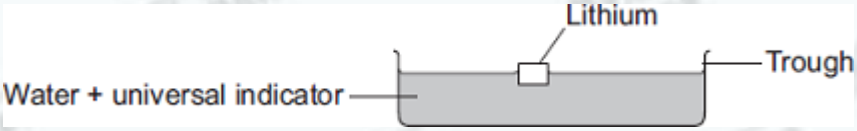
Group 1 metal – exam style question with answer

1. A student was investigating the reaction of lithium and water.

She added a few drops of universal indicator to water in a trough and added a piece of lithium.



The word equation for the reaction is:

lithium + water ⟶ lithium hydroxide + hydrogen

(a) (i) The lithium floated on the water.

State **two** other observations that the student would **see** during the reaction.

1.....

2.....

(2)

(ii) Balance the symbol equation for the reaction of lithium and water.

2 Li(s) + ... H_2O(l) ⟶ ..... LiOH(aq) + H_2(g)

(2)

(iii) Describe a simple test and the result that would show the gas was hydrogen.

.....

.....

(1)

(iv) All Group 1 metals have similar reactions with water.

State why, in terms of electronic structure.

.....

.....

(1)

(b) Lithium and other Group 1 metals have different properties from the transition metals.

Tick (✓) **two** properties that are properties of Group 1 metals.

They react with oxygen. ☐

They form coloured compounds. ☐

They are strong and hard. ☐

They have low melting points. ☐

(2)

(c) The electronic structure of a potassium atom is 2, 8, 8, 1

(i) Draw a diagram to show the electronic structure of a potassium ion. Show the charge on the potassium ion.

(2)

(ii) Potassium is more reactive than sodium.

Explain why, in terms of electronic structure.

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.....

.....

(3)

(Total 13 marks)

M1.(a) (i) any **two** from:

- bubbles / effervescence / fizzing

  ignore hydrogen / gas produced
- lithium disappears / gets smaller

  allow dissolves

  *do **not** allow melts / burns*
- lithium moves on the surface of the water

  ignore floats
- (universal indicator) turns blue / purple

2

(ii) 2

left-hand side correct

1

2

right-hand side correct

allow multiples for full credit

1

(iii) light / burn, which will give a (squeaky) pop / explosion

1

(iv) all have 1 electron in their outer shell / energy level

allow have the same number of electrons in their outer shell / energy level

1

(b) They react with oxygen

1

They have low melting points

1

(c) (i) electronic structure [2,8,8] is drawn

*incomplete inner shells scores a maximum of **1** mark*

1

charge is +

*allow $[2,8,8]^+$ for **1** mark*

1

(ii) because (in potassium) the outer shell electron is further away from the nucleus **or** because potassium atoms are larger than sodium atoms

*it should be clear that the candidate is referring to the outer shell electron: if this is not clear a maximum of **2** marks can be awarded*

1

therefore the outer shell electron is less strongly attracted to the nucleus **or** is more shielded from the attraction of the nucleus and so the outer shell electron in potassium is more easily lost

1

***3** marks can be scored for answering the question in terms of sodium*

1

[13]