1 Potassium and lithium are Group 1 metals that exist as isotopes.

(a) (i) Complete the table of information about two isotopes of potassium.

(3)

Atomic number	Mass number	Number of protons	Number of neutrons
19	39		
		19	22

(ii) A sample of lithium has this percentage composition by mass.

$^{6}Li = 7.4\%$ $^{7}Li = 92.6\%$

Use this information to calculate the relative atomic mass of lithium.
Give your answer to one decimal place.

(2)

relative atomic mass of lithium = ...

(b) A reaction occurs when a small piece of potassium is added to water in a trough.

State two observations that could be made during the reaction.

(2)

1 .....

.....

2 .....

.....

(c) A few drops of phenolphthalein are added to the liquid in the trough at the end of the reaction. A colour change occurs.

(i) State the final colour of the liquid in the trough.

(1)

.....

(ii) Give the formula of the ion formed during the reaction that causes this colour change.

(1)

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(d) The electronic configurations of lithium and potassium are

Li 2,1 K

Explain why potassium is more reactive than lithium.

(2)

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(Total for Question 1 = 11 marks)

2 Lithium hydroxide (LiOH) and lithium peroxide (Li_2O_2) have been used in spacecraft to remove the carbon dioxide astronauts breathe out.

The equations for the reactions with carbon dioxide are

$$2LiOH + CO_2 \rightarrow Li_2CO_3 + H_2O$$

$$2Li_2O_2 + 2CO_2 \rightarrow 2Li_2CO_3 + O_2$$

(a) Explain, with reference to these equations, two advantages of using lithium peroxide, rather than lithium hydroxide, to remove carbon dioxide from the air in a spacecraft.

(2)

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(b) (i) Calculate the mass of lithium hydroxide needed to react with 100 g of carbon dioxide.

[M_r of LiOH = 24]

(3)

mass of lithium hydroxide = ... g

(ii) Calculate the volume of carbon dioxide, at room temperature and pressure, removed by 100 g of lithium peroxide.

[M_r of Li_2O_2 = 46]

Assume that one mole of gas has a volume of 24 000 cm^3 at rtp.

(3)

volume of carbon dioxide = ... cm^3

(Total for Question 2= 8 marks)

3 A teacher added some of the Group 1 elements to separate samples of water.

(a) State two observations that could be made when a small piece of sodium is added to a large trough containing water.

(2)

1 .....

.....

2 .....

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(b) In another experiment she added a small piece of a different Group 1 element and noticed that the reaction was less vigorous.

Which element did she add in this experiment?

(1)

.....

(c) In another experiment she added a small piece of potassium to a large trough containing water. This time she observed a lilac flame.

(i) Identify the gas that burned.

(1)

.....

(ii) Give the formula of the ion that caused the flame to be lilac.

(1)

.....

(d) When the Group 1 elements react with water, each of their atoms loses an electron from its outer shell. For sodium and potassium, these processes can be represented by the equations

- $Na \rightarrow Na^+ + e^-$
- $K \rightarrow K^+ + e^-$

Explain, by referring to the electronic configurations of sodium and potassium, why potassium is more reactive than sodium.

(4)

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(Total for Question 3 = 9 marks)

4 A small piece of potassium is added to water.

The list below shows some statements.

Only four of these statements describe what happens when potassium reacts with water.

Place a cross (☒) in the box next to each of the **four** correct statements.

potassium oxide solution is formed	☐
fizzing occurs	☐
potassium sinks to the bottom of the water	☐
potassium moves around	☐
potassium melts	☐
bubbles of oxygen gas are produced	☐
a lilac flame is seen	☐
potassium reacts to form an acidic solution	☐

(Total for Question 4 = 4 marks)