Q1. This question is about salts of ammonia and salts of lead.

(a) Ammonia dissolves in water to make an alkaline solution.

Draw a ring around the correct answer to complete each sentence.

The pH of a solution of ammonia is

2.
7.
11.

(1)

(b) Ammonia can be reacted with an acid to produce the salt ammonium nitrate.

(i) Name the acid used to produce ammonium nitrate.

.....

(1)

(ii) Draw a ring around the correct answer to complete each sentence.

The reaction of ammonia with an acid is a

neutralisation
polymerisation
reduction

reaction.

(1)

(c) Why do farmers use ammonium nitrate on their fields?

.....

.....

(1)

(d) Lead iodide is a salt that can be produced without using an acid.

(i) Lead iodide is produced by mixing two solutions.

Complete the word equation.

lead ..... + potassium ..... $\longrightarrow$ lead iodide + potassium nitrate

(2)

(ii) The lead iodide is produced as a solid.

Complete the sentence.

A solid that is produced when two solutions are mixed is called a..... .

(1)

(iii) How could the solid lead iodide be separated from the solution?

.....

(1)

(iv) A student mixed two solutions to make sodium chloride.

The equation for the reaction the student used is:

$$HCl(aq) + NaOH(aq) \longrightarrow NaCl(aq) + H_2O(l)$$

How could the student obtain solid sodium chloride from the solution?

.....

(1)

(Total 9 marks)

Q2. This question is about lithium and sodium.

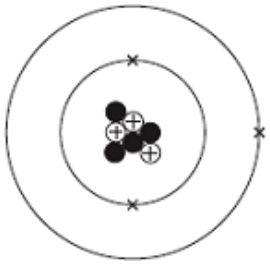
(a) Use the Chemistry Data Sheet to help you to answer this question.

In which group of the periodic table are lithium and sodium? Group ☐

(1)

(b) A lithium atom can be represented as $^{7}_{3}Li$

The diagram represents the lithium atom.



(i) Some particles in the nucleus have a positive charge.

What is the name of these particles? .....

(1)

(ii) Some particles in the nucleus have no charge.

What is the name of these particles? .....

(1)

(iii) Use the correct answer from the box to complete the sentence.

3	**4**	**7**

The mass number of this atom of lithium is ☐

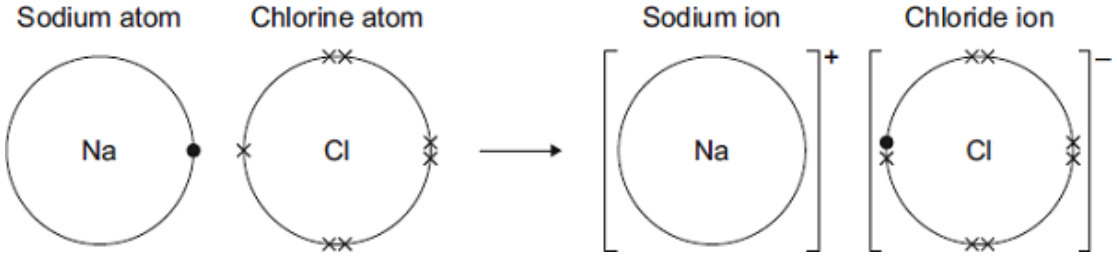
(1)

(c) Sodium reacts with chlorine to produce sodium chloride.

sodium + chlorine ⟶ sodium chloride

The diagram shows how the reaction happens.

Only the outer electrons are shown.



Draw a ring around the correct answer to complete each sentence.

(i) A sodium atom changes into a sodium ion by [gaining / losing / sharing] an electron.

(1)

(ii) A sodium ion has [a negative / no / a positive] charge.

(1)

(iii) The ions in sodium chloride are held together by strong [covalent / electrostatic / magnetic] forces.

(1)

(d) Sodium chloride is an ionic compound.

Tick (✓) **two** properties of ionic compounds.

Property	Tick (✓)
Do **not** dissolve in water	
High melting points	
Low boiling points	
Strong bonds	

(2)

(e) (i) The formula of sodium chloride is NaCl

Calculate the relative formula mass of sodium chloride.

Relative atomic masses: Na = 23; Cl = 35.5

.....

.....

Relative formula mass = ...

(1)

(ii) Draw a ring around the correct answer to complete each sentence.

The relative formula mass of a substance, in grams, is one | ion / isotope / mole | of the substance.

(1)

(f) Nanoparticles of sodium chloride (salt) are used to flavour crisps.

What are nanoparticles?

.....

.....

(1)

(Total 12 marks)

Q3. Thermosoftening polymers can be used to make plastic bottles and food packaging.

(a) Why are thermosoftening polymers **not** suitable for storing very hot food?

.....

.....

(1)

(b) The reaction to produce the polymers uses a catalyst.

Why are catalysts used in chemical reactions?

.....

.....

(1)

(c) Compounds from food packaging must not get into food.

Gas chromatography can be used to separate compounds in food.

The output from the gas chromatography column can be linked to an instrument which can identify the compounds.

(i) Name the instrument used to identify the compounds.

.....

.....

(1)

(ii) Give **one** reason why instrumental methods of analysis are used to identify the compounds.

.....

.....

(1)

(d) Poly(ethene) is a thermosoftening polymer.

Poly(ethene) can be made with different properties. The properties depend on the conditions used when poly(ethene) is made.

Suggest **two** conditions which could be changed when poly(ethene) is made.

.....

.....

(2)

(Total 6 marks)

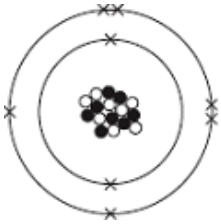
Q4. This question is about atoms and molecules.

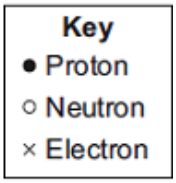
(a) Complete the table to show the relative masses of the particles in atoms.

Name of particle	Relative mass
Proton	.....
Neutron	1
Electron	.....

(2)

(b) The diagram shows an oxygen atom.





Use the correct number to complete each sentence.

8	16	18	24

The atomic (proton) number of the oxygen atom shown above is ..... .

The mass number of the oxygen atom shown above is ..... .

(2)

(c) (i) Draw a ring around the correct answer to complete each sentence.

Oxygen atoms with different numbers of neutrons are called

isotopes.

molecules.

polymers.

(1)

(ii) An oxygen atom with a different number of neutrons has 10 neutrons.

Draw a ring around the symbol which represents this atom.

$^{16}_{8}O$ $^{18}_{10}O$ $^{18}_{8}O$

(1)

(d) A water molecule contains hydrogen and oxygen atoms.

(i) Use the correct answer to complete the sentence.

a compound	an element	a mixture

Water is ..... .

(1)

(ii) Draw a ring around the correct structure of a water molecule.

H – O – H **O – H – H** **O – H – O**

(1)

(iii) Draw a ring around the type of bonding in a water molecule.

covalent **ionic** **metallic**

(1)

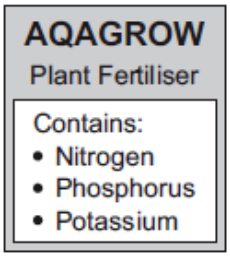
(iv) Draw a ring around the correct answer to complete each sentence.

The bonds in a water molecule are formed by | gaining | losing | sharing | electrons.

(1)

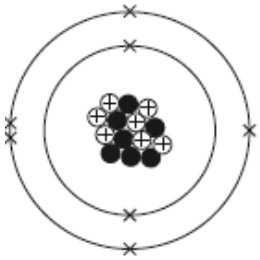
(Total 10 marks)

Q5. Fertilisers contain elements that plants need.



(a) **Figure 1** represents a nitrogen atom.

Figure 1



Complete each sentence.

(i) The mass number of this nitrogen atom is ..... .

(1)

(ii) Atoms of nitrogen with different numbers of neutrons are called ..... .

(1)

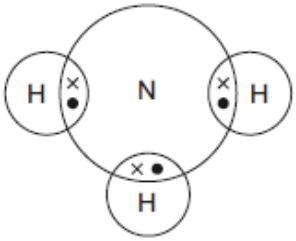
(iii) Compared with a proton, the mass of an electron is ..... .

(1)

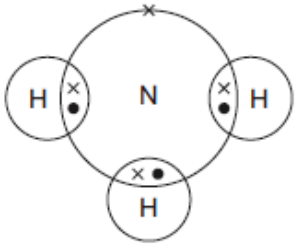
(b) Fertilisers can be made from ammonia.

(i) Which diagram, **A**, **B**, or **C**, represents the electronic structure of an ammonia molecule?

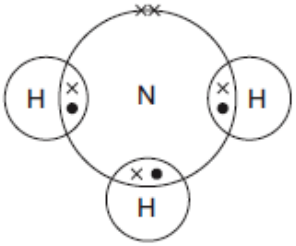
A



B



C



(1)

The electronic structure of an ammonia molecule is shown in diagram ☐

(ii) What is the correct formula of ammonia?

Draw a ring around the correct answer.

N_3H **NH_3** **NH^3**

(1)

(c) A student made ammonium nitrate by reacting ammonia solution with an acid.

(i) Name the acid used to make ammonium nitrate.

.....

(1)

(ii) Complete the sentence.

The student added a few drops of ....., which changed colour when the ammonia solution had neutralised the acid.

(1)

(iii) The student added charcoal and filtered the mixture.

This produced a colourless solution of ammonium nitrate.

How is solid ammonium nitrate obtained from the solution?

.....

(1)

(iv) A farmer put ammonium nitrate fertiliser onto a field of grass.

Suggest what would happen to the grass.

.....

.....

(1)

(d) Some fertilisers contain potassium chloride.

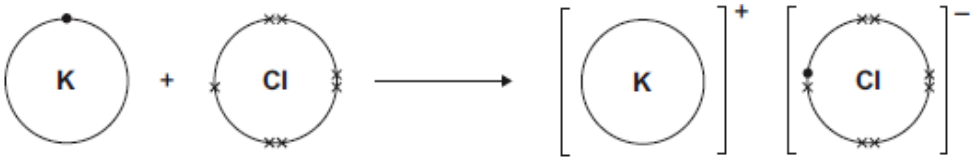
Potassium reacts with chlorine to produce potassium chloride.

Figure 2 shows how this happens.

The dots (•) and crosses (x) represent electrons.

Only the outer shell is shown.

Figure 2



Use **Figure 2** to help you answer this question.

Describe, as fully as you can, what happens when potassium reacts with chlorine to produce potassium chloride.

.....

.....

.....

.....

.....

.....

.....

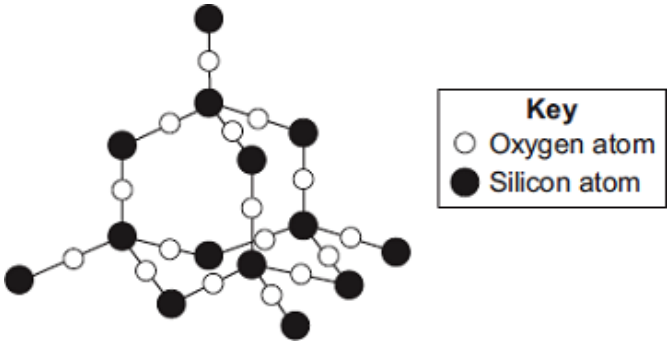
.....

.....

.....

(4)
(Total 13 marks)

Q6. The diagram shows a small part of the structure of silicon dioxide.



(a) Use the diagram above to answer the question.

Draw a ring around the correct answer to complete each sentence.

In silicon dioxide, each silicon atom is bonded with

two
three
four

oxygen atoms.

The bonds in silicon dioxide are

ionic.
covalent.
metallic.

(2)

(b)

© Oleksiy Mark/iStock

Silicon dioxide is used as the inside layer of furnaces.

Suggest why.

.....

.....

(1)

(c) Nanowires can be made from silicon dioxide.

Draw a ring around the correct answer to complete the sentence.

The word ‘nano’ means the wires are very

brittle.
thick.
thin.

(1)

(Total 4 marks)

Q7. This question is about diamonds.

Draw a ring around the correct answer to complete each sentence.

(a) Diamonds are found in meteorites.

(i) Meteorites get very hot when they pass through the Earth’s atmosphere, but the diamonds do not melt.

Diamond has a

high
low
very low

melting point.

(1)

(ii) Most diamonds found in meteorites are nanodiamonds.

A nanodiamond contains a few

hundred
thousand
million.

atoms

(1)

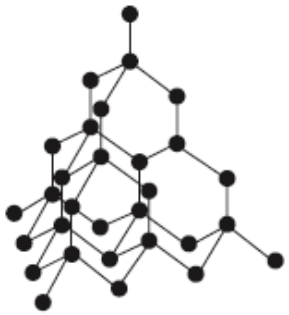
(b) Diamonds are used for the cutting end of drill bits.

Diamonds can be used for drill bits because they are

hard.
shiny.
soft.

(1)

(c) The figure below shows the arrangement of atoms in diamond.



(i) Diamond is made from carbon / nitrogen / oxygen atoms.

(1)

(ii) Each atom in diamond is bonded to three / four / five other atoms.

(1)

(iii) Diamond has a giant covalent / ionic / metallic structure.

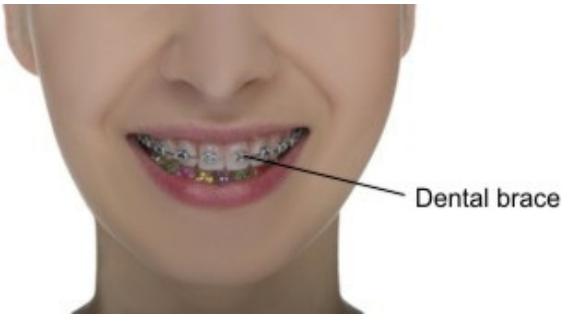
(1)

(iv) In diamond all / none / some of the atoms are bonded together.

(1)

(Total 7 marks)

Q8. Dental braces are made from nitinol wires. Nitinol is a mixture of metals.



/iStock/Thinkstock © Zametalov/iStock/Thinkstock

(a) Nitinol can return to its original shape after being deformed.

Draw a ring around the correct answer to complete the sentence.

Nitinol is a shape memory

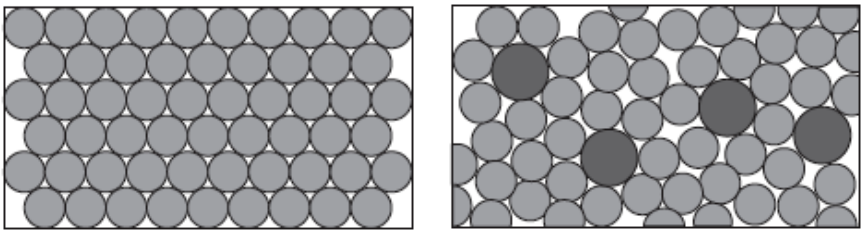
alloy.
catalyst.
polymer.

(1)

(b) **Figure 1** shows the arrangement of atoms in a pure metal and in a mixture of metals.

Figure 1

Pure metal **Mixture of metals**



The mixture of metals is harder than the pure metal.

Use **Figure 1** to explain why.

.....

.....

.....

.....

(2)

(c) Gold and stainless steel are also used for dental braces.

Suggest **two** factors to consider when choosing which metal to use for dental braces.

.....

.....

.....

.....

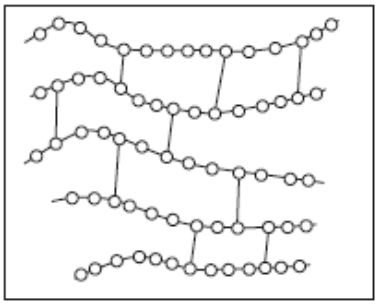
(2)

(d) A thermosetting polymer is used to hold dental braces on the teeth.

Figure 2 shows the structure of a thermosetting polymer.

Figure 2

Thermosetting polymer



How can you tell from **Figure 2** that the polymer is thermosetting?

.....

.....

(1)
(Total 6 marks)

M1. (a) 11

1

(b) (i) nitric

1

(ii) neutralisation

1

(c) fertiliser

accept helps plants grow
accept provide nitrogen

1

(d) (i) nitrate

1

iodide

1

must be in this order

(ii) precipitate

1

(iii) filtration / filtering

1

(iv) crystallisation

allow evaporation / heat / cooling
do not accept freezing
ignore "leave it" if unqualified

1

[9]

M2. (a) 1 / one

1

(b) (i) protons

1

(ii) neutrons

1

(iii) 7

1

(c) (i) losing

1

(ii) a positive

1

(iii) electrostatic

1

(d) high melting points

1

strong bonds

1

(e) (i) 58.5

1

(ii) mole

1

(f) very small (particles) **or**

ignore tiny / small / smaller / microscopic etc.

1-100nm in size **or**

(particle with a) few hundred atoms

1

[12]

M3. (a) would melt

accept they have a low melting point
allow lose their shape
ignore would soften when hot
ignore boiling point

1

(b) to speed up the reaction

accept can use a lower temperature
accept less energy needed

1

(c) (i) mass spectrometer

allow mass spectroscopy

1

(ii) any **one** from:

ignore reliable
ignore more precise

- accurate
- sensitive
- rapid / quicker
- small amount of sample

1

(d) any **two** from:

allow concentration

- pressure
- temperature
- catalyst **or** initiator
- solvent

2

[6]

M4. (a) proton 1

ignore ±

1

electron very small owtte

allow zero

allow values from 1 / 1800 to 1 / 2000 ***or*** *0.0005 – 0.00055*

1

(b) 8

1

16

1

(c) (i) Isotopes

1

(ii) $^{18}_{8}O$

1

(d) (i) compound

1

(ii) H-O-H

1

(iii) covalent

1

(iv) sharing

1

[10]

M5. (a) (i) 14

1

(ii) isotope

1

(iii) (very) small

accept smaller / tiny / (very) little

1

(b) (i) C

1

(ii) NH_3

1

(c) (i) nitric (acid)

1

(ii) indicator

1

(iii) crystallisation **or** evaporation

*allow by heating **or** cooling **or** leave (on windowsill)*

do not accept freezing

1

(iv) any **one** from:

- grass grows faster
- grass grows taller **or** thicker

allow grass grows better / greener

1

(d) potassium (atom) loses (an electron)

*reference to incorrect bonding or particle = max **3***

1

chlorine (atom) gains (an electron)

ignore references to full outer shells

1

1 (electron)

1

electron

1

[13]

M6. (a) four

1

covalent

1

(b) because it has a high melting point

accept it won't melt

accept it won't decompose or react

allow withstand high temperatures

ignore boiling point

1

(c) thin

1

[4]

M7. (a) (i) high

1

(ii) hundred

1

(b) hard

1

(c) (i) carbon

1

(ii) four

1

(iii) covalent

1

(iv) all

1

[7]

M8. (a) alloy

1

(b) in mixture:

different sized / bigger atoms

1

so there are no layers / rows / lines (to slide)

accept converse

1

(c) any **two** from:

ignore references to bend and mould

- cost
- toxicity
- strength
- *appearance of brace*
- *unreactive **or** resistant to corrosion / saliva*

allow rusting as alternative to corrosion

2

(d) crosslinks

allow lines / bonds between the rows / chains

1

[6]