

Answers to worksheet questions

Chapter 2

Worksheet 2.1

- 1 a A = gas; B = liquid; C = solid; D = increasing; E = sublimation
b A change in pressure can bring about a change in state.
- 2 a sugar
b alcohol
c chalk

Worksheet 2.2

- 1 a i filtration
ii the residue
iii the filtrate
b Stir the mixture of salt and sand in hot water.
Filter the hot solution through the filter paper, collecting the salt solution in the conical flask and the sand on the filter paper.
c Heat the solution in an evaporating dish to evaporate off most of the water and concentrate the solution.
Cool the solution slowly to allow crystals to form.
Filter off the crystals and dry them between filter papers.
- 2 All substances are made from *atoms*. There are over 90 *different* kinds of atom. A substance made from only one kind of atom is called an *element*.
A substance made from two or more different types of atoms chemically bonded together is called a *compound*.
- 3 a The water molecules in steam are far apart and moving very fast.
At temperatures above 100 °C, if the molecules collide, they simply bounce apart again.
As the steam cools, the particles slow down.
At or below 100 °C, the particles stick together if they collide.
Clumps of particles stick together and collect, forming liquid water droplets.
The steam condenses.
- b i distillation
ii to measure the boiling point of the liquid distilling over
iii to cool down the vapour in the condenser and cause it to condense to a liquid

Worksheet 2.3

- 1 Everything is made up of tiny *particles*. In *solids* and liquids, these particles are close together, so solids and liquids cannot be *compressed*. In *gases*, these particles are far apart and moving *randomly*. When a gas is compressed, the particles are pushed *closer* together.

- 2** a A = liquid; B = gas; C = solid
 b i solid
 ii gas
 iii solid
 iv liquid and gas
 v gas
- 3** a In solid ice, the particles are vibrating about fixed positions.
 As ice is heated, the particles vibrate faster and faster about their positions.
 At 0°C, the particles are vibrating fast enough to start breaking the forces that hold them together.
 The ice melts.
- b The forces between particles in sulfur are stronger than those between the particles in water. The temperature needs to be higher before the particles have sufficient energy to overcome the attractive forces between them.
- c The forces between the particles in the alcohol vapour are weaker than between the water particles. The temperature needs to fall to a lower value before the alcohol particles have low enough energy for the forces to be strong enough to cause the alcohol particles to condense together.
- d Water particles surround the salt crystal.
 Water particles are attracted to the salt particles in the crystal and surround the salt particles.
 Some of the surrounded outer salt particles break free from the crystal.
 The salt and water particles diffuse away, allowing more salt particles from the next layer to be freed, and so on.

Worksheet 2.4

- 1** a Atoms of the same element have the same number of *protons* / *neutrons*. The number of *protons* / *neutrons* in an atom is called its *proton* / *mass* number. The number of protons plus the number of *electrons* / *neutrons* in an atom gives the *atomic* / *nucleon* number. As an atom is neutral, the number of negative *electrons* / *neutrons* in an atom is always the same as the number of positive protons in the nucleus.
- b The *electrons* in an atom are not free to move where they like. They can only occur at fixed distances from the nucleus in electron *shells* (or *energy* levels).
 The first shell, *closest* to the nucleus, can only take two electrons, while the second shell can take up to *eight* electrons.

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	Proton number (atomic number)	Nucleon number (mass number)
a	2	4
b	9	19
c	26	56
d	92	232

3 a

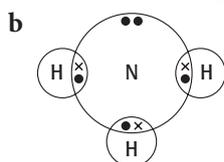
Element	Protons	Neutrons	Electrons	Nucleon number
Li	3	4	3	7
Na	11	12	11	23
P	15	16	15	31
Pb	82	125	82	207

- b i They have the same proton number (17).
- ii They have different numbers of neutrons in their nuclei (18 and 20).
- iii $^{14}_6\text{X}$ is an isotope of carbon (C), as the proton number (atomic number) is the same.

- 4 a A is helium; B is argon; C is neon
 b These electron arrangements are particularly stable.

Worksheet 2.5

- 1 a covalent bonding



ammonia molecule

- c there are only weak forces between the molecules so it does not require a great amount of energy to overcome them and for the molecules to move apart
- 2 a the molecules of HCl and NH_3 spread out (diffuse) in the tube and move towards each other / the smoke ring forms where the molecules meet and react
 b the molecules of ammonia are lighter than those of HCl and so they move (diffuse) faster / so the ring is nearer the HCl end of the tube
 c ammonium chloride
 ammonia + hydrogen chloride \rightarrow ammonium chloride
 $\text{NH}_3(\text{g}) + \text{HCl}(\text{g}) \rightarrow \text{NH}_4\text{Cl}(\text{s})$
- 3 a The smoke particles seem to be moving randomly because they collide with the unseen gas molecules of the air / these collisions cause them to change direction / their movement appears jerky because they can be hit from any direction and the collisions occur randomly.
 b diffusion
 c In a solid, the particles are held in fixed positions and can only vibrate about that fixed position.

Worksheet 2.6

- 1 all are soluble
- 2 all are soluble
- 3 all except the nitrate are insoluble
 a lead carbonate + sodium nitrate
 $\text{Pb}(\text{NO}_3)_2 + \text{Na}_2\text{CO}_3 \rightarrow \text{PbCO}_3 + 2\text{NaNO}_3$
 b no precipitate formed / no reaction
 c barium sulfate + sodium chloride
 $\text{Ba}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{BaSO}_4(\text{s})$
- 5 Barium sulfate is very insoluble – it is not absorbed into the bloodstream.