

member and understand

What are the three common states of matter?

Select one word to replace each phrase.

The spreading out of a substance, such as a dye or smell.

The ability of one substance to scratch another substance.

The ratio of the mass divided by the volume.

Which of the three major states of matter do the particles have the most energy? Explain your reasoning.

What is the difference between the physical and chemical properties of a substance?

What is the difference between mass and matter?

What is the correct word or words for the following descriptions?

A group of atoms chemically bonded together.

A three-dimensional arrangement of particles in rows, columns and layers.

Where energy breaks apart a compound into simpler substances or elements.

- d A feature of a substance that you can observe and measure without destroying or changing the substance.

Apply and analyse

- 7 When you are boiling water, the volume the water is reduced as it evaporates. Does this mean that the density of water changes?
- 8 Use the kinetic theory of matter to explain why the pressure inside car tyres will increase on a hot day.
- 9 If you heated a newly discovered substance and it decomposed into two new substances, was the original substance an element or a compound? Give reasons for your answer.
- 10 When you breathe out on a cold morning, your breath appears white and foggy. This only occurs when it is very cold. What is the white fog that you see?

Evaluate and create

- 11 Many people have ideas they think will explain observations and events in science. For an idea to become a theory, it must be able to explain a range of observations. The idea must also be supported by evidence and/or observations.

- a Can you suggest what evidence would have been required to support the idea that all substances are made of atoms?
- b It is found that a substance cannot be broken down into a more simple substance. How could you use the kinetic theory of matter to explain this observation?

- 12 Elements only contain one type of atom, whereas compounds contain a combination of different atoms. This difference in structure can explain some of the behaviours of elements and compounds. By referring to the arrangement of atoms, explain the following statements.

- a When an electric current is passed through water, it is possible to produce hydrogen gas and oxygen gas.
- b Early chemists, called alchemists, tried to turn lead and other metals into gold, but none of them succeeded.
- c When limestone, which is made of the compound calcium carbonate (CaCO_3), is heated strongly, carbon dioxide gas is produced. However, when iron is heated, no new substance is created.

- 13 You should now realise that the structure and properties of a substance can be explained by the particles that make up the substance. Explain the following observations by referring to the arrangement and/or the movement of the particles within the substance. You can use labelled diagrams to improve your answers.

- a Water left in an open bottle will gradually evaporate and, if the temperature of the water increases, the water will evaporate more quickly.
- b Mercury is a unique substance because it is the only metal that is liquid at room temperature, and it even gives off a vapour (which makes it very dangerous because this vapour can be breathed into our lungs).
- c Polythene can be produced in two different forms, high-density polythene (HDPE) or low-density

polythene (LDPE). If the particles in both HDPE and LDPE are the same, suggest how the structure of the two substances would be different.

- d When you heat a piece of polythene it will melt. While it is liquid, it can be formed into a different shape and when it cools the polythene will stay in this new shape.
- e We can see steam, but we cannot see water vapour.

Research

- 14 Choose one of the following topics for a research project. Present your research in a format of your own choosing, giving careful consideration to the information you are presenting.

> State of the matter

The changes between the states of matter have many uses. Research some of these uses and their impact on our society. Some ideas are how refrigeration and air conditioning work; making moulds and casts, such as chocolate, iron and aluminium castings; obtaining medical-grade oxygen and nitrogen from the air; how the energy changes that occur during evaporation of water and the subsequent condensation of water vapour into rain affect thunderstorms and cyclones.

> People matter

The discovery of air pressure is a long and interesting story. Research the background of Evangelista Torricelli, Blaise Pascal and Otto von Guericke. For example, Otto von Guericke built a large water thermometer in the front of his house and made the Magdeburg hemispheres. Two opposing teams of eight horses, working like a tug-of-war, could not pull the hemispheres apart.

