**1** This question is about the reactions of some metals and their compounds.

(a) A student adds a sample of four metals R, S, T and U separately to water and to dilute sulfuric acid.

The table shows the observations in each experiment.

| Metal | Observation with water | Observation with dilute sulfuric acid |
|---|---|---|
| R | no change | bubbles form slowly |
| S | bubbles form quickly | bubbles form very quickly |
| T | no change | no change |
| U | bubbles form slowly | bubbles form quickly |

(i) State two properties of the metals that the student should keep the same in all of the experiments in order to compare their reactivity.

**(2)**

1 .....

.....

2 .....

.....

(ii) Which is the least reactive metal?

**(1)**

☐ **A** metal R

☐ **B** metal S

☐ **C** metal T

☐ **D** metal U

(iii) Which gas forms during the reactions with dilute sulfuric acid?

**(1)**

☐ **A** carbon dioxide

☐ **B** hydrogen

☐ **C** oxygen

☐

(b) The student carries out a test to show that the solution formed when metal U reacts with dilute sulfuric acid contains sulfate ions.

Use words from the box to complete the sentence about this test.

Each word may be used once, more than once or not at all.

**(2)**

| | | | |
|---|---|---|---|
| brown precipitate | solution of barium chloride | s | of silver nitrate |
| solution of sodium hydroxide | white precipitate | yellow precipitate | |

He adds a ..... and observes

the formation of a .....

(c) The student observes a lilac colour in a flame test on a small sample of a different metal compound.

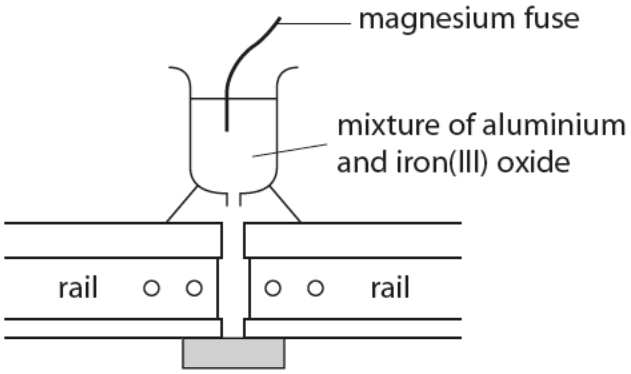
Which metal ions cause the formation of this colour?

**(1)**

- ☒ **A** copper
- ☒ **B** magnesium
- ☒ **C** potassium
- ☒ **D** zinc

**(Total for Question 1 = 7 marks)**

**2** The thermite reaction is used on railways to produce molten iron for joining rails together. The diagram shows how this is done.




The equation for this thermite reaction is

$$2Al + Fe_2O_3 \rightarrow Al_2O_3 + 2Fe$$

(a) What does this reaction show about the reactivity of iron compared to the reactivity of aluminium?

**(1)**

.....

.....

(b) Why is this reaction described as displacement?

**(1)**

.....

.....

(c) State two reasons why the term oxidation applies to aluminium in this reaction.

**(2)**

1 .....

.....

2 .....

.....

(d) Although the thermite reaction is exothermic, it only begins after a lot of heat energy is supplied.

How is this heat energy supplied?

**(1)**

.....

.....

**(Total for Question 2= 5 marks)**