugar solution
    (c) Emulsions (d) Suspension

16. Cheese is an example of
    (a) emulsion (b) foam
    (c) gel (d) sol

17. Smoke is an example of
    (a) gas dispersed in liquid
    (b) gas dispersed in solid
    (c) solid dispersed in gas
    (d) liquid dispersed in solid

18. Which one of the following is correctly matched?
    (a) Aerosol-smoke (b) Foam-mist
    (c) Emulsion-curd (d) All of these

19. Which of the following is not a colloid?
    (a) Chlorophyll (b) Smoke
    (c) Ruby glass (d) Milk

20. Which of the following is not a true solution?
    (a) Air (b) A gold ring
    (c) Smoke (d) Salt water

21. Fog is an example of colloidal system of
    (a) liquid in a gas
    (b) gas in a liquid
    (c) gas in a solid
    (d) solid in a liquid

22. An emulsion consist of
    (a) two liquids (b) two solids
    (c) two gases (d) two salts

23. Artificial rain is caused by spraying
    (a) neutral charged colloidal dust over a cloud
    (b) similar charged colloidal dust over a cloud
    (c) Both (a) and (b)
    (d) opposite charged colloidal dust over a cloud

Answers

1. (c)	2. (c)	3. (d)	4. (b)	5. (a)	6. (b)	7. (b)	8. (d)	9. (b)	10. (c)
11. (d)	12. (c)	13. (d)	14. (a)	15. (b)	16. (c)	17. (c)	18. (a)	19. (a)	20. (c)
21. (a)	22. (a)	23. (d)							