3 A student prepares a sample of the insoluble salt barium sulfate, $BaSO_4$.
The student adds aqueous sodium sulfate, $Na_2SO_4(aq)$, to aqueous barium chloride, $BaCl_2(aq)$.

The student carries out the following steps.

step 1 Dissolve 0.100 moles of solid $BaCl_2$ in 100 cm^3 of distilled water in a beaker to form $BaCl_2(aq)$.

step 2 Add an aqueous solution which contains 0.100 moles of $Na_2SO_4(aq)$ to the beaker containing the $BaCl_2(aq)$ from **step 1**.

step 3 Stir the mixture and then filter it.

step 4 Dry the solid left in the filter paper.

(a) Complete the symbol equation for the reaction. Include state symbols.

$$BaCl_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(.....) + ...(.....)$$

[2]

(b) Calculate the mass of solid $BaCl_2$ dissolved in **step 1**.

mass = ... g [2]

(c) The concentration of $Na_2SO_4(aq)$ in **step 2** is 1.25 mol/dm^3.

Calculate the volume, in cm^3, of 1.25 mol/dm^3 $Na_2SO_4(aq)$ added in **step 2** which contains 0.100 moles of Na_2SO_4.

volume = ... cm^3 [1]

(d) State the colour of the solid formed in **step 2**.

..... [1]

(e) The mixture is filtered in **step 3**.

State the general term given to a solid left in the filter paper after filtration.

..... [1]

(f) The actual mass of dry $BaSO_4$ collected in **step 4** is greater than the expected mass. This is because the student should do an additional step between **step 3** and **step 4**.

Suggest what the student should do in this additional step, and explain why the actual mass collected is greater than the expected mass.

.....

.....

.....

..... [2]

(g) State the name of this method of salt preparation.

..... [1]

(h) State the name of a different:

- barium salt that can be used in place of $BaCl_2$ .....
- sulfate salt that can be used in place of Na_2SO_4 .....
- barium salt that can be made by this method. .....

[3]

[Total: 13]