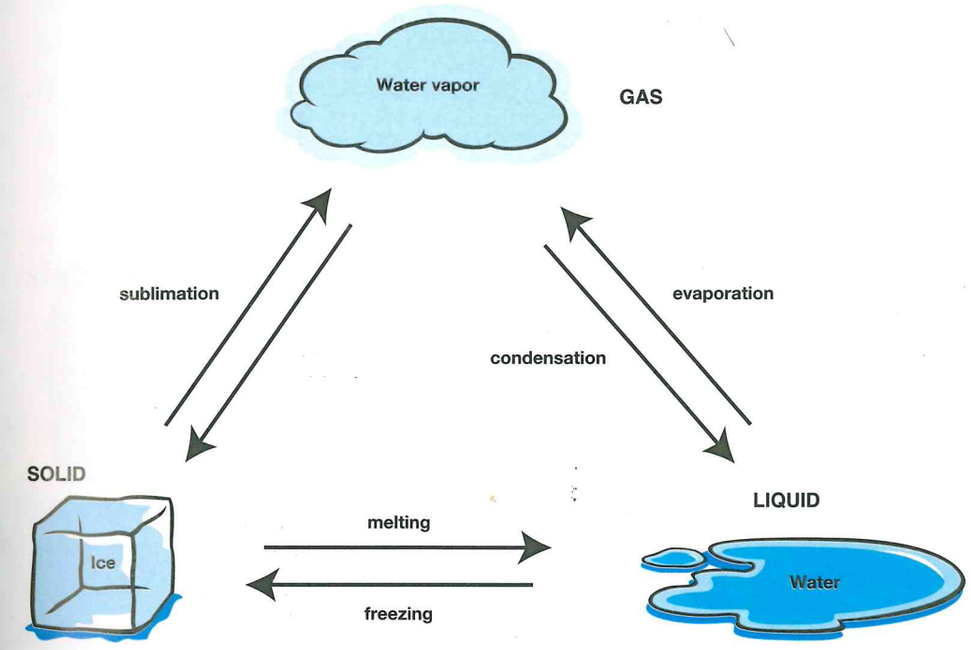
UNIT 9

States of matter

Section 1 *Vocabulary*

CD 1-44

A. Read the text and look at the diagram.



A piece of ice is a **solid**. A pool of water is a **liquid.** The steam from a kettle is a **gas**.

All three **substances** are water but they are in different **states**. Solid, liquid and gas are the three possible states of matter.

Matter changes its state when heat is **applied** or **removed**. We can change a piece of ice into a pool of water by **heating** it. The ice **melts** and becomes a liquid. If we continue to apply heat to the water, **evaporation** begins and some of the water becomes a gas. If we boil the water, some of the water becomes steam. The steam spreads out in the air as **water vapor**.

We can change a gas into a liquid by **cooling** it. For example, water vapor in a bathroom changes to water droplets when it touches a cold mirror. The gas **condenses** into a liquid.

We can change a liquid back into a solid by **freezing** it. For example, water turns into ice if we put it into a freezer.

We can sometimes change a substance from a gas to a solid or a solid to a gas without going through the liquid stage. This process is called **sublimation**.

When you **dissolve** a solid like sugar in a liquid like water, the **solution** that you produce behaves like a liquid. However, you cannot say that the sugar has become a liquid. It is just a solid spread out in the water, which is called a **solvent**. After dissolving the sugar, we can reverse the process by evaporating the water away so the sugar **crystallizes**. This is the process of **crystallization**.

B. **Write each substance in the box in the correct column according to its state. The drawings will help you sometimes.**

air / alcohol / C / Ca / CO_2 / cream / sugar / Cu / gasoline / H / lotion / milk powder / N / O_2 / perfume/ wood

Solid	Liquid	Gas
ice	water	water vapor

C. **Complete each sentence about change of state. Use the words in the box.**

condensation / crystals / dissolves / evaporates / gases / ice / liquid / solid / steam / sublimation

1. If you freeze water, it turns to _____.
2. If you heat water, some of the water _____.
3. Sometimes water, which is a liquid, changes to hydrogen and oxygen, which are _____.
4. If you boil water, some of it becomes _____.
5. In most cases, when you cool a gas it becomes a _____.
6. This process is called _____.
7. In some cases a gas changes to a _____ without going through the liquid stage.
8. This process is called _____.
9. Sugar _____ when you mix it with water.
10. As the water evaporates from the sugar solution, sugar _____ form.

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Section 2 Reading

An experiment

Aim

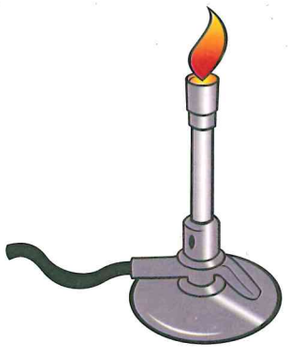
To discover whether temperature affects the speed at which sugar dissolves in water.

Hypothesis

Sugar dissolves more quickly in hot water than in cold water.

Apparatus and substances

- 5 measuring flasks
- a stopwatch
- sugar crystals
- water
- a thermometer
- a Bunsen burner
- a spoon



Water temperature (in °C)	Time to dissolve (in secs)
20	52
30	41
40	19
50	15
60	7

Table 1: Time for sugar to dissolve at different temperatures

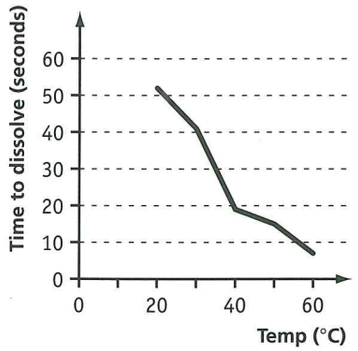


Figure 1: Temperature vs time to dissolve

Method

Water at 20°C was poured into one measuring flask to the 200 ml level. Water was heated to 30°C and poured into another measuring flask to the same level. The process was repeated with water at other temperatures. One spoonful of sugar was added to the water in each flask. The mixture in each flask was stirred once. A stopwatch was used to measure the time required for the sugar to dissolve fully in each flask. The results were recorded and are shown in Table 1. They were displayed as a line graph (Figure 1).

Conclusion

Sugar dissolves more quickly in hot water than in cold water. The hotter the water, the more quickly the sugar dissolves.

A. Choose the best answer in each case.

1. *Aim* means:
   a. where you are going
   b. how you did the experiment
   c. what you proved
   d. what you want to check
2. *Hypothesis* means:
   a. what you wanted to do
   b. what you used
   c. what you think is true
   d. what you proved
3. What does the graph show?
   a. The temperature is directly proportional to the time.
   b. The temperature is inversely proportional to the time.
   c. The higher the temperature is, the longer the time it takes.
   d. As the temperature falls, it takes less time.

4. Which statement is true?
   a. Sugar crystals are the only substance used in the experiment.
   b. The apparatus in this experiment includes a beaker.
   c. The hypothesis was rejected.
   d. The hypothesis was verified.
5. Approximately how long will a spoonful of sugar take to dissolve in water at 70°C?
   a. 20 seconds
   b. 10 seconds
   c. between 7 and 10 seconds
   d. less than 7 seconds

B. Study the table. Compare the formal and informal sentences.

Formal English	Informal English (with phrasal verbs)
The aim was to **discover** whether temperature affects the speed.	I wanted to **find out** if temperature makes any difference to the speed.
Sugar **was added** to each flask.	I **put** sugar **into** each flask.
The results **were recorded**.	I **took down** the results.
The results **were displayed** as a line graph.	I **turned** the results **into** a line graph.

C. Match each formal sentence with an informal equivalent.

1. The mixture emitted a gas.
2. The liquid became a gas.
3. The gas extinguished the flame.
4. The gas exploded.
5. The solid disintegrated.

a. It blew up.
b. It fell apart.
c. It gave off a gas.
d. It put out the flame.
e. It turned into a gas.

CD 1-46

Section 3 *Listening*

A. Listen and complete the summary of the reading text in Section 2. Write one word in each space.

In this _____, one spoonful of sugar was added to five measuring flasks. Each flask contained 200 ml of _____ but the water was at five different _____. The _____ was stirred once in each case. The results proved the _____ – that sugar dissolves more quickly in hot water than in cold water.

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B. Listen to the conversation in an oil refinery. Circle the correct word or phrase in each case.

1. The people are talking about
   fractions / condensation / fractional distillation / evaporation
2. Crude oil enters the cylinder at
   400°C / 300°C / 200°C / 50° C
3. One of the last products to condense out is
   diesel / petroleum / jet fuel / crude oil

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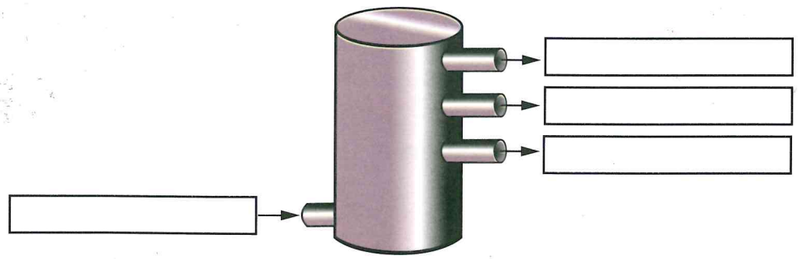
C. Listen again. Label the diagram with suitable words.



Distillation cylinder