1 Look at the electronic structures of some atoms.

Atom	Electronic structure
W	2.8.1
X	2.8.4
Y	2.8.7
Z	2.8.8

(a) (i) One of the atoms is a metal which makes a positive ion.

Which one? Choose from the table.

answer ..... **[1]**

(ii) One of the atoms has a stable electronic structure and is unreactive.

Which one? Choose from the table.

answer ..... **[1]**

(iii) Two of the atoms can combine together by **transferring** electrons to form an **ionic** bond.

Which two? Choose from the table.

..... and ..... **[1]**

(b) Ammonia has the formula, NH_3.

The electronic structure of nitrogen is 2.5.

The electronic structure of hydrogen is 1.

Draw a 'dot and cross' diagram to show the **covalent** bonding in ammonia.

Show all the electrons.

[2]

(c) Sodium chloride is an **ionic** compound.

Sodium chloride

- will not conduct electricity when it is a solid
- will conduct electricity when it is dissolved in water.

Explain these two observations in terms of structure and bonding.

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..... **[2]**

2 Sam researches different ways of making insoluble salts such as lead iodide.

In one reaction she adds potassium iodide solution to lead nitrate solution.

Potassium iodide solution contains $K^+(aq)$ and $I^-(aq)$.

Lead nitrate solution contains $Pb^{2+}(aq)$ and $NO_3^-(aq)$.

Look at the balanced ionic equation for the precipitation reaction.

$$Pb^{2+}(aq) + 2I^-(aq) \rightarrow PbI_2(s)$$

(a) Explain why this precipitation reaction is extremely fast.

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..... [1]

(b) In this reaction the $K^+(aq)$ and the $NO_3^-(aq)$ are called spectator ions.

What is meant by a spectator ion?

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..... [1]

(c) Sam publishes her results in a scientific journal.

Explain how this can help her research.

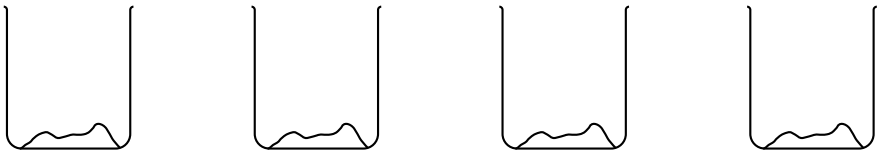
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..... [2]

3 Oskar has four beakers containing different solids.



solid **A** solid **B** solid **C** solid **D**

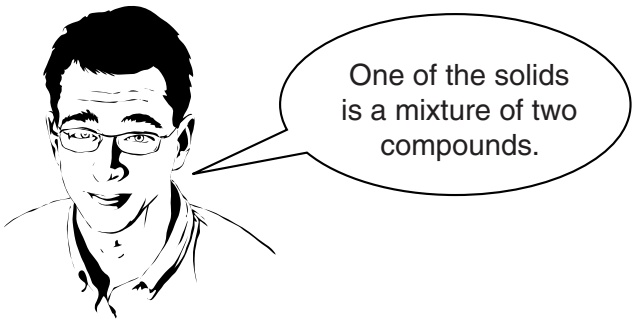
He dissolves each solid in water to make a solution.

He tests each solution and records the results in a table.

Look at his results.

Test	**Result with A**	**Result with B**	**Result with C**	**Result with D**
Reaction with barium chloride solution	no precipitate	no precipitate	white precipitate	white precipitate
Reaction with silver nitrate solution	cream precipitate	white precipitate	no precipitate	white precipitate
Reaction with sodium hydroxide solution	colourless solution	blue precipitate	blue precipitate	green precipitate

Oskar makes a conclusion.



Which solid was a mixture of two compounds?

Explain how Oskar came to this conclusion.

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..... **[3]**

[Total: 3]

4 This question is about paint and pigments.



(a) Emulsion paint is one type of paint.

Describe how emulsion paint dries.

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..... **[1]**

(b) Look at the table. It gives some information about pigments.

pigment	colour at 20 °C	colour at 100 °C	effect of light
A	blue	blue	colour fades
B	green	green	gives off light in the dark
C	blue	red	no change
D	yellow	yellow	no change

Which pigment would be useful on a kettle of boiling water?

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Explain your choice.

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..... **[2]**

(c) Paint is a **colloid**.

A colloid contains pigment particles mixed with particles of a liquid.

Explain why the pigment particles and liquid particles do not separate.

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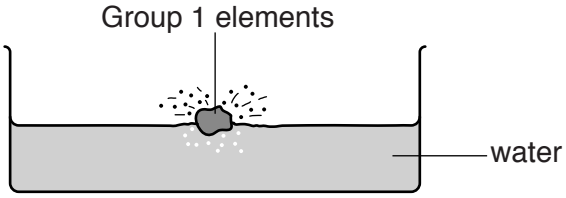
..... **[2]**

[Total: 5]

5 This question is about the reaction of Group 1 elements with water.

Lithium, sodium and potassium are Group 1 elements.

They all react with water.



Look at the table.

Group 1 element	Time for 0.5 g of metal to react in seconds	Observations
sodium	15	melts moves across surface of water makes a gas which burns with a 'pop' makes an alkaline solution
potassium	7	melts and catches fire moves quickly across surface of water makes a gas which burns with a 'pop' makes an alkaline solution
lithium	25	moves slowly across surface of water makes a gas which burns with a 'pop' makes an alkaline solution

Rubidium is another Group 1 element.

It is below potassium in Group 1 of the periodic table.

Predict the reaction time, and name the products, of the reaction between rubidium and water.

Include a balanced symbol equation for the reaction.



The quality of written communication will be assessed in your answer to this question.

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..... [6]

6 **(a)** An element **X** has the electronic structure 2.8.8.2.

Explain how you can tell that element **X** is calcium.

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..... **[1]**

(b) Chlorine has the electronic structure 2.8.7.

Chlorine, Cl_2, is a covalent molecule.

Use the 'dot and cross' model to describe the bonding in a molecule of chlorine, Cl_2.

You only need to draw the outer shell electrons.

[2]

(c) Sodium chloride, NaCl, contains sodium ions, Na^+, and chloride ions, Cl^-.

Explain why sodium ions are positively charged and chloride ions are negatively charged.

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..... **[2]**

(d) Chlorine reacts with sodium bromide solution.

Look at the **ionic** equation for this reaction.

$$Cl_2 + 2Br^- \longrightarrow Br_2 + 2Cl^-$$

Explain why chlorine is **reduced** in this reaction.

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..... **[1]**

(e) Chlorine also reacts with potassium iodide solution, KI.

Iodine and potassium chloride are made.

Construct a **balanced symbol** equation for this reaction.

..... **[2]**

[Total: 8]