

Amount of substance – A2 Chemistry P1 & P3

1. No.2

0	2
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This question is about an experiment to determine the solubility of strontium hydroxide in water at 20 °C

Strontium hydroxide is slightly soluble in water. Strontium hydroxide solution reacts in a similar way to calcium hydroxide solution.

- Some solid strontium hydroxide is added to approximately 1 dm³ of distilled water in a stoppered flask.
- The mixture is kept at 20 °C. Every day, the mixture is checked. If no solid is present in the flask, more solid strontium hydroxide is added.
- On the day when no more solid needs to be added, the flask is opened and the mixture is filtered into another flask and stoppered.
- A 25.0 cm³ sample of the filtrate is transferred to a conical flask with a pipette and a few drops of indicator added.
- This sample is titrated with 0.100 mol dm⁻³ hydrochloric acid.
- The titration is repeated several times with further samples of the filtrate. The results are shown in **Table 1** on page 8.

0	2	.	1
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Suggest why the solution is kept until no more solid needs to be added.

[1 mark]

To ensure that it is saturated.

0	2	.	2
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Suggest why it is important to remove the undissolved strontium hydroxide before the titration.

[1 mark]

Undissolved strontium will react with the acid (HCl)

0	2	.	3
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After the filtration, the solution is stored in a stoppered flask.

Suggest a reason for stoppering the flask.

[1 mark]

To prevent its reaction with carbon dioxide in air.

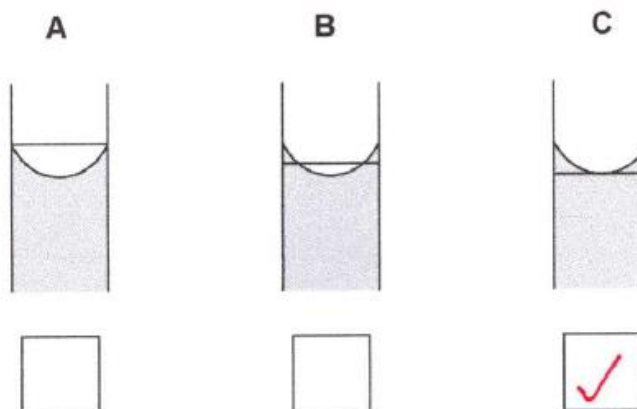
0 2 . 4 The diagrams in **Figure 2** show the part of a pipette with the graduation line.

Which diagram identifies the pipette that is correctly filled?

[1 mark]

Tick (✓) **one** box.

Figure 2



0 2 . 5 Solubility can be quoted as 'g of solute per 100 cm³ of solution'.

Table 1 shows the results of the titrations between strontium hydroxide and hydrochloric acid. These can be used to determine the solubility of strontium hydroxide.

Table 1

Titration	Rough	1	2	3
Final burette reading / cm ³	34.40	38.00	41.05	37.00
Initial burette reading / cm ³	0.00	5.55	8.05	4.60
Titre / cm ³	34.40	32.45	33.00	32.40

Give the equation for the reaction between strontium hydroxide and hydrochloric acid.

Use the results in **Table 1** to calculate the mean titre.

Use the mean titre to calculate the solubility of strontium hydroxide, in g per 100 cm³ of solution, at 20 °C

[6 marks]

$$\text{Mean titre} = \frac{32.45 + 32.40}{2} = 32.425 = 32.43$$

Equation

Mean titre 32.43 cm³

① Moles of HCl in mean titre.

$$= \frac{32.43}{1000} \times 0.100 = 3.243 \times 10^{-3} \text{ moles}$$

② Moles of $\text{Sr}(\text{OH})_2$ in 25.0 cm³ sample.

$$n_{\text{Sr}(\text{OH})_2} = \frac{n_{\text{HCl}}}{2} = \frac{3.243 \times 10^{-3}}{2} = 1.6215 \times 10^{-3} \text{ moles}$$

③ moles per 100 cm³ solution.

$$n_{\text{Sr}(\text{OH})_2} \text{ in } 100 = 1.62 \times 10^{-3} \times \frac{100}{25} = 6.48 \times 10^{-3} \text{ moles}$$

④ Mass per 100 cm³.

$$M_r \text{ Sr}(\text{OH})_2 = 121.62 \text{ g/mol}$$

$$\text{Mass} = 6.48 \times 10^{-3} \times 121.62$$

$$= 0.7880976 \approx 0.788$$

Solubility of strontium hydroxide 0.788 g per 100 cm³ solution

2. No.8

Compound **P** is converted into compound **R** by a two-stage synthesis via compound **Q**.

The yields for the individual steps are:



What is the overall yield of **R** in this synthesis?

[1 mark]

A 15%

☒

B 30%

☐

C 40%

☐

D 80%

☐

Overall yield.

$$= 0.50 \times 0.30 = 0.15$$
$$0.15 \times 100 = 15.$$

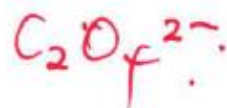
3. No.9

What is the formula of ammonium ethanedioate?

[1 mark]

A $\text{NH}_4(\text{C}_2\text{O}_4)_2$ ☐B $(\text{NH}_4)_2\text{C}_2\text{O}_4$ ☒C $\text{NH}_4\text{C}_2\text{O}_4$ ☐D $(\text{NH}_4)_2(\text{C}_2\text{O}_4)_3$ ☐

Ethanedioate is an
oxalate ion



A -2 anion.

Ammonium NH_4^+

+1 cation.

