NCERT QUESTIONS WITH SOLUTIONS

1. What is meant by a pure substance?

Ans. A pure substance is one that cannot be separated into different constituents by physical or chemical process. A pure substance is one that contains particles of only one type of a substance.

2. List the points of differences between homogeneous and heterogeneous mixtures.

Ans. **Homogeneous mixture**

(i) The composition of a homogeneous mixture is the same throughout. For example, if you make a solution of sugar in water and taste it by taking a spoonful of solution either from the surface or from somewhere underneath the surface, it tastes equally sweet.

(ii) A homogeneous mixture has no distinct boundaries i.e. it consists of only one phase which may be solid, liquids or gaseous. For example, alloys such as brass(30% zinc and 70% copper) is a homogeneous mixture in the solid state. A solution of sugar or common salt in water is homogeneous mixture in the liquid state. Similarly, a solution of water and alcohol is a homogeneous mixture in the liquid state. Pure air (without dust particles and suspended impurities) is a homogeneous mixture in the gaseous state.

Heterogeneous mixture

(i) The composition of a heterogeneous mixture is not the same throughout. For example, if we prepare a mixture of starch and sugar by thoroughly grinding it and taste it by picking up a few particles from the various portions of the mixture, it will not have the same sweetness.

(ii) A heterogeneous mixture has distinct boundaries of separation i.e. it consists of two or more phases which can either be solids or liquids but not gaseous. For example, iron filings (greyish in colour) and sulphur powder(yellow) on mixing form a heterogeneous mixture (greyish yellow). When we examine this mixture under a microscope, we clearly see that every small portion of the mixture consists of two solid phases – one of greyish colour consisting of iron filings and the other of yellow colour consisting of sulphur powder. Similarly, a mixture of oil in water is heterogeneous mixture, consisting of two liquid phases – one of oil and the other of water. In other words, oil in water has a distinct boundary separating oil from water.

3. Differentiate between homogeneous and heterogeneous mixtures with examples.

Ans. **Homogeneous mixture**

They have uniform compositions. The components of homogeneous mixtures are not physically distinct. Most solutions are homogeneous mixtures. Salt in water, sugar in water are examples of homogeneous mixtures.

Heterogeneous mixture

They contain physically distinct parts and have non-uniform compositions. Mixtures of sodium chloride and iron filings, salt and sulphur, and oil and water are examples of heterogeneous mixtures. Suspensions and colloids are heterogeneous mixtures.

4. How are sol, solution and suspension different from each other?

Ans. Difference between true solutions, suspensions and colloidal solutions

Property	True Solutions	Suspensions	Colloidal Solutions
Particle size	Less than 10^{-9} m/10^{-7} cm /1 nm	Greater than 10^{-6} m/10^{-4} cm /1000 nm	(10^{-9} to 10^{-6} m)/ (10^{-7} to 10^{-4} cm)/ (1 to 1000 nm)
Visibility of particles	Invisible to naked eye and under powerful microscope.	Easily visible	Invisible to naked eye. Visible under powerful microscope.
Sedimentation of particles	Do not settle down.	Settle down due to gravity.	Settle down under high centrifugation
Filtration through filter paper	No residue is formed.	Residue is formed.	No residue is formed.
Mixture type	Homogeneous	Heterogeneous	Heterogeneous
Appearance	Clear and Transparent	Translucent or Opaque	Translucent

5. To make a saturated solution, 36 g of sodium chloride is dissolved in 100 g of water at 293 K. Find its concentration at this temperature.

Ans. Concentration = $\frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$

Here, mass of solute = 36 g

and mass of solvent = 100 g

Therefore, Mass of solution

= 100 + 36 = 136 g

Thus, concentration = $\frac{36}{136} \times 100 = 26.47\%$

6. Classify the following as chemical or physical changes

- Cutting of trees
- Melting of butter in a pan
- Rusting of almirah
- Boiling of water to form steam
- Passing of electric current through water and the water breaking down into hydrogen and oxygen gases
- Dissolving common salt in water
- Making a fruit salad with raw fruits, and
- Burning of paper and wood.

Ans. Physical changes: Cutting of trees, melting of butter in a pan, boiling of water to form steam, dissolving common salt in water making a fruit salad with raw fruits.

Chemical changes: Rusting of almirah, passing of electric current through water and the water breaking down into hydrogen and oxygen gases, burning of paper and wood.

7. Try segregating the things around you as pure substances or mixtures:

(a) distilled water (b) curd
(c) diamond (d) ice-cream
(e) kerosene oil (f) cooking oil
(g) steel (h) graphite
(i) raw rubber
(j) vulcanized rubber
(k) solder wire
(l) glass
(m) iron nail.

Ans. (i) Pure substances: distilled water, diamond, graphite, raw rubber glass, iron nail.

(ii) Mixture: curd, ice cream, kerosene oil, cooking oil, steel, vulcanized rubber, solder wire.

9. Write the steps you would use for making tea. Use the words solution, solvent, solute, dissolve, soluble, insoluble, filtrate and residue.

Ans. Take some water in pan. Keep the pan over flame. The solutes tea leaves and sugar should be added to a pan containing water as solvent. Heat the water over the pan till the sugar, which is soluble in water dissolves in it. Tea leaves are insoluble in water and will remain suspended. Now, add water to the sugar and tea leaves solution and bring the mixture to boil. After that, filter the prepared tea through a sieve. Filtrate should be poured in a cup, while the residue can be thrown away.

10. Pragya tested the solubility of three different substances at different temperatures and collected the data as given below. Result are given in the following table, as grams of substance dissolved in 100 grams of water to form a saturated solution.

Substance Dissolved	**Temperature in K**				
	283	293	313	333	353
Potassium nitrate	21	32	62	106	167
Sodium chloride	36	36	36	37	37
Potassium chloride	35	35	40	46	54
Ammonium chloride	24	37	41	55	66

(a) Potassium nitrate would be needed to produce saturated solution of potassium nitrate in 50 grams of water at 313 K?

(b) Pragya makes a saturated solution of potassium chloride in water at 353 K and leaves the solution to cool at room temperature. What would she observe as the solution cools?

(c) Find the solubility of each salt at 293 K. Which salt has the highest solubility at this temperature?

(d) What is the effect of change of temperature on the solubility of a salt?

Ans. (a) Since 62 g of potassium nitrate is dissolved in 100 g of water to prepare a saturated solution at 313 K, 31 g of potassium nitrate would be needed to produce saturated solution of potassium nitrate in 50 grams of water at 313 K.

(b) The amount of potassium chloride that should be dissolved in water to make a saturated solution increases with temperature. Thus, as the solution cools some of the potassium chloride will precipitate out of the solution.

(c) The solubility of the salt at 293 K are
Potassium nitrate - 32 g
Sodium chloride - 36 g
Potassium chloride - 35 g
Ammonium chloride - 37 g
Ammonium chloride has the highest solubility at293 K.

(d) The solubility of a salt increases on increasing the temperature.

11. Explain the following by giving examples.
(a) Saturated solution
(b) Pure substance
(c) Colloid
(d) Suspension

Ans. (a) At any particular temperature, a solution that has dissolved as much solute as it is capable of dissolving is said to be a saturated solution. Few examples of saturated solutions are soft drinks and nitrogen in Earth's soil.

(b) A pure substance is one that cannot be separated into different constituents by physical or chemical processes. A pure substance is one that contains particles of only one type of a substance. Pure substance can be elements or compounds. Some examples of pure substances are iron, water, oxygen, etc.

(c) Colloids are heterogeneous mixtures in which the particle size is too small to be seen with the naked eye, but is big enough to scatter light. Smoke, paint, butter are few examples of colloids.

(d) Materials that are insoluble in a solvent and have particles that are visible to naked eyes form a suspension. A suspension is a heterogeneous mixture. Some examples of suspension are water with chalk particles, sandy water and water with stones.

12. Classify each of the following as a homogeneous or heterogeneous mixture: soda, water, wood, air, soil, vinegar, filtered tea.

Ans. **Homogeneous** – soda, water, air, vinegar, filtered tea.
Heterogeneous – wood, soil

13. How would you confirm that a colourless liquid given to you is pure water?

Ans. If the boiling and freezing points of the given liquid comes out to be 100°C and 0°C respectively under one atmosphere pressure, it confirms that the given liquid is pure water.

14. Which of the following materials fall in the category of a "pure substance"?
(a) Ice
(b) Milk
(c) Iron
(d) Hydrochloric acid
(e) Calcium oxide
(f) Mercury
(g) Brick
(h) Wood
(i) Air

Ans. Ice, iron, hydrochloric acid, calcium oxide, and mercury are pure substances.

15. Identify the solution among the following mixtures.
(a) Soil
(b) Sea water
(c) Air
(d) Coal
(e) Soda water

Ans. Sea water, air and soda water are solutions.

16. Which of the following will show "Tyndall effect"?
(a) Salt solution
(b) Milk
(c) Copper sulphate solution
(d) Starch solution

Ans. Colloids show Tyndall effect, Milk is a colloid. Thus, it will show Tyndall effect. Therefore, the correct answer is (b).

17. Classify the following into elements, compounds and mixtures.
(a) Sodium (b) Soil
(c) Sugar solution (d) Silver
(e) Calcium carbonate (f) Tin
(g) Silicon (h) Coal
(i) Air (j) Soap
(k) Methane (ℓ) Carbon dioxide
(m) Blood

Ans. **Elements:** sodium, silver, tin and silicon
Compounds: calcium carbonate, soap, methane and carbon dioxide
Mixtures: soil, sugar solution, coal, air and blood.

18. Which of the following are chemical changes?
(a) Growth of a plant
(b) Rusting of iron
(c) Mixing of iron filings and sand
(d) Cooking of food
(e) Digestion of food
(f) Freezing of water
(g) Burning of a candle

Ans. Growth of a plant, rusting of iron, cooking of food, digestion of food and burning of candle are chemical changes.

EXERCISE-01

Multiple choice questions

1. Most element are
(1) solids (2) liquids
(3) gases (4) mixtures

2. Water is
(1) a compound (2) a mixture
(3) true solution (4) all of these

3. Which of the following is not a compound?
(1) Sugar
(2) Common salt
(3) Diamond
(4) Plaster of Paris

4. Which of the following is not a compound?
(1) Common salt
(2) Water
(3) Iron filings
(4) Copper sulphate

5. Which of the following is an example of a mixture?
(1) Sugar (2) Brass
(3) CO_2 (4) NO_2

6. Which of the following is an example of a heterogeneous substance?
(1) Bottled water (2) Table salt
(3) Pieces of copper (4) Candle

7. Which of the following statements is true?
(1) Homogeneous mixtures have non-uniform composition.
(2) Homogeneous mixtures have uniform composition.
(3) Heterogeneous mixtures have uniform composition.
(4) Sugar solution is heterogeneous mixture.

8. Which of the following is a true solution?
(1) NaCl in sulphur dioxide
(2) Zinc in copper
(3) Salt in petrol
(4) Mud in water

9. Drinking soda is an example of a solution of
(1) gas in liquid
(2) liquid in gas
(3) gas in gas
(4) solid in liquid

10. Brass is a _____.
(1) compound
(2) element
(3) homogeneous mixture
(4) heterogeneous mixture

11. In sugar solution,
(1) sugar is solute, water is solvent.
(2) sugar is solvent, water is solute.
(3) both are solutes.
(4) both are solvents.

12. A true solution is a
(1) homogeneous mixture.
(2) heterogeneous mixture.
(3) pure compound.
(4) impure compound.

13. Milk is
(1) fat dispersed in water.
(2) fat dispersed in milk.
(3) fat dispersed in fat.
(4) water dispersed in milk.

14. An emulsion is a colloidal system of
(1) solid dispersed in solid.
(2) liquid dispersed in liquid.
(3) gas dispersed in liquid.
(4) Brownian motion.

15. Foam is a colloidal solution of
(1) gaseous particles dispersed in gas.
(2) gaseous particles dispersed in liquid.
(3) solid particles dispersed in liquid.
(4) solid particles dispersed in gas.

16. Which of the following forms a colloidal solution in water?
(1) Salt
(2) Glucose
(3) Starch
(4) Barium nitrate

17. Sol is
(1) solid dispersed in liquid.
(2) liquid dispersed in gas.
(3) gas dispersed in liquid.
(4) gas dispersed in solid.

18. Liquid dispersed in gas is called
(1) liquid aerosol (2) solid sol
(3) sol (4) solid foam

19. Milk of Magnesia is an example of
(1) sol (2) true solution
(3) precipitate (4) suspension

20. Solid foam is
(1) solid dispersed in solid.
(2) liquid dispersed in solid.
(3) gas dispersed in solid.
(4) solid dispersed in liquid.

21. Which of the following statements is not true?
(1) True solutions are homogeneous in nature.
(2) Suspensions are heterogeneous in nature.
(3) Solute particles in a colloidal solution can be separated by filtration.
(4) True solutions are transparent to light.

22. Particles of which of the following are visible by naked eyes?
(1) Mixture
(2) Colloidal solution
(3) Suspension
(4) None of these

23. A solution in which more quantity of solute can be dissolved without raising its temperature is called _____.
(1) unsaturated solution
(2) saturated solution
(3) super saturated solution
(4) concentrate solution

24. Suspensions are _____.
(1) transparent (2) opaque
(3) homogeneous (4) none of these

25. Salt can be obtained from sea water by
(1) filtration (2) decantation
(3) evaporation (4) sublimation

26. Which of the following is not a chemical change?
(1) Electrolysis of water
(2) Boiling of water
(3) Digestion of food
(4) Burning of magnesium ribbon in oxygen to form magnesium oxide.

27. Which of the following are physical changes?
(i) Melting of iron metal.
(ii) Rusting of iron.
(iii) Bending of an iron rod.
(iv) Drawing a wire of iron metal.
(1) (i), (ii) and (iii)
(2) (i), (ii) and (iv)
(3) (i), (iii) and (iv)
(4) (ii), (iii) and (iv)

28. Which the following are chemical changes?
(i) Decaying of wood
(ii) Burning of wood
(iii) Sawing of wood
(iv) Hammering a nail into a piece of wood
(1) (i) and (ii)
(2) (ii) and (iii)
(3) (iii) and (iv)
(4) (i) and (iv)

29. Which of the following is a compound?
(1) Stainless steel
(2) bronze
(3) Graphite
(4) Hydrogen sulphide

30. Select the compound from the following
(1) Alloy (2) Copper
(3) Salt (4) Sodium

Fill in the blanks

1. Air is a _____.

2. Wood is a _____.

3. Brass is a mixture of _____ and _____.

4. 10% by mass of a solution means _____ g of solute are present in 50g of solution.

5. _____ show tyndall effect.

6. Digestion of food is a _____ change.

7. Electrolysis of water is a _____ change.

8. _____ is a metal which exists as liquid.

9. Compound is a _____ substance.

10. A pure substance has a fixed _____ and ____ at constant temperature.

True or False

1. Water is a homogeneous substance.

2. Constituents of a mixture can be separated by physical methods.

3. Mass percentage of a solution containing 10 g of solute in 90g of water is 10%.

4. Fog is an example of liquid dispersed in gas.

5. Solutions cannot be separated by the process of filtration.

6. The separation of butter from curd can be done by centrifugation.

7. Graphite is a good conductor of electricity.

8. Steam is a compound.

9. All mixture are defined as "heterogeneous".

10. Substance is always homogeneous.

ANSWER KEY

Multiple choice questions

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	**1**	**1**	**3**	**3**	**2**	**4**	**2**	**2**	**1**	**3**	**1**	**1**	**1**	**2**	**2**
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	**3**	**1**	**1**	**1**	**3**	**3**	**3**	**1**	**2**	**3**	**2**	**3**	**1**	**4**	**3**

Fill in the blanks

1. mixture
2. mixture
3. copper and zinc
4. 5
5. Colloids
6. chemical
7. chemical
8. Mercury
9. Pure
10. melting point & boiling point

True or False

1. True
2. True
3. True
4. True
5. True
6. True
7. True
8. True
9. False
10. False

EXERCISE-02

Very short answer type questions

1. What is meant by a pure substance?
2. Is air a mixture or a compound? Explain.
3. Give one example of solution of gas in liquid.
4. Classify the following as element, compound or mixture.
   (i) Zinc amalgam (ii) Sea water (iii) Iodine vapour (iv) Gold coin (v) Water.
5. Smoke and fog both are aerosols. In what way are they different?
6. Name the dispersed phase and dispersion medium in case of an emulsion.
7. What are suspensions? Give an example.
8. Arrange true solution, suspension and colloid in the decreasing order of size of the particles.
9. What type of change is burning of candle?
10. Define an element.
11. An element is sonorous and highly ductile. Under which category would you classify this element? What other characteristics do you expect the element to possess?
12. Which of the following are not compounds?
    (a) Chlorine gas
    (b) Potassium chloride
    (c) Iron
    (d) Iron sulphide
    (e) Aluminium
    (f) Iodine
    (g) Carbon
    (h) Carbon monoxide
    (i) Sulphur powder
13. A hard substance produces a sound when beaten. Is it metal or a non-metal and which property does it shows?
14. Give one example each of homogeneous and heterogeneous mixture.
15. Give one example of solid-liquid homogeneous mixture.

Short answer type questions

1. Give difference between homogeneous and heterogeneous mixture. Give one example of each.
2. The 'sea-water' can be classified as a homogeneous as well as heterogeneous mixture. Comment.
3. What would you observe when
   (a) a saturated solution of potassium chloride prepared at 60°C is allowed to cool to room temperature?
   (b) an aqueous sugar solution is heated to dryness?
   (c) a mixture of iron filings and sulphur powder is heated strongly?
4. A solution contains 5 g glucose in 45 g of water. Calculate concentration of solution in mass percentage.
5. Calculate the mass of sodium sulphate required to prepare its 20% (mass percent) solution in 100 g of water?
6. Give some examples of Tyndall effect observed in your surroundings?
7. Give an example of chemical change.
8. What is meant by Tyndall effect? What is its cause?

9. Give two differences between true solution and colloidal solution.

10. Give four properties of suspension.

11. Give an example each for the mixture having the following characteristics. Suggest a suitable method to separate the components of these mixtures

(a) A volatile(liquid) and a non-volatile(solid) component.

(b) Two volatile components with appreciable difference in boiling points.

(c) Two immiscible liquids.

(d) One of the components changes directly from solid to gaseous state.

(e) Two or more coloured constituents soluble in some solvent.

12. You are provided with a mixture containing sand, iron filings, ammonium chloride and sodium chloride. Describe the procedures you would use to separate these constituents from the mixture?

13. Classify the following as physical or chemical properties.

(a) The composition of a sample of steel is: 98% iron, 1.5% carbon and 0.5% other elements.

(b) Zinc dissolves in hydrochloric acid with the evolution of hydrogen gas.

(c) Metallic sodium is soft enough to be cut with a knife.

(d) Most metal oxides form alkalis on reacting with water.

14. Classify each of the following, as a physical or a chemical change. Give reasons.

(a) Drying of a shirt in the sun.

(b) Rising of hot air over a radiator.

(c) Burning of kerosene in a lantern.

(d) Churning of milk cream to get butter.

15. What are metals? Give two examples of metals.

16. Classify each of the following as a homogeneous or heterogeneous mixture. Soda water, wood, air, soil, vinegar.

17. Differentiate between metals and non-metals.

18. Classify the following into elements, compounds and mixtures.

a. Sodium

b. Soil

c. Sugar solution

d. Silver

e. Calcium carbonate

f. Tin

19. Explain why water is a compound and not a mixture?

20. What are the three groups into which all the elements can be divided? Name two elements belonging to each group.

Long answer type questions

1. What is a mixture? Explain two types of mixtures and give two examples of each.

2. What is a solution? Give its three properties.

3. Define the following terms

(i) Saturated solution

(ii) Solvent

4. Explain in detail about classification of solution on the basis of amount of solute.

5. Define-Foam, Aerosol, Emulsion, Sol.

6. Write a brief note on
(i) Tyndall effect
(ii) Solubility

7. What is a suspension? Give its three properties.

8. Explain the method to separate cream from milk.

9. What are physical and chemical changes? Give two examples of each.

10. Give differences between compounds and mixtures.

11. Define element, compound and mixture. Give two examples of each.

12. (a) Can a physical and a chemical change occur together? Illustrate your answer.
(b) Is air a mixture or a compound? Give three reasons.

13. (a) State the main points of difference between homogeneous and heterogeneous mixtures.
(b) Classify the following materials as homogeneous mixtures and heterogeneous mixtures.
Soda-water, Wood, Air, Soil, Vinegar, Alcohol and water mixture, Petrol and water mixture, Chalk and water mixture, Sugar and water mixture, Copper sulphate solution.

14. Explain why a solution of salt in water is considered a mixture and not a compound.

15. (a) What are (i) metals (ii) non-metals, and (iii) metalloids? Give two examples each of metal, non-metals and metalloids.
(b) Classify the following into metals, non-metals and metalloids:
Silicon, Mercury, Diamond, Sulphur, Iodine, Germanium, Sodium, Carbon, Magnesium, Copper, Boron, Helium.

Exercise-01 Solutions

Multiple choice questions

1. Option (1)

Most of the elements are solid at room temperature.

2. Option (1)

Water is a compound of hydrogen and oxygen, combined together in the ratio of 1 : 8 by weight.

3. Option (3)

Diamond is the allotrope of carbon in which the carbon atoms are arranged in the specific type of cubic lattice called diamond cubic. So, it is a pure substance.

4. Option (3)

Iron metal, whether powdered a solid chunk or filings is an element. Elements and compounds are pure substances. Therefore, iron fillings are a pure substance.

5. Option (2)

Copper and Zinc are physically mixed together to form brass as a mixture. Copper and zinc retain their individual characteristics.

6. Option (4)

Candle is made up of many chemical substances such as paraffin wax, which is chemically composed of many different elements.

7. Option (2)

Homogeneous mixture is a mixture in which different constituents are mixed uniformly and has same composition throughout.

8. Option (2)

Copper in silver is an alloy i.e. homogeneous mixture of metals mixed uniformly.

9. Option (1)

In drinking soda or aerated drinks, CO_2 is dissolved in water.

10. Option (3)

Brass is an alloy made up of uniform composition of copper and zinc. It is a homogenous mixture in which zinc and copper can be varied to create a range of brasses with varying of properties.

11. Option (1)

A simple solution is basically two substances that are evenly mixed together; one of them is called solute and the other is solvent. In sugar solution, sugar is the solute and water is the solvent.

12. Option (1)

True solution is a homogeneous mixture in which different constituents are mixed uniformly and has same composition throughout.

13. Option (1)

Milk is the colloidal mixture of fat or cream in water.

14. Option (2)

Emulsion is a colloidal system of liquid dispersed in liquid dispersion medium.

15. Option (2)

Foam is a colloidal solution in which gas in the form of gas bubbles is dispersed in a liquid.

16. Option (3)

The solution of starch in water is having particle size between 10^{-7} cm to 10^{-4} cm and thus it forms a colloidal solution.

17. Option (1)

Sol is solid dispersed in liquid or solid e.g. starch solution, muddy water, gelatine.

18. Option (1)

Liquid-aerosols are liquid dispersed in gases. In liquid-aerosols, the particles often exceed the usual size limits for colloids.

19. Option (1)

Milk of magnesia (Emulsion) is an example of colloid solution which solid liquid is called sol (liquid dispersed in liquid).

20. Option (3)

Solid foam is gas dispersed in solid. E.g., ice-cream.

21. Option (3)

The particle size of the solute particles in the colloidal solution is bigger than the pore size of filter paper. So, the solute cannot be separated by the filtration process.

22. Option (3)

The particle size of the solute particles in the suspension solution is greater than 10^{-4} cm or 10^{-6} m

23. Option (1)

An unsaturated solution is the one which can dissolve more of the solute at given temperature.

24. Option (2)

A suspension is a heterogeneous mixture in which the solid particles are spread throughout the liquid without dissolving in it. So, it is opaque.

25. Option (3)

When sea water is heated to evaporate the water, salt crystals are left behind. This method is used to obtain salt from sea water, generally using sun's heat.

26. Option (2)

Boiling water is a physical change because in boiling of water only the state of water is being changed from liquid to vapour. By cooling water vapour, it can easily return in to liquid state.

27. Option (3)

Physical changes are those in which no new substance is formed and easily returned to their original form by physical process.

28. Option (1)

In chemical change, the substances change their identity and converts into entirely new substances.

29. Option (4)

Hydrogen sulphide is chemical compound with the formula H_2S.

30. Option (3)

Salt is an ionic compound consisting of a crystal, lattice structure of two ions Na^+ and Cl^-.

True or False

1. True

The constituents of water are mixed uniformly and same composition throughout. So, water is a homogeneous substance.

2. True

Mixture is two or more substances (elements, compounds or both) physically mixed in any proportion and can be separated by physical method.

3. True

Mass of solute = 10 gram

Mass of solution = 90 gram + 10 gram = 100 grams

Hence ;

Mass% of solution = $\frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$

= $\frac{10 \times 100}{100}$ = 10 % w/w

4. True

Fog is a colloid containing liquid as dispersed phase and gas as dispersion medium.

5. True

The size of solute particles in a solution is less than 1nm which can easily pass through the filter paper. So, solution cannot be separated by process of filtration.

6. True

In centrifugation, a very fine suspension of butter in curd is whirled rapidly.

The heavier particles are forced towards the bottom of liquid and lighter (butter) stays at the top.

7. True

Graphite has a tendency to behave very much like a metal because the carbon molecules arrange themselves into a lattice structure. The crystal lattice is the same orientation that metal forms, and it allows the free-movement of electrons, making it a good electrical conductor.

8. True

Steam is composed of two or more gases chemically combined in definite ratio. So, it makes a compound.

9. False

All mixture are defined as "homogenous or heterogeneous".

10. False

Substance can be homogenous or heterogeneous.

Exercise-02 Solutions

Very short answer type questions

1. A homogeneous material which contains particles of only one kind and has a definite set of properties is called a pure substance. E.g. oxygen, iron, sulphur, etc.

Or

If a substance is composed of two or more different kinds of particles combined together in fixed proportion by weight, then also substance is regarded as a pure substance. e.g. Sodium chloride.

2. Air is a mixture of gas in gas. Air is a homogeneous mixture of a number of gases like Nitrogen (78%), oxygen (21%), CO_2 (0.04%), argon (0.93%) and other gases.

3. Soda water

4. Element - Iodine vapour
Compound - Water,
Mixture - Zinc amalgam, Sea water, Gold coin

5. Smoke is an example of solid aerosol in which solid is the dispersed phase which is dispersed in gas (dispersion medium). Fog is an example of liquid aerosol in which liquid is the dispersed phase which is dispersed in gas (dispersion medium).

6. Dispersed phase is liquid and dispersion medium is also liquid.

7. A suspension is a heterogeneous mixture in which the solid particles are spread throughout the liquid without dissolving it. The particles have a tendency to settle down at the bottom of the container and can be filtered out.

Examples :

(1) Chalk-water mixture is a suspension of fine chalk particles in water.

(2) Muddy water is a suspension of soil particles in water.

8. Suspension > Colloid > true solution (order of particle size)

9. Burning of candle is a chemical change.

10. A pure substance which is made up of one kind of atoms only is called an element.

11. This element is a metal and some other properties of metals are as follows:
They have generally silver-grey colour.
They easily conduct heat and electricity.
They are malleable i.e. they can be beaten into sheets.
They have a lustre; freshly cut surface has a shine on it.

12. Chlorine gas, Iron, Aluminium, Iodine, Carbon, Sulphur powder are elements not compounds.

13. It is a metal, as metals are sonorous. Metals produces sound when beaten.

14. Homogenous $\rightarrow$ Brass (Alloy)
Heterogenous $\rightarrow$ Sand and water.

15. Salt in water solution is a solid-liquid homogeneous mixture.

Short answer type questions

1.

S.No.	Difference between Homogeneous mixture and Heterogeneous mixture	
(i)	Homogeneous mixture	Heterogeneous mixture
(ii)	Homogeneous mixtures have uniform composition.	Heterogeneous mixtures have non-uniform composition
(iii)	It has no visible boundaries of separation between its constituents.	It has visible boundaries of separation between its constituents.
(iv)	Some examples of homogeneous mixtures are: salt in water, sugar in water.	Some examples of heterogeneous mixtures are: water and sand, oil and water.

2. Sea water is the mixture of many salts, water and other many impurities. Apart from these many gases are also dissolved in sea water. Because of salt and some other bigger size of impurities sea water is classified as heterogeneous mixture. Because of mixture of several gases in sea water it is also classified as homogeneous mixture.

3. (a) A saturated solution of potassium chloride prepared at 60°C. While it is allowed to cool to room temperature, some of the potassium chloride is settled down at the bottom, because saturation decreases with decrease in temperature.

(b) An aqueous sugar solution is heated to dryness; the sugar will be left behind in the container after vaporization of water. The sugar left in the container may be charred because of more heating.

(c) A mixture of iron fillings and sulphur powder is heated strongly. On heating the mixture, the sulphur melts and reacts with the iron exothermically to form iron (II) sulphide a new substance (black iron sulphide) is formed which cannot be separated by using a magnet.

4. Mass of solute (glucose) = 5g

Mass of solution

= 45g (water) + 5g (glucose) = 50g

Hence;

Mass percentage of solution

$= \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$

$= \frac{5 \times 100}{50} = 10\%$ w/w

5. Mass percentage of solution = 20%

Mass of the water = 100 g

Suppose, Mass of solute (Na_2S) = x g

Mass of solution = x + 100 g

Hence,

Mass percentage of solution

$= \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$

$20 = \frac{x}{x + 100} \times 100$

$x = 25\text{g}$

Hence, to prepare 20 % (w/w) solution in 100g of water, 25g of sodium sulphate is needed.

6. (1) Sun light coming from window. The dust particles present in the way of beam looks luminous because of the scattering of light.

(2) Milk in a glass appearing faint blue, since milk is a colloid and light passed through it scattered.

(3) Sun beam coming from behind the clouds looks luminous because of the scattering of light.

7. Burning of candle is an example of chemical change.

8. The scattering of beam of light by colloidal particles is called the Tyndall effect. Because the particles of colloidal solution are big enough to scatter light and hence the path of light becomes visible.

9. Give two differences between true solution and colloidal solution.

Sr. No.	Solution	Colloidal solution
1	Particle size is less than 1 nm.	Particle size is between 1 nm to 1000 nm.
2	It is a homogeneous mixture.	It is a heterogeneous mixture.
3	Particles cannot be seen by naked eye and even under the microscope.	Particles cannot be seen by naked eye but can be seen under powerful microscope.

10. (1) Particle size is greater than 10^{-5} cm or 10^{-7} cm or more than 1000 nm.

(2) Particles can be easily visible.

(3) A suspension scatters a beam of light passing through it. So, it shows Tyndall effect.

(4) The particles of suspension settle down, when the suspension is kept undisturbed.

11. (a) In the mixture of salt and water, water is volatile and salt is non-volatile. The mixture of water and salts can be separated by the process of evaporation.

(b) In the mixture of acetone and ethanol, boiling point of acetone is 56 °C and that of ethyl alcohol is 78 °C. The mixture of acetone and ethanol can be separated using fractional distillation.

(c) If there are two immiscible liquids, thus their mixture can be separated using separating funnel.

(d) One of the components changes directly from solid to gaseous state. For example, in the mixture of salt and ammonium chloride, ammonium chloride changes from solid to gaseous state directly but salt cannot. So, the mixture of salt and ammonium chloride can be separated by the process of sublimation.

(e) For example, the ink is the mixture of dyes of many colours. The different dyes of ink can be separated using chromatography.

12. The given mixture can be separated using the following process.

Magnetic Separation : Using magnetic separation the iron fillings can be separated from the given mixture. In this a magnet is hover just above the mixture, since iron is a magnetic substance it is attracted by magnet and stuck with it. By this first of all iron fillings are separated.

Sublimation : After the separation of iron fillings, ammonium chloride is separated by the process of sublimation. Since, ammonium chloride is a sublimate and it turns into vapour directly without changing into liquid, thus when the mixture is sublimated.

The ammonium chloride is deposited over the inner wall of funnel leaving the sodium chloride and sand in the watch glass. Ammonium chloride is separated by scratching from the inner wall of the funnel.

Filtration : Now the left over mixture of sand and sodium chloride is put in water, after stirring the sodium chloride is dissolved in water. The solution is separated by the process of filtration. The sand left over the filter paper is separated out.

Crystallization : By the process Crystallization, the liquid so obtained is Evaporated and crystals of sodium chloride can be obtained.

Hence, by using the methods of magnetic separation, sublimation, filtration and Crystallization the component of given mixture of sand, iron fillings, ammonium chloride and sodium chloride can be separated.

13. (a) This is the physical property. Since steel is the alloy and considered as mixture of more than one elements.

(b) It is a chemical property because this shows the reaction of zinc with hydrochloric acid.

(c) Since, it shows the softness of sodium. Thus it is a physical property.

(d) This property shows the reaction of metal oxides with water. Thus it is a chemical property.

14. (a) Drying of shirt in the sun is a physical change. Since in this change, no new substance is formed.

(b) Since, in rising of hot air over a radiator no new substance is formed, hence it is a physical change.

(c) While burning of kerosene in a lantern carbon dioxide, and water vapour is formed. Hence, it is a chemical change.

(d) While churning of milk cream to get butter, no new substance is formed. Hence, it is a physical change.

15. Metal is a solid material which is typically hard, shiny, malleable and ductile, with good electrical and thermal conductivity (e.g. iron, gold, silver, and aluminium, and alloys such as steel).

16. Soda water- Homogeneous mixture
Wood- Heterogeneous mixture
Air- Homogeneous mixture
Soil- Heterogeneous mixture
Vinegar- Homogeneous mixture

17.

Difference between metal and non-metals	
Metal	**Non-metal**
They have generally silver-grey colour. However, some metal or their alloys have golden yellow colour.	They exist in solid, liquid and gaseous state. They display variety of colour.
They easily conduct heat and electricity.	They are poor conductors of heat and electricity.
They are malleable i.e. they can be beaten into sheets.	They are generally neither malleable nor ductile.
They are sonorous. For example, Gold, silver, copper, iron, sodium, potassium, etc. Mercury is the only metal that is liquid at room temperature.	They are not sonorous. For example, Hydrogen, oxygen, iodine, carbon, etc.

18. Elements: An element is defined as a pure substance made up of only one kind of atoms that cannot be converted into anything simpler than itself by any physical or chemical process.
Compounds- A compound is a substance made up of two or more different chemical elements combined in a fixed ratio.
Mixtures - A substance that is formed by mixing two or more chemical compounds or substances that do not combine together chemically.
Elements: Sodium, Silver, Tin
Compounds: Calcium Carbonate
Mixtures: Sugar solution, Soil

19. Water is a compound as-
a. the atoms of hydrogen and oxygen combined with each other to form water.
b. its constituents can be separated only by chemical or electrochemical reactions.
c. The elements Hydrogen and oxygen are in fixed ratio.

20. Elements can be divided into metals, non-metals, and metalloids.
Metals: Aluminium and copper
Non-metals: Potassium and calcium
Metalloids: Arsenic and antimony

Long answer type questions

1. When two or more substances (elements, compounds or both) are physically mixed together in any proportion, such that they do not undergo any chemical change, but retain their individual characteristics, the resulting product is called a mixture.
For example, Brass is a mixture of copper and zinc.
Crude oil is a mixture of large number of different hydrocarbons.
If we dissolve sugar in water both of which are pure compounds, the solution of sugar in water is a mixture.

Characteristics of mixtures

(1) A mixture may be homogeneous or heterogeneous.
(2) The constituents of a mixture can be separated by physical means like filtration, evaporation, sublimation and magnetic separation.

(3) In the preparation of a mixture energy is neither evolved nor absorbed.

(4) A mixture has no definite melting point and boiling point.

(5) The constituents of a mixture retain their original set of properties. For example, magnet attracts iron filings in a mixture of sand and iron filings.

Types of Mixtures:

Depending upon the nature of components, a mixture can be divided into two types.

(a) Heterogeneous mixture

A mixture in which different constituents are not mixed uniformly, is called a heterogeneous mixture. The components of a heterogeneous mixture can be observed with naked eyes or with the help of a microscope. This mixture has different composition in different parts for example, Sand and iron filings, sand and water, etc.

(b) Homogeneous mixture

A mixture in which different constituents are mixed uniformly, is called a homogeneous mixture. This mixture has same composition throughout. Homogeneous mixtures are also known as solutions. The components of such a mixture cannot be seen even under a microscope. For example, salt solution, sugar solution. Similarly alloys such as brass, bronze, etc. are homogeneous solid solutions of metals.

2. When one substance dissolves or mixes well with another substance, we regard the mixture as the solution. A solution may be defined as a homogeneous mixture of two or more non-reacting substances whose composition can be varied within certain limits.

For example, Air is a mixture of gas in gas. Air is a homogeneous mixture of a number of gases. Its two main constituents are oxygen (21%) and nitrogen (78%).

It may be noted that all mixtures are not solutions. If a mixture is to be called a solution. It must satisfy the following two conditions.

- Components should be non-reacting.
- Should be homogeneous.

Components of a solution

The substances present in a homogeneous solution, are called components of the solution. A solution basically has two components i.e. a solvent and a solute and such a solution is called a binary solution.

(a) Solvent

The component of a solution which dissolves the other component in itself, is called solvent. Usually a solvent is the larger component of the solution. For example, a solution of sugar in water is a solid in liquid solution. In this solution, sugar is the solute and water is the solvent.

(b) Solute

The component of the solution which dissolves in the solvent, is called solute. Usually solute is the smaller component of the solution for example, solution of iodine in alcohol, known as 'tincture of iodine', iodine is the solute in this solution.

Similarly, in carbonated drinks (soda water), carbon dioxide gas is the solute.

Characteristics of a solution

(1) A solution is a homogeneous mixture.

(2) The size of solute particles in a solution is extremely small. It is less than 1 nm(10^{-9} m) in diameter.

(3) The particles of a solution cannot be seen even with a microscope.

(4) The particles of a solution pass through the filter paper. So, a solution cannot be separated by filtration.

(5) The solutions are very stable. The particles of solute present in a solution do not separate out on keeping it undisturbed.

(6) A true solution does not scatter light passing through the solution (because its particles are very small).

(7) The components of a solution do not chemically react with one another.

(8) A solution is always transparent in nature.

(9) From a true solution, the solute can be easily recovered by evaporation or crystallisation.

3. (i) Saturated solution

A solution which at a given temperature dissolves as much solute as it is capable of dissolving, is said to be a saturated solution. For example, when we add sugar to water, the crystals of sugar keep on going into the solution in the beginning. But after some time, no mass of sugar dissolves provided temperature is kept constant.

For example, At 30°C, 55 g of common salt dissolves in 100 g of water. However, if more of common salt is added to the above solution, it just does not dissolve. In such a situation, the solution of common salt containing 55 g of salt in 100 g of water, is a saturated solution at 30°C.

- If a saturated solution at some particular temperature is heated, the solution becomes unsaturated, because of the increase in solubility.
- If a saturated solution at some higher temperature is cooled, it remains saturated. The excess solute comes out of the solution and deposits itself in the form of crystals.

(ii) Solvent

The component of a solution which dissolves the other component in itself, is called solvent. Usually a solvent is the larger component of the solution. For example, a solution of sugar in water is a solid in liquid solution. In this solution, sugar is the solute and water is the solvent.

4. Classification of solution on the basis of amount of solute

(i) Unsaturated Solution : When the amount of the solute contained in a solution is less than the saturation level at a given temperature, the solution is said to be an unsaturated solution.

e.g. At 30 °C, if 45 g of common salt is dissolved in 100 g of water, such solution so formed is capable of dissolving more of the common salt, then such a solution is called an unsaturated solution.

(ii) Saturated Solution : A solution which contain maximum amount of solute that can be dissolved in solvent at a given temperature is said to be a saturated solution at that temperature. e.g. At 30 °C, 55 g of common salt dissolves in 100 g of water. However, if more than 55 g of common salt is added to the above solution, only 55 g salt can be dissolved and remaining portion of salt remains as it is in the bottom of the container. In such a situation, the solution of common salt containing 55 gm of salt in 100 gm of water is a saturated solution at 30 °C.

(iii) Supersaturated Solution : A solution which contains more of the solute than required to make a saturated solution at high temperature, is called a super saturated solution.

5. **Foam :** A colloidal dispersion of a gas in a liquid or solid medium.

Aerosol : A colloidal system of solid or liquid particles in a gas. An aerosol includes both the particles and the suspending gas, which is usually air.

Emulsion : An emulsion is a mixture of two or more liquids that are normally immiscible or it is any colloidal suspension of a liquid in another liquid.

Sol : A sol is a colloidal suspension of very small solid particles in a continuous liquid medium.

6. **(i) Tyndall effect :** The phenomenon in which light is scattered by very small particles (colloid or suspension) in its path; it makes a beam of light visible.

Tyndall Effect : When an intense beam of light is passed through a colloidal solution kept in dark, the path of the beam gets illuminated with a bluish light. This phenomenon is called Tyndall effect and the illuminated path is known as Tyndall cone. The phenomenon was first observed by Tyndall in 1869.

Tyndall effect may be defined as the scattering of light by colloidal particles present in a colloidal solution.

Tyndall effect is not exhibited by true solutions. This is because the particles (ions or molecules) present in a true solution are too small to scatter light.

Thus, Tyndall effect can be used to distinguish a colloidal solution from a true solution. Tyndall effect also establishes the fact that colloidal systems are heterogeneous in nature.

(ii) Solubility : The maximum amount of solute in grams which can be dissolved in 100 gm of the solvent at a given temperature to form a saturated solution is called solubility of the solute in that solvent at that particular temperature.

Depending upon solubility, solution can be classified as

(1) Unsaturated solution : When the amount of solute contained in a solution is less than the saturation level, the solution is said to be an unsaturated solution. E.g. At 30 °C, if 25 g of sugar is dissolved in 100 g of water, such solution so formed is capable of dissolving more of the sugar, then such a solution is called an unsaturated solution.

(2) Saturated solution : A solution which contains maximum amount of solute that can be dissolved in solvent at a given temperature is said to be a saturated solution at that temperature. E.g. At C, 50 g of sugar dissolves in 100 g of water.

However, if more than 50 g of sugar is added to the above solution, only 50 g sugar can be dissolved and remaining portion of sugar remains as it is in the bottom of the container. In such a situation, the solution of sugar containing 55 gm of sugar in 100 gm of water is a saturated solution at 30 C.

(3) Super saturated solution : A super saturated solution that is more concentrated than a saturated solution is known as super saturated solution. If a crystal of solute is added to this solution, the excess of solute crystallizes.

7. A suspension is a heterogeneous mixture in which the solid particles are spread throughout the liquid without dissolving in it. The Particles have a tendency to settle down at the bottom of the container and can be filtered out.

Properties of a suspension :

(1) A suspension is a heterogeneous mixture.

(2) The size of the solute particles in a suspension is quite large. It is larger than 1000 nm or 10^{-7} m in diameter.

(3) A suspension scatters a beam of light passing through it (because it's particles are quite large and thus makes its path visible.)

8. (a) Take some full-cream milk in a test tube or in shallow pan.

(b) Centrifuge it by using centrifuging machine for two minutes. If a centrifuging machine is not available then you can do this activity at home by using a milk churner, used in the kitchen.

Centrifugation machine

Discussion : when the milk is churned, the lighter fat colloidal particles coagulate with each other to form cream. The cream thus separated starts floating on the surface of milk and continuously collected from the outlet provided near the top of the centrifuging machine.

9. Physical changes are those changes in which no new substances are formed and they can be easily returned to their original form by some physical process. e.g. melting of ice, boiling of water, condensation of steam Chemical changes are those in which new substances are formed and the new substances usually cannot be returned to their original form. e.g. Burning of candle, Burning of hydrogen in oxygen to form water, Burning of magnesium oxide.

10. Difference between Compounds and Mixtures.

Difference between Compounds and Mixtures	
Compounds	**Mixtures**
Elements react to form new compounds.	Elements or compounds just mix together to form a mixture and no new compound is formed.
The composition of each new substance is always fixed.	A mixture has variable composition.
The new substance has totally different properties.	A mixture shows the properties of the constituent substance.
The constituents can be separated only by chemical or electrochemical methods.	The constituents can be separated easily by physical method.

11. **Element :** A pure substance which is made up of one kind of atoms only is called an element. e.g. sodium, silver, tin and silicon

Compound: A pure substance which is composed by two or more elements, combined chemically in a definite ratio, such that it can be broken into elements only by chemical means, is called compound. e.g. Calcium carbonate, soap, methane and carbon dioxide.

Mixture : When two or more substances (elements, compounds or both) are physically mixed together in any proportion, such that they do not undergo any chemical change, but retain their individual characteristics, the resulting product is called a mixture. e.g. Curd, ice cream, kerosene oil, steel, vulcanized rubber, coal, air and blood.

12. **(a)** Yes, in some cases the physical and the chemical changes can occur together. One such example is the burning of candle. The wax present in the candle changes to liquid state. This means that the change is of physical nature. At the same time, the constituents carbon and hydrogen present in wax react with oxygen of air to form new substances. This means that a chemical reaction or change is also taking place.

(b) Air is a mixture and not a compound because of the following reasons:

(i) Air can be separated into its constituents such as oxygen, nitrogen etc. by fractional distillation of liquid air.

(ii) Air shows the properties of all the gases present in it. For Example: Air supports combustion because of oxygen present in the air.

(iii) Air has a variable composition because at different places the different amount of gases are present in the air.

13. **(a)**

Homogeneous mixture	Heterogenous mixture
A substance that is uniform in composition.	Composition is not uniform.
It has a single phase.	Two or more than two phases.
Eg: Sugar solution.	Eg: Sand solution.

(b) Homogeneous mixtures – Soda water, air, vinegar, alcohol and water mixture, sugar and water mixture, Copper sulphate solution.

Heterogeneous mixture – Wood, petrol and water mixture, chalk, and water mixture.

14. The solution of salt in water is considered as a mixture because the salt solution is made up of salt and water

1. The constituents of the salt solution might be variable
2. It does not have a fixed ratio, and properties depend upon the nature of its components.
3. The constituents of the salt solution can be separated

15. (a)

(i) Metals are elements that are malleable, ductile and conduct electricity.
Example: Aluminium and zinc

(ii) Non-metals are elements that are neither malleable nor ductile, and they do not conduct electricity. But most of the non-metals are brittle
Examples: Phosphorus and hydrogen

(iii) Metalloids are the elements that show properties of both metals and non-metals
Examples: Germanium and silicon.

(b) Metals – Mercury, Sodium,
Non-metals – Diamond, Sulphur, Iodine, Carbon, Boron
Metalloids – Silicon, Germanium.