

Section 3 • Changes in Matter

Student textbook, pages 275 and 276

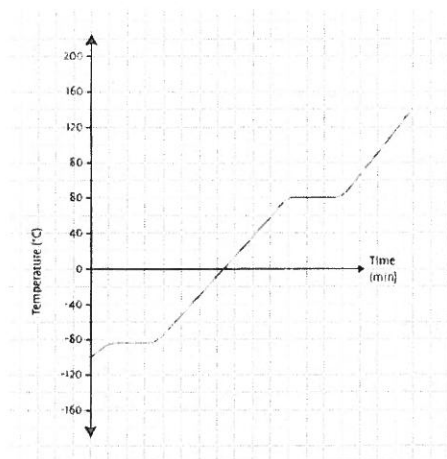
Physical Changes (pages 255 to 267)

1. What is a physical change? *A physical change occurs when the appearance of a substance is changed but its chemical nature remains the same.*
2. How can you compare the total mass and volume of a solution after dissolution with that of the solute and solvent before dissolution? *The mass is identical: the mass of the solute plus the mass of the solvent is equal to the total mass of the solution. However, the total volume of the solution is less than the combined volume of the solute and the solvent.*
3. What does the rate of dissolution of a substance correspond to? *The rate of dissolution is the speed with which the solute dissolves in the solvent.*
4. We want to dissolve a specific quantity of salt (large crystals) in water to make pickles. Suggest three ways to increase the dissolution speed of this solute. *Stir the solution, crush the salt to obtain smaller crystals and increase the water temperature.*
5. What is dilution? *Dilution is a process that produces a solution with a lower concentration than the original solution.*
6. We dilute 200 mL of a saltwater solution with a concentration of 24 g/L by adding 400 mL of water. What is the new concentration of the diluted solution? *Since the volume of the final solution is multiplied by three (200 mL + 400 mL)/200 mL = 3), the initial concentration must be divided by three to obtain its final value. The new concentration is therefore equal to 8 g/L (24 g/L ÷ 3 = 8 g/mL).*
7. Isabelle is diluting peroxide to put streaks in her cousin's hair. She starts off with a solution with a 30% V/V concentration and wants to make up exactly 750 mL of solution with a concentration of 6% V/V. How will she do this?
$$V_1 = \frac{C_2 V_2}{C_1} \quad \text{Where } \begin{array}{l} C_1 = 30\% \text{ V/V} \\ C_2 = 6\% \text{ V/V} \\ V_1 = X \\ V_2 = 750 \text{ mL} \end{array}$$
$$V_1 = \frac{6\% \text{ V/V} \times 750 \text{ mL}}{30\% \text{ V/V}}$$
$$V_1 = 150 \text{ mL}$$
Isabelle should take 150 mL of the 30% V/V solution and add water until she obtains 750 mL of liquid.
8. Indicate the phase change described in each of the following statements:
 - a) Steam forms on the mirror when we take a shower. *Condensation*
 - b) The smell of naphthalene balls (mothballs) spreads throughout a room. *Sublimation*
 - c) You pour chocolate into moulds to make Easter chocolates. *Solidification*
 - d) Rocks form the magma from a volcano. *Fusion*
 - e) The volume of water in a pool decreases after several hot days. *Evaporation*

9. Using a particle model, explain how ice changes from a solid state to a liquid state on a warm spring day. *When the sun heats the water particles in their solid state, they absorb energy and vibrate faster. When the water particles have enough energy, their vibrations are strong enough to weaken the bonds between them. The particles are therefore able to move away from each other, travel around more and are less organized. This is how ice melts.*

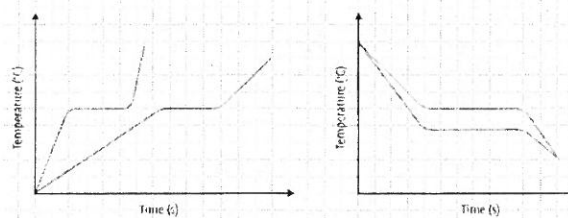
10. Below is a phase-change diagram. Use it to answer the following questions:

- a) What is a plateau? *A plateau is an interval of time when the temperature remains the same.*



- b) What phase change do you observe at the first plateau? *Fusion: the solid substance becomes liquid.*
- c) How many different phases can be observed on the plateau? *Two phases coexist throughout the entire plateau.*
- d) At what temperature is the substance both a liquid and a gas at the same time? *The substance is both a liquid and a gas at 80°C.*
- e) At what temperature does this substance solidify? *This substance solidifies between -80°C and -90°C.*
- f) What is the boiling temperature of this substance? *The boiling temperature is 80°C.*

11. Below are two phase-change diagrams. The curves on one of the diagrams represent phase changes of a single pure substance and the curves on the other diagram refer to different pure substances.



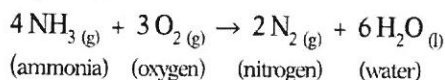
- a) How can you tell if the diagrams represent phase changes for a single pure substance? *The plateaus will be reached at the same temperatures.*
- b) Which diagram represents a single pure substance? *Diagram A represents a single pure substance.*

Chemical Changes (pages 267 to 273)

12. What four signs can indicate a chemical change? *Colour change, formation of a precipitate, release of a gas, energy change*
13. Indicate which of the statements below describe physical changes and which describe chemical changes. Indicate what clues helped you to identify any chemical changes.
- a) Sugar dissolves well in water. *Physical change*
- b) The filament in a light bulb glows when an electric current runs through it. *Chemical change: the production of light*
- c) A piece of chalk is crushed. *Physical change*
- d) Snow melts. *Physical change*

- e) Lime water becomes cloudy in the presence of carbon dioxide.
Chemical change: formation of a precipitate

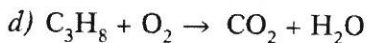
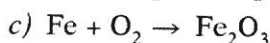
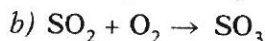
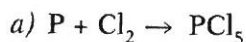
14. Study the following chemical equation:



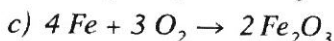
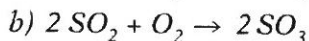
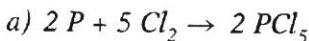
Identify:

- a) Products *Nitrogen and water*
 b) Reactants *Ammonia and oxygen*
 c) State of the water *Liquid*
 d) State of the ammonia *Gaseous*
 e) What abbreviation is used to represent a substance dissolved in water? (*aq*)

15. Balance the following equations correctly:



Answers:



16. What is a synthesis reaction? A *synthesis reaction occurs when two or more reactants combine to form a new product.*

17. What is a decomposition reaction? A *decomposition reaction occurs when a compound breaks down into two or more substances.*

18. a) What is an oxidation reaction? An *oxidation reaction occurs when a substance combines with one or more oxygen atoms.*

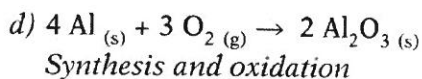
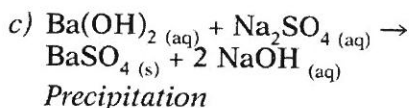
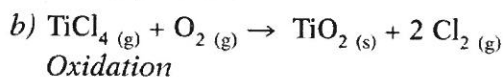
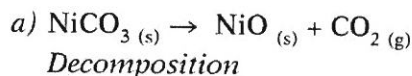
b) What is the substance produced by oxidation called? *The substance produced by oxidation is called an oxide.*

c) Why are oxidation reactions so common in nature? *The oxygen atom is very reactive and naturally tends to combine with other atoms. In addition, oxygen is very abundant in nature.*

19. a) What is a precipitation reaction? A *precipitation reaction occurs when two substances in a solution interact to form an insoluble or slightly soluble compound in a new solution.*

b) What is the name of the insoluble substance that is formed? *The insoluble substance formed is called a precipitate.*

20. Determine whether each of the following is a synthesis reaction, decomposition reaction, oxidation reaction or precipitation reaction:



Forms of Energy (pages 273 and 274)

21. What is energy? *Energy is necessary to produce work or motion.*

22. Determine if the form of energy in each example below is chemical, mechanical, thermal or radiant:

a) Energy in a fast-moving ball
Mechanical energy

- b) Energy transmitted through waves, such as solar energy *Radiant energy*
 - c) Energy you feel when you hold a hot cup of coffee *Thermal energy*
 - d) Energy in a molecule of natural gas *Chemical energy*
23. We say that energy is never created or destroyed. However, a glass of hot water cools down after some time because it loses its thermal energy. What happened to the energy in the water? *When a body loses energy, one or more other bodies gain the same*
24. When we build a wood fire, the chemical energy in the wood molecules is released during combustion. It then transforms into two other forms of energy. What are they? Explain your answer. *When we build a wood fire, the chemical energy is transformed into radiant energy (the light emitted by the fire) and thermal energy (the heat produced).*

Section 4 • Fluids

Student textbook, pages 289 and 290

Pressure (pages 280 to 286)

1. a) What is a fluid? *A fluid is a substance that has no defined form and can flow in all directions.*
 - b) What are the different states of matter of fluids? *Liquids and gases*
 - c) Name two fluids that are present in the human body. *Blood, urine, sweat, sebum, etc.*
2. a) What is pressure? *Pressure is the measurement of force exerted on a surface.*
 - b) What formula is used to measure pressure?

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$
3. a) Pressure can be measured in newtons per square metre (N/m^2). What is the equivalent of N/m^2 in the international metric system? *1 Pascal (1 Pa)*
 - b) Name two other units used to measure pressure. *Kilopascals (1 kPa), millimetres of mercury (mm Hg), atmospheres (atm)*
- c) A patient has a systolic blood pressure of 120 mm of Hg. Convert this reading into kPa. *16 kPa*
4. Pressure varies with the force exerted and the surface area upon which this force is applied. Describe the relationship between pressure and the following:
 - a) Applied force *The change in pressure is directly proportional to the applied force.*
 - b) The surface area upon which force is applied *The change in pressure is inversely proportional to the area on which the force is applied.*
5. In the following two diagrams:
 - a) Which one represents the change in pressure as a function of the surface area upon which force is exerted? *A*
 - b) Which one represents the change in pressure as a function of the force applied? *B*