# 16 Materials

## 16.1

**(a)** Anything which occupies space and has mass is called _____.

**(b)** Gases have neither a definite _____ nor a definite _____.

**(c)** A certain volume of gas may be squeezed into a smaller volume, i.e. the gas may be _____

**(d)** Liquids are very difficult to compress. This is an important factor in how car brakes work. What do you think might happen when you press the brake pedal if brake fluid could be compressed?

_____

**(e)** Describe an experiment to show that a gas has mass.

_____

_____

_____

## 16.2

A beaker which is full of water is inverted over a dish as shown in Figure 16.1(a). An empty beaker is then lowered into the water and under the first beaker as shown in Figure 16.1(b). Explain why the level of water drops in the first beaker.

_____

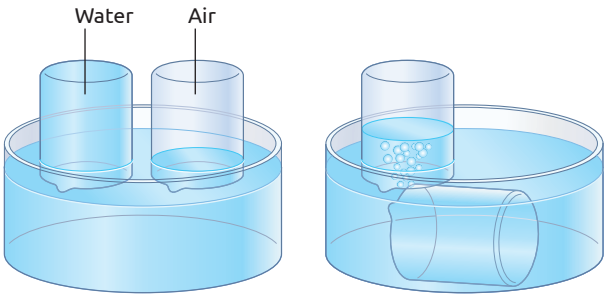



Figure 16.1(a)

Figure 16.1(b)

## 16.3

**(a)** In a sample of gas the particles are much further apart than the particles in a _____ or _____. This means that there is more room for them to be squeezed closer together, i.e. the gas can be _____ .

**(b)** In the _____ state the particles are closest together. In the _____ state the particles are moving fastest and are far apart from each other.

**(c)** The particles in a solid are packed tightly together. Therefore, solids have a definite _____.

## 16.4

**(a)** Use the particle theory to explain:

**(i)** Why it is difficult to compress solids. _____

_____

**(ii)** How water freezes. _____

_____

**(iii)** How steam condenses. _____

_____

**(b)** Draw diagrams to illustrate your answer.

## 16.5

A student drew a diagram (Figure 16.2) to represent an experiment that a teacher had demonstrated in class. The teacher used a can of air freshener to demonstrate a certain property of one of the states of matter. What property was the teacher demonstrating?

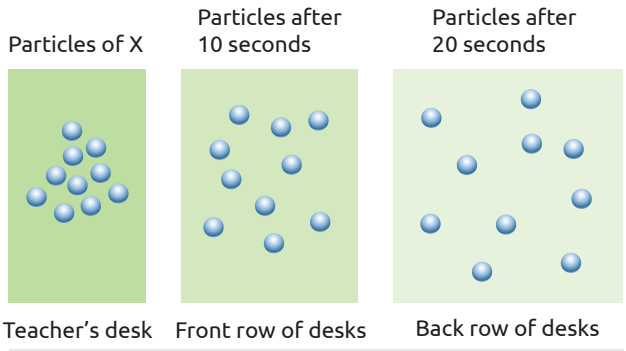



**Figure 16.2**

## 16.6

Give a scientific explanation for the following observations:

**(a)** On a cold day a mist often appears on a person's spectacles when they enter a warm room.

**(b)** Butter spreads more easily if it is warmed slightly.

**(c)** Ice cubes added to a glass of lemonade gradually disappear.

**(d)** On a warm day puddles of water on a road gradually disappear.

## 16.7

Define the following terms:

Evaporation _____

Melting point _____

Boiling point _____

## 16.8

The melting and boiling points of some substances are given in Table 16.1.

| Substance | Melting point (°C) | Boiling point (°C) |
|---|---|---|
| **Water** | 0 | 100 |
| **Aluminium** | 660 | 2,470 |
| **Ether** | −116 | 35 |
| **Alcohol (ethanol)** | −117 | 78 |
| **Tungsten** | 3,410 | 5,930 |

**Table 16.1**

**(a)** At what temperature will water turn into steam? _____

**(b)** At what temperature will aluminium metal turn into a liquid? _____

**(c)** At what temperature will ether change from a liquid to a gas? _____

**(d)** At what temperature will alcohol change from a liquid to a solid? _____

**(e)** Tungsten was the metal used in the filaments of electric light bulbs. Give one reason why it was particularly suitable for this purpose.

_____

## 16.9

The three states of matter are **solid**, **liquid** and **gas**. Figure 16.3 shows the arrangement of particles in the three states of matter. In Figure 16.3, write the letter **L** beside the arrangement of particles in a **liquid**. Write the letter **G** beside the arrangement of particles in a **gas**.

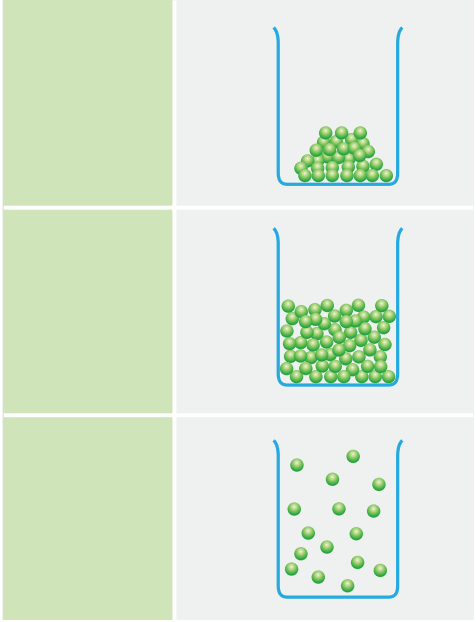


Figure 16.3

## 16.10

Water exists in the three states of **solid**, **liquid** and **gas**. In Figure 16.4, write **S** opposite the solid.

What word describes the change of state from a solid to a liquid?

_____

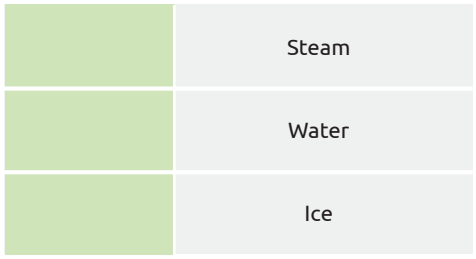



Figure 16.4

## 16.11

**(a)** Complete this sentence: When iron is heated to 1540 °C, it _____,
i.e. it changes into a liquid. This means that it can be poured into moulds.

**(b)** Define the melting point of a solid. _____

_____

**(c)** What do you call the changing of a liquid to a vapour? _____

**(d)** Complete this sentence: When evaporation begins to occur throughout the liquid,
the _____ of the liquid has been reached.

## 16.12

The three states of matter are **solid**, **liquid** and **gas**.

Figure 16.5 shows the arrangement of particles in the three states of matter.

**(a)** In the diagram, write the letter **S** beside the arrangement of articles in a **solid**.

**(b)** Write the letter **G** beside the arrangement of particles in a **gas**.

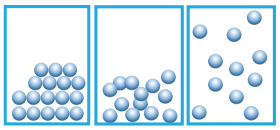


**Figure 16.5**

## 16.13

The three states of matter are **solid**, **liquid** and **gas**. Figure 16.6 shows how the arrangement of particles in the states of matter changes as they are heated.

**(a)** In the diagram, write the letter **M** beside the illustration that shows **melting**.

**(b)** Write the letter **B** beside the illustration that shows **boiling (evaporation)**.

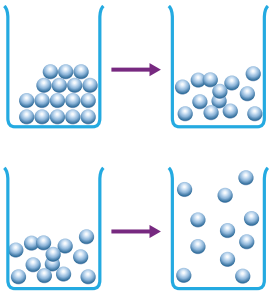


**Figure 16.6**

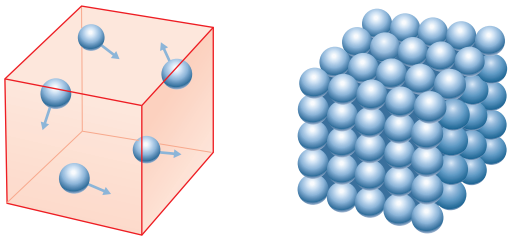
## 16.14

Study Figure 16.7 carefully. It shows the ways in which the particles of gases and solids occupy space.

The particles of a gas have lots of space and move randomly at high speeds in three dimensions and collide with each other and with their container.

The particles of a solid are packed closely together and cannot move around but they can vibrate.

Give one property of a gas and one property of a solid that you have observed and that is consistent with (matches) the particle theory of these states of matter.



Particles of a gas  Particles of a solid

**Figure 16.7**

**Gas** _____

**Solid** _____

## Multiple Choice questions on this chapter

**1** Seán blows into an inverted glass as shown in Figure 16.8. This experiment shows that:

**(a)** The gas blown into the water dissolves in the water.

**(b)** The gas blown into the water can occupy a certain volume.

**(c)** The gas blown into the water has no mass.

**(d)** The gas blown into the water does not displace any water.

Answer: _____

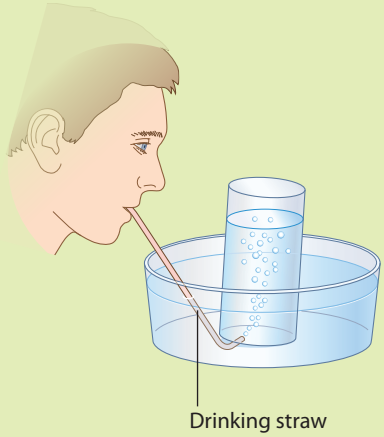



Figure 16.8

**2** Which of the following is **not** a property of solids?

**(a)** Solids have a definite shape.

**(b)** Solids have a definite volume.

**(c)** Solids are difficult to compress.

**(d)** Solids flow.

Answer: _____

**3** Which of the following is **not** a property of gases?

**(a)** Gases have no definite shape.

**(b)** Gases have a definite volume.

**(c)** Gases undergo diffusion.

**(d)** Gases can be compressed.

Answer: _____

**4** Which of the diagrams in Figure 16.9 best represents matter in the liquid state?

**(a)** Diagram 1 **(c)** Diagram 3

**(b)** Diagram 2 **(d)** Diagram 4

Answer: _____

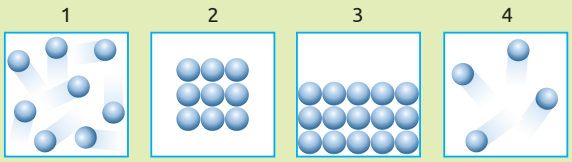



Figure 16.9

**5** When water boils, the bubbles of gas that form inside the liquid are made from:

**(a)** Air **(c)** Oxygen gas

**(b)** Water vapour **(d)** A vacuum

Answer: _____

**6** Which row in Table 16.2 contains an error?

**(a)** Row 1 **(c)** Row 3

**(b)** Row 2 **(d)** Row 4

Answer: _____

| Row no. | Statement |
|---|---|
| 1 | Evaporation is the changing of a liquid to a gas. |
| 2 | The melting point is the temperature at which a solid changes to a liquid. |
| 3 | The boiling point of a liquid is the temperature at which a liquid changes to a gas at the surface of the liquid. |
| 4 | Condensation is the changing of a gas to a liquid. |

Table 16.2

7 Ciara spilled a bottle of nail varnish remover on her arm. Which of the following did she notice?

**(a)** The area on which the liquid spilled felt warmer.

**(b)** The area on which the liquid spilled felt colder.

**(c)** The area on which the liquid spilled remained wet.

**(d)** None of the above was observed.

Answer: _____

8 Two balloons containing air are hung on a metre stick so that it is balanced as shown in Figure 16.10. The air is released from the balloon on the right of the diagram. What will be observed?

**(a)** The metre stick will tilt to the left.

**(b)** The metre stick will tilt to the right.

**(c)** The string on which the metre stick is suspended will break.

**(d)** The metre stick will stay as it is.

Answer: _____

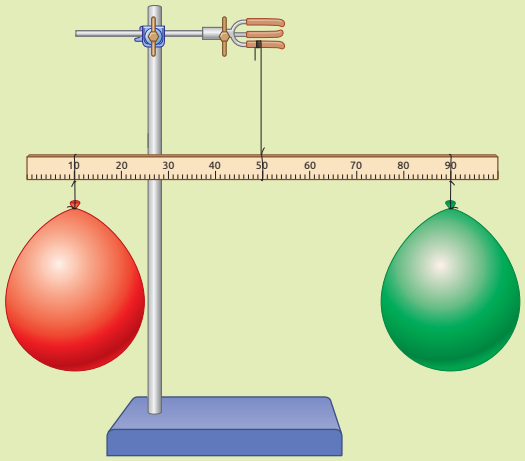



**Figure 16.10**

Acknowledgements
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