Answers Matter

Year 8 Science Chapter 5

p105

1 **Matter** is anything that has mass and takes up space.

2 Solids, liquids, and gases are called the **three states of matter**. Water can exist as ice (solid), water (liquid), and water vapour (gas).

3 Indicate whether you can usually change the volume of each of the following states of matter:

a) The **volume** of solids is usually hard to change.

b) The **volume** of liquids is usually hard to change.

c) The **volume** of gases can be changed.

4 Indicate whether you can usually change the shape of each of the following states of matter:

a) The **shape** and of solids is usually hard to change.

b) The **shape** of liquids can be changed.

c) The **shape** of gases can be changed.

p107

1 **Density** is defined as the ratio of mass to volume (Mass divided by volume).

2 1 kg of gold has the same mass as 1 kg of feathers. 1 kg of gold has a smaller volume than 1 kg of feathers.

3 Water has a density of 1 g/cm^3. An object has a density of 2.6 g/cm^3. The object will sink in water because it is denser than water.

4 Calculate the density of an object that has a mass of 628 grams and a volume of 391 cm^3.

$$Density = \frac{m}{V} = \frac{628g}{391cm^3} = 1.61g/cm^3$$

5 Calculate the density of an object that has a mass of 272 grams and a volume of 347 cm^3.

$$Density = \frac{m}{V} = \frac{272g}{347cm^3} = 0.78g/cm^3$$

6 Calculate the density of an object that has a mass of 561 grams and increases the water level from 350 mL to 476 mL.

$$Density = \frac{m}{V} = \frac{561g}{(476-350)cm^3} = \frac{561g}{126cm^3} = 4.45g/cm^3$$

7 Calculate the density of an object that has a mass of 4.6 kg and a volume of 8.2 L.

$$Density = \frac{m}{V} = \frac{4600g}{8200cm^3} = 0.56g/cm^3$$

p111

1 Use the particle model to describe each of the following states of matter:

a) Particles of a solid are: Tightly packed together in a regular pattern due to forces of attraction, unable to move freely, vibrate.

b) Particles of a liquid are not tightly packed together in a regular pattern, vibrate and move.

c) Particles of a gas: Have larger space, move freely, vibrate, move, and rotate.

2 The particles in a liquid be made to move faster by give them more energy. For example, more energy can be given to particles by heating.

3 The heating of a solid adds energy to the particles and they vibrate faster and faster. At the melting point, the particles vibrate fast enough to overcome the force of attraction holding the particles in their position.

4 The melting point of gold (1064°C) is higher than the melting point of water (100°C) because the forces of attraction between the particles of gold are much stronger than water and need more energy to overcome..

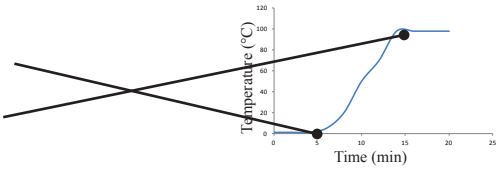
5 The heating of a liquid adds energy to the particles and they bounce against each other, and the container, faster and further - the liquid expands. At the boiling point the particles have enough energy to break free of the forces holding the particles in the liquid.

6 The cooling of a liquid removes energy from the particles and they vibrate slower and slower. At the melting point, the particles vibrate slow enough so that the force of attraction between the particles is able to hold the particles in position as the liquid freezes to a solid.

7 If the particles of a gas slow down the the forces of attraction between the particles may be sufficient to restrain them to the properties of a liquid.

8 **a)** Which part of the graph shows a change of state from solid to liquid?

b) Which part of the graph shows a change of state from liquid to gas?



p113

1 As a solid, liquid, or gas is **heated** the particles have more energy and move more violently against each other. This causes the solid, liquid, or gas to **expand**.

2 Two everyday examples of the expansion of a:

a) solid. Bridges and railway lines have gaps to allow the expansion during warmer weather.

b) liquid. Many thermometers indicate the temperature by the expansion of a liquid. The global ocean currents are cause by the expansion of warmer water.

c) gas. Hot air balloons rise due to the expansion of heated air. An air bed will expand if left in the Sun.

3 As a solid, liquid, or gas is **cooled** the particles have less energy and slow their movements against each other. This causes the solid, liquid, or gas to **contract**.

4 Can you provide two everyday examples of the contraction of a:

a) solid. Contracting timber in the roof of a house makes noises at night. Metal parts are fitted together when hot and contract when cooled to make a tight fitting.

b) liquid. When most liquids are cooled they contract and become steadily more and more dense. Oceans contract in size as they cool.

c) gas. Many jars have a cap put on while hot. The cooling contracting air in the jar sucks the lid onto the jar. Balloons contract in size when the balloon is cooled. A cooled soccer ball contracts in size.

5 A clinical thermometer used for measuring human body temperature. Body heat, increasing the energy and movement of mercury particles, expands the mercury in the bulb up through a thin tube magnified by the glass.

6 Heating the air in a hot air balloon, increasing the energy and movement of the air particles, causes the air to expand. The density of the air in the balloon is less than the outside air and the balloon rises

7 Sometimes a solid will change directly to a gas (no liquid state). This is called sublimation. Solid carbon dioxide (dry ice) changes to a gas with no liquid state.

8 Dry ice is preferred to water ice in producing fog for a stage because the dry ice doesn't have waste products in the form of a liquid.

9 A hot air balloon heats air to go higher. The balloon is made to go lower by reducing the amount of air

p114

1 Heat pumps are able to absorb heat energy from the cooler surroundings to provide hot water.

2 Heat pumps use heat sources that are colder than the area/substance to be heated.

3 Heat pumps are typically cheaper to run than conventional devices such as hot water systems, air conditioners etc.

4 Two other possible sources of heat for heat pumps are outside water, and the ground.

5 A heat pump still be able to provide hot water if the outside air was -10°C because the refrigerant would be able to function above its boiling point (-26°C).

p115

1 The Sun's energy is the primary source of energy for life on Earth. It is also our primary source of renewable energy.

2 he Sun's nuclear fusion is a nuclear reaction in which two atoms of hydrogen collide at very high speed to form helium and massive amounts of energy released.

3 Hydrogen atoms that fuse together to produce energy in the Sun.

4 The symbol for hydrogen is H.

5 The symbol for helium is He.

p118

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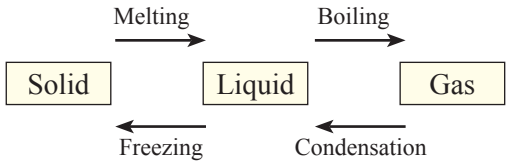
5 **a)** A gas takes the shape of the container that it is in and doesn't have a fixed volume.
- **b)** A solid has a fixed volume and a fixed shape.
- **c)** A liquid has a fixed volume and takes the shape of the container that it is in.

6



p119

1 **Density** is defined as the ratio of mass to volume (Mass divided by volume).

2 1 kg of gold has the same mass as 1 kg of feathers. 1 kg of gold has a smaller volume than 1 kg of feathers.

3 Water has a density of 1 g/cm^3.

4 An object has a density of 1.3 g/cm^3. The object will sink in water because it is denser than water.

5 An object has a density of 0.7 g/cm^3. The object will float in water because it is less dense than water.

6 When a solid, liquid, or gas is heated, its density will likely decrease.

7 When a solid, liquid, or gas is cooled, its density will likely increase.

p119

8 A balloon of hydrogen will rise faster than a similar balloon of helium because hydrogen has a lower density than helium.

9 An egg will sink in fresh water but float in salt water because the density of an egg is between the density of fresh water and the density of salt water.

10 Calculate the density of an object that has a mass of 562 grams and a volume of 387 cm^3.

$$Density = \frac{m}{V} = \frac{562g}{387cm^3} = 1.45g / cm^3$$

11 Calculate the density of an object that has a mass of 106 grams and a volume of 120 cm^3.

$$Density = \frac{m}{V} = \frac{106g}{120cm^3} = 0.88g / cm^3$$

12 Calculate the density of an object that has a mass of 365 grams and increases the water level from 328 mL to 493 mL.

$$Density = \frac{m}{V} = \frac{365g}{(493-328)cm^3} = \frac{365g}{165cm^3} = 2.21g / cm^3$$

13 Calculate the density of an object that has a mass of 7.2 kg and a volume of 4.7 L.

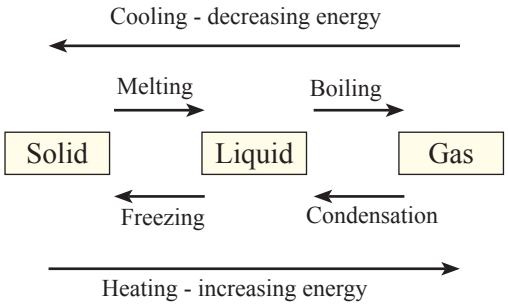
$$Density = \frac{m}{V} = \frac{7200g}{4700cm^3} = 1.53g / cm^3$$

14 Calculate the density of an object that has a mass of 9.7 kg and a volume of 1.2 L.

$$Density = \frac{m}{V} = \frac{9700g}{1200cm^3} = 8.08g / cm^3$$

p120

1



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p120

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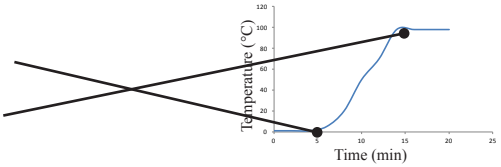

p121

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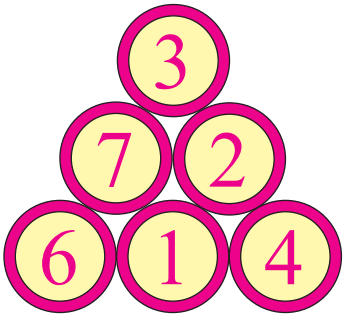

2

13	6	11
8	10	12
9	14	7

3a) 26 **3b)** 38

p122

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7 A hot air balloon heats air to go higher. The balloon is made to go lower by reducing the amount of air in the balloon.

8 **a)** A solid - the particles vibrate only
b) A liquid or a gas - the particles take the shape of their container and have enough energy to move past each other.
c) A liquid - the particles are held together but the occasional particle has enough energy to break free and move out into the air (evaporation).
d) A solid - the particles have enough energy to vibrate, move, and rotate.

9 Sometimes a solid will change directly to a gas (no liquid state). This is called sublimation. Solid carbon dioxide (dry ice) changes to a gas with no liquid state.

10 Dry ice is preferred to water ice in producing fog for a stage because the dry ice doesn't have waste products in the form of a liquid.

p123

1 d) **2** b) **3** b) **4** d)

p124

1 Dry ice is frozen carbon dioxide which, when warmed, sublimes into carbon dioxide gas.
A piece of dry ice is put inside a balloon and then sealed. It is then noticed that the dry ice disappears while the balloon becomes larger. The dry ice particles absorb energy from the warmer surroundings. The higher energy particles escape from the forces of attraction of the dry ice and begin roaming freely within the balloon. The high energy gass particles begin colliding on the wall of the balloon causing it to begin expanding.

2 Diffusion happens when particles such as perfume or burnt toast mix with the air particles and spread throughout a room. Diffusion (spreading) happens faster with gases than with liquids because the gas particles have higher energy and spread rapidly throughout other gaseous particles. The particles of a liquid have less energy and are still constrained by the force of attraction between particles. Diffusion with liquids thus happens more slowly than with gases.

3 b)

4 When 100 mL of alcohol is added to 100 mL of water, the total volume is less than 200 mL because alcohol particles move into some of the space between water particles. Thus the total volume is less .

5 Ethanol is a liquid at 0°C.

6 Use the particle model to explain each of the following phenomena:

a) A windy day allows clothes to dry faster because the wind removes water particles allowing room for other water particles to escape from the water liquid..

b) Water condenses on the outside of a glass of cold water because the cold glass absorbs energy from the nearby water vapour particles causing them to be overcome by attraction between particles thus forming liquid water..

c) Breathing warm water vapour onto cool glasses can reduce the energy of the water vapour particles to be absorbed by the glasses. The lower energy water particles can then become liquid causing the glasses to fog up.

7 a)

8 Gold has a density of 19.3 g/cm^3. What would be the mass of the gold that would fill a 250 cm^3 cup?
mass = density × volume = 19.3 g/cm^3 × 250 cm^3 = 4825 g = 4.8 kg

9 A block of wood has the dimensions 10 cm 6 cm 12 cm. It has a mass of 940 grams.

a) What is the density of the wood?

$$Density = \frac{m}{V} = \frac{940g}{10 \times 6 \times 12cm^3} = 1.31g / cm^3$$

b) This block of wood would not float in water because its density is greater than 1 g/cm^3.