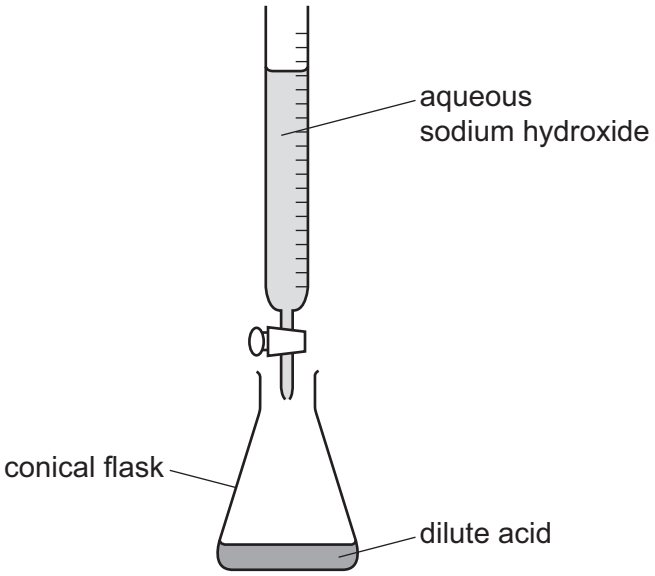
1 The concentration of a dilute acid can be found by reacting it with aqueous sodium hydroxide using the apparatus shown.



(a) What piece of apparatus should be used to add exactly 25.0 cm^3 of dilute acid to the conical flask?

..... [1]

(b) A few drops of litmus solution are added to the conical flask.

Explain why litmus solution is added to the conical flask.

.....

..... [1]

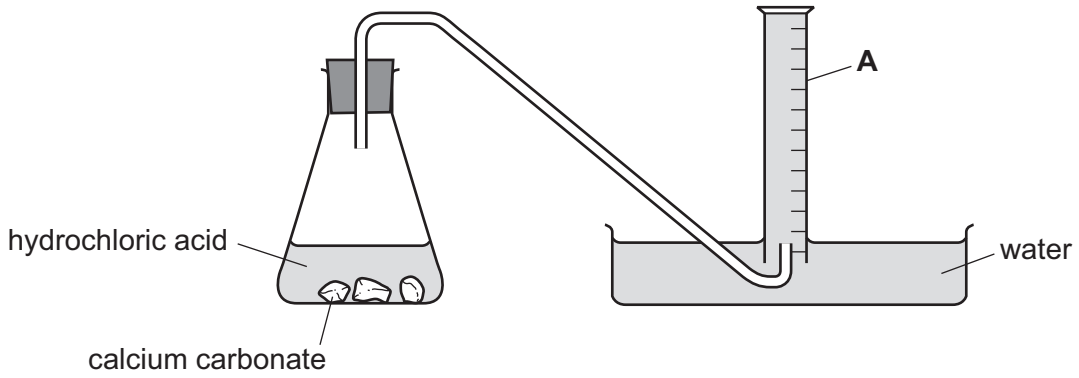
(c) Aqueous sodium hydroxide is then added to the dilute acid until it is in excess.

Describe the change in the colour of the litmus solution in the conical flask.

from .....to ..... [2]

[Total: 4]

2 The apparatus shown is used to investigate the rate of reaction between calcium carbonate and hydrochloric acid at 30 °C.



(a) Name the piece of apparatus labelled **A** in the diagram.

..... [1]

(b) Describe how this apparatus can be used to find the rate of reaction.

.....

.....

..... [2]

[Total: 3]

3 Aluminium reacts with hydrochloric acid to form aluminium chloride and a gas which 'pops' with a lighted splint.

(a) Identify this gas.

..... [1]

(b) Suggest a practical method for investigating the rate of this reaction involving collection of the gas.
You may include a labelled diagram in your answer.

.....

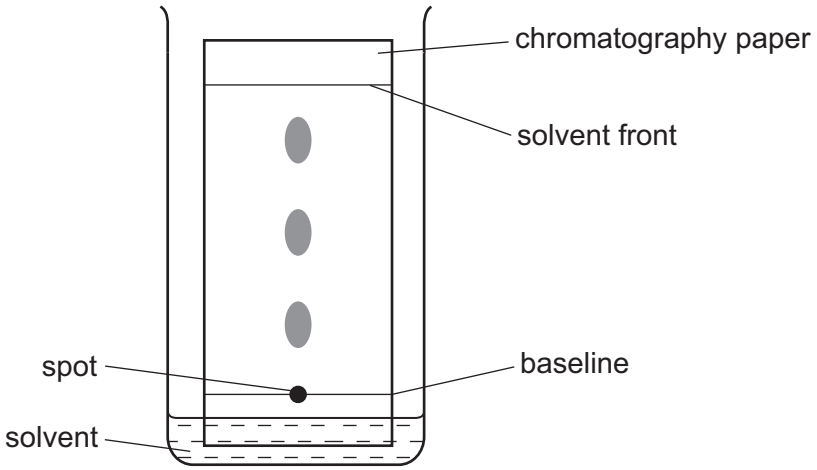
.....

.....

..... [3]

[Total: 4]

4 The diagram shows the apparatus used to separate the different components of a mixture by chromatography.



Which statement about this experiment is correct?

A A locating agent is used to find the position of the solvent front.

B The components to be separated must be soluble in the solvent.

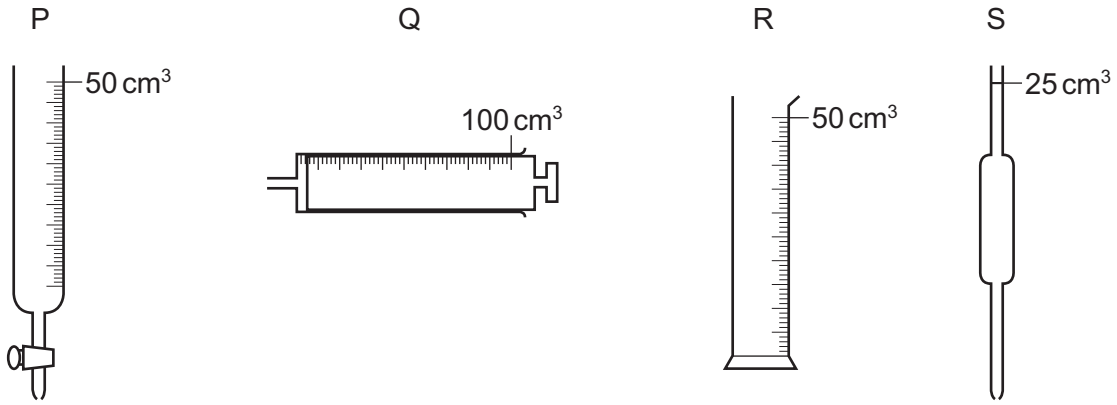
C The baseline on which the spot of the mixture is placed is drawn in ink.

D The R_f value is calculated by $\frac{\text{the distance travelled by the solvent front}}{\text{the distance travelled by the component}}$.

[1]

[Total: 1]

5 P, Q, R and S are pieces of apparatus.



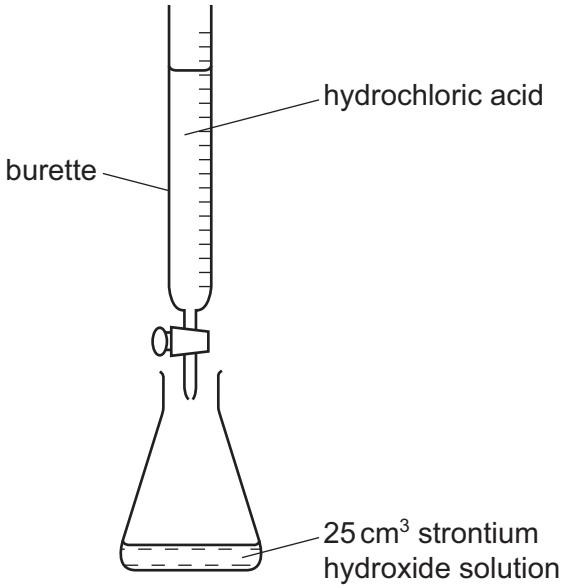
Which row describes the correct apparatus for the measurement made?

	apparatus	measurement made
A	P	the volume of acid added to alkali in a titration
B	Q	1 cm^3 of acid to add to calcium carbonate in a rate-determining experiment
C	R	75 cm^3 of a gas given off in a rate-determining experiment
D	S	20 cm^3 of alkali for use in a titration

[1]

[Total: 1]

6 The solution formed at the end of the reaction between strontium and water is alkaline. It is a solution of strontium hydroxide.
The teacher titrated this solution with hydrochloric acid using the apparatus shown below.

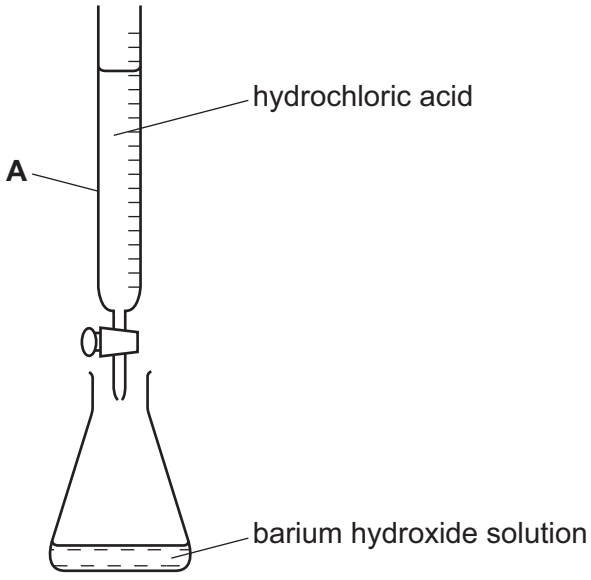


What piece of apparatus should be used to put exactly 25.0 cm^3 of the strontium hydroxide solution into the flask?

..... [1]

[Total: 1]

7 A student used the apparatus shown below to calculate the concentration of barium hydroxide solution.



(a) Give the name of the piece of apparatus labelled **A**.

..... [1]

(b) The hydrochloric acid is added to the barium hydroxide solution in the flask until the acid is in excess.

Describe how the pH of the solution changes as the acid is added.

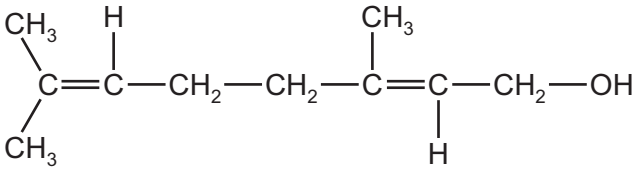
.....

..... [2]

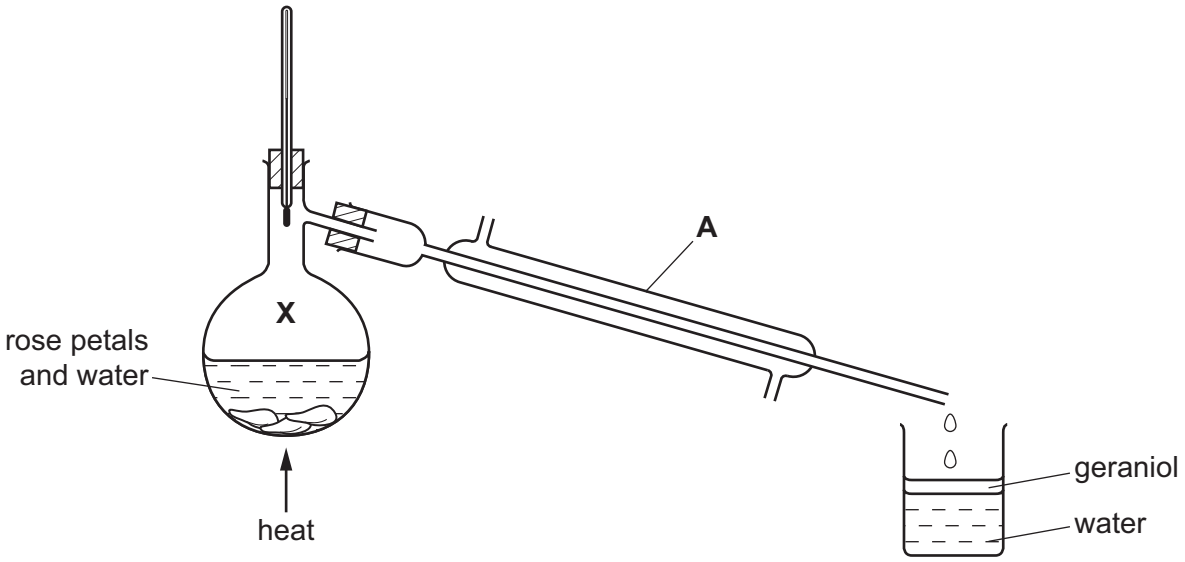
[Total: 3]

8 Geraniol is a chemical found in rose petals.

The structure of geraniol is shown below.



Geraniol can be extracted from rose petals by steam distillation using the apparatus shown below. The geraniol is carried off in small droplets with the steam.



(a) Give the name of the piece of apparatus labelled **A**.

..... [1]

(b) The vapour at point **X** is a mixture of geraniol and steam.

Give **one** property of a mixture which distinguishes it from a compound.

.....

..... [1]

(c) The geraniol and water are collected in the beaker.

What information in the diagram above shows that geraniol is less dense than water?

..... [1]

[Total: 3]

9 Describe how to separate the following. Give a description of the procedure used and explain why this method works.

Copper powder from a mixture containing copper and zinc powders.

procedure.....

.....

explanation.....

..... [3]

[Total: 3]

10 Describe how to separate the following. Give a description of the procedure used and explain why this method works.

Nitrogen from a mixture of nitrogen and oxygen.

procedure.....

.....

explanation.....

..... [3]

[Total: 3]

11 Describe how to separate the following. Give a description of the procedure used and explain why this method works.

Magnesium hydroxide from a mixture of magnesium hydroxide and zinc hydroxide.

procedure.....

.....

explanation.....

..... [3]

[Total: 3]

12 Describe how to separate the following. Give a description of the procedure used and explain why this method works.

Glycine from a mixture of the two amino acids glycine and alanine. Glycine has the lower R_f value.

procedure.....

.....

explanation.....

..... [2]

[Total: 2]

13 Glycolic acid is found in unripe grapes.
Grape skins contain a number of different coloured pigments.

Describe how you could obtain a solution of these pigments from grape skins.

.....

.....

.....

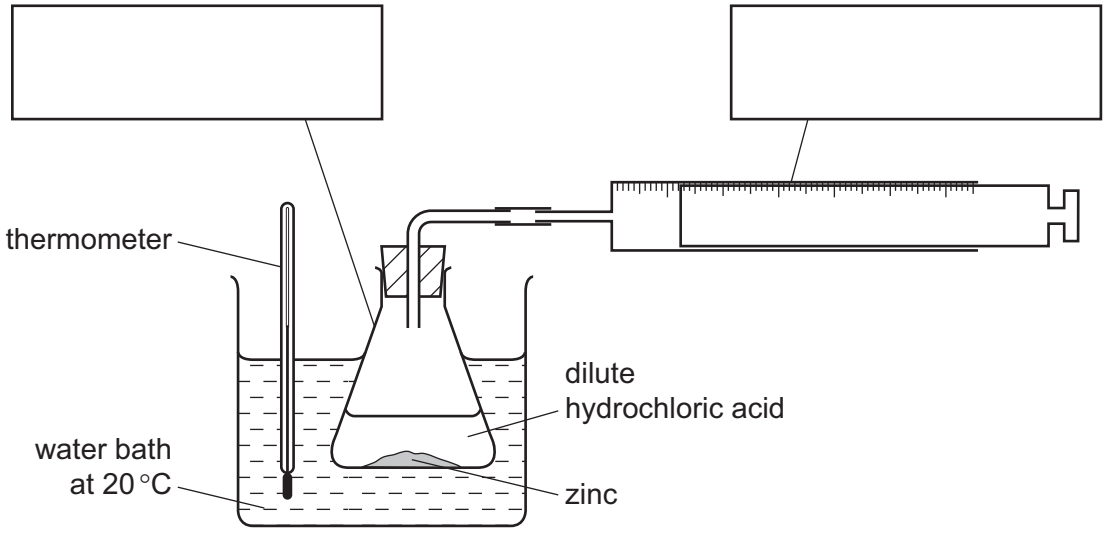
..... [3]

[Total: 3]

14 A student investigated the rate of reaction of zinc with dilute hydrochloric acid.

$$Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$$

Complete the labelling of the apparatus by filling in the two boxes.



[2]

[Total: 2]

15 Balsam flowers contain a mixture of pigments.

Describe how you could obtain a solution of this mixture of pigments from balsam flowers.

.....

.....

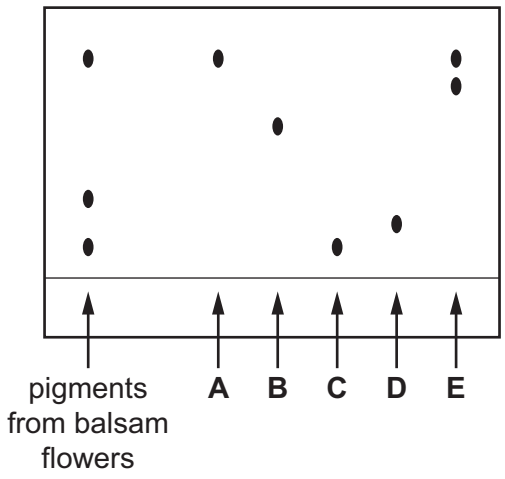
..... [3]

[Total: 3]

16 Balsam flowers contain a mixture of pigments.

A student uses chromatography to separate the pigments in balsam flowers. He puts the pigment mixture on a sheet of chromatography paper as well as 5 spots of pure pigments **A**, **B**, **C**, **D** and **E**.

The diagram below shows the results after chromatography.

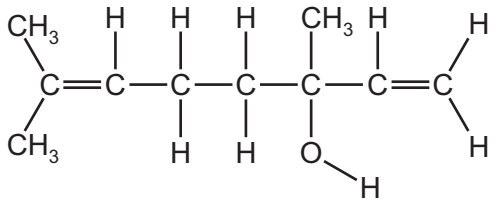


Which of the pigments **A**, **B**, **C**, **D** and **E** are present in balsam flowers?

..... [1]

[Total: 1]

17 Linalool is a compound found in the seeds of the coriander plant.
The formula of linalool is shown below.



Linalool can be extracted from coriander seeds.
The following statements are about the procedure for extracting linalool from coriander seeds.

A Distil the solution.

B Add a solvent to the ground up seeds.

C Grind the coriander seeds.

D Filter off the solid from the solution.

E Stir the mixture, then it leave for 24 hours.

(a) Put the statements **A**, **B**, **C**, **D** and **E** in the correct order.
The first one has been done for you.

C				

[2]

(b) On what physical property does distillation depend?

..... [1]

[Total: 3]

18 Copper(II) oxide is a solid.
An aqueous solution of copper(II) sulfate can be made by heating excess copper(II) oxide with dilute sulfuric acid.

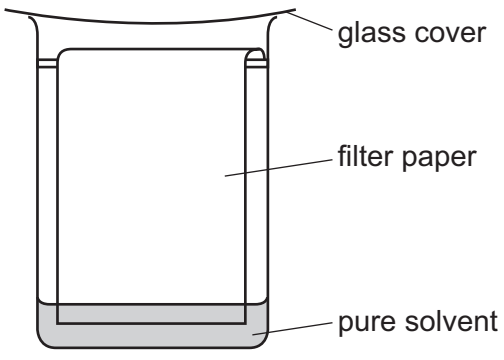
Draw a labelled diagram of the apparatus you would use to separate the excess copper(II) oxide from the solution.

[2]

[Total: 2]

19 A mixture contains a variety of different coloured pigments.

A student uses the apparatus shown below to identify the different pigments in the mixture.



(a) State the name of this method of separating the pigments.

..... [1]

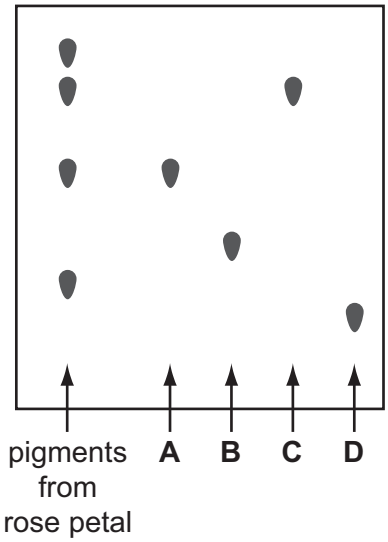
(b) On the diagram above, draw a spot, ●, to show where the mixture of pigments is placed at the start of the experiment.

[1]

(c) What is the purpose of the glass cover?

..... [1]

(d) The student also puts four spots of pure pigments, **A**, **B**, **C** and **D**, onto the filter paper. The diagram below shows the results of her experiment.



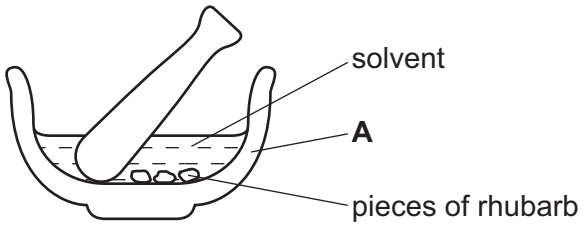
Which of the pigments, **A**, **B**, **C** and **D**, are present in the rose petals?

..... [1]

[Total: 4]

20 Rhubarb is a plant which has a red stem.

A student separated the pigments in the rhubarb stem by chromatography.
He used the apparatus shown below to extract the pigments.



Suggest a suitable solvent, other than water, that he could use to extract the pigments.

..... [1]

[Total: 1]

21 A mixture of soil and water was shaken and then filtered.

Draw a labelled diagram of the apparatus you would use for separating the insoluble particles of soil from the solution.

[2]

[Total: 2]

22 Rose petals contain a variety of different coloured pigments.
A student wants to identify these pigments.

(a) She grinds up rose petals with a solvent.
Explain why.

.....

.....

..... [2]

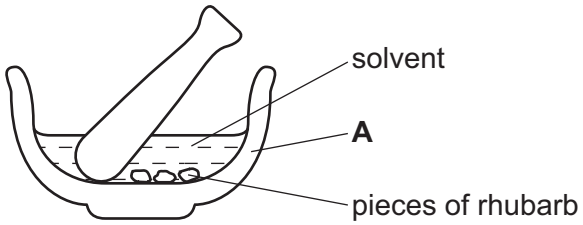
(b) She then filters the solution through some glass wool.
Suggest why she does not use filter paper.

..... [1]

[Total: 3]

23 Rhubarb is a plant which has a red stem.

A student separated the pigments in the rhubarb stem by chromatography.
He used the apparatus shown below to extract the pigments.



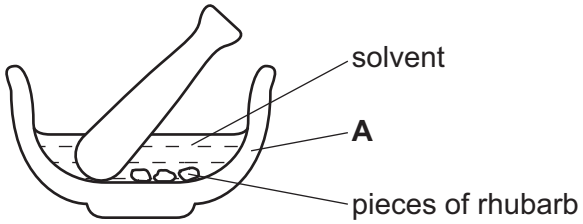
The solution of pigments was not concentrated enough to use for chromatography.
Suggest how the student could make the solution more concentrated.

..... [1]

[Total: 1]

24 Rhubarb is a plant which has a red stem.

A student separated the pigments in the rhubarb stem by chromatography.
He used the apparatus shown below to extract the pigments.

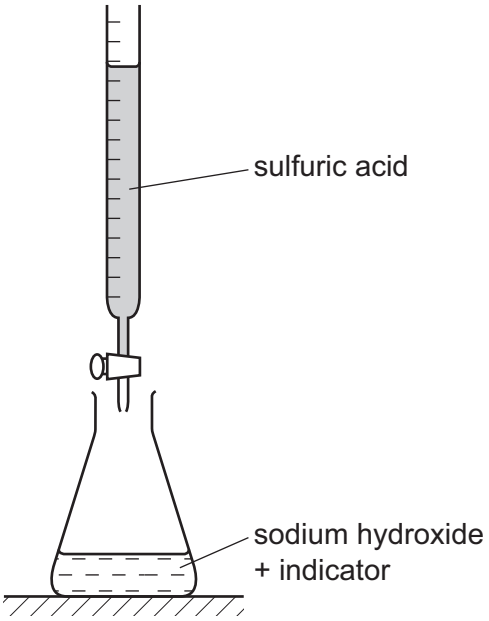


State the name of the piece of apparatus labelled **A**.

..... [1]

[Total: 1]

25 Sulfur trioxide reacts with water to form sulfuric acid.
A student used the apparatus shown below to determine the concentration of a solution of sodium hydroxide.



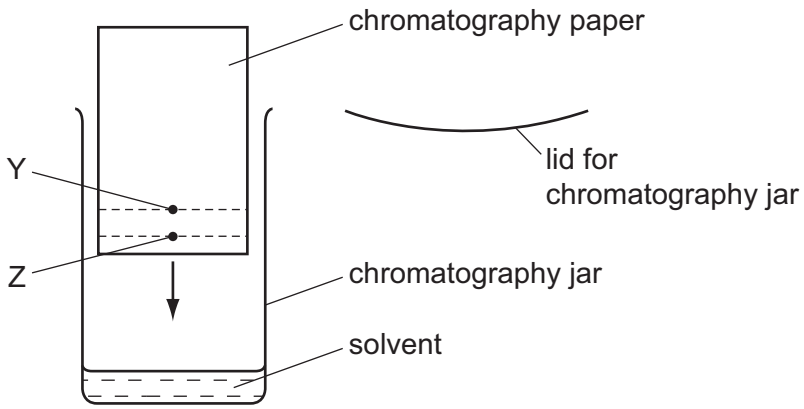
Which **one** of these pieces of apparatus should the student use to put 25.0 cm^3 of sodium hydroxide into the flask.
Tick **one** box.

beaker	☐
measuring cylinder	☐
test-tube	☐
volumetric pipette	☐

[1]

[Total: 1]

26 A student carried out chromatography using the apparatus shown below.



(a) A spot of a pigment mixture was placed at Y.
Explain why a spot of the mixture was not placed at Z.

..... [1]

(b) Describe how the rest of the procedure was carried out.

.....

.....

..... [2]

[Total: 3]

27 A list of techniques used to separate mixtures is given below.

chromatography crystallisation diffusion dissolving

evaporation filtration fractional distillation simple distillation

(a) From the list, choose the most suitable technique to separate the following.

water from sea-water .....

helium from a mixture of helium and methane .....

ethanol from a mixture of ethanol and propanol .....

iron filings from a mixture of iron filings and water .....

a mixture of two amino acids, glycine and alanine ..... [5]

(b) Describe how you would obtain a pure sample of copper(II) sulfate-5-water crystals from a mixture of copper(II) sulfate-5-water with copper(II) oxide using some of the techniques listed above.

.....

.....

.....

.....

..... [4]

[Total: 9]

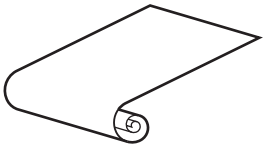
28 An important aspect of chemistry is purity and methods of purification.

Give an example of substances used in everyday life which must be pure.

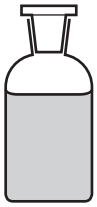
..... [1]

[Total: 1]

29 A student used chromatography to separate the dyes in the blue ink from a ball-point pen. She used the equipment shown in the diagrams below.

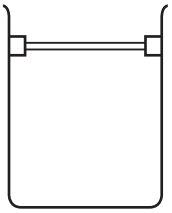


chromatography paper



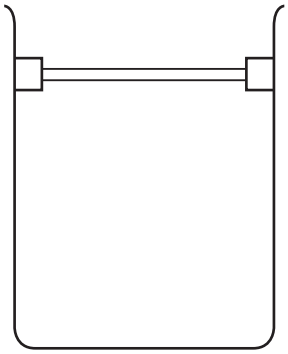
solvent

large watchglass



chromatography tank

(a) Complete the diagram below to show how she set up the apparatus.



[3]

(b) Describe how chromatography could be used by the student to separate the dyes.

.....

.....

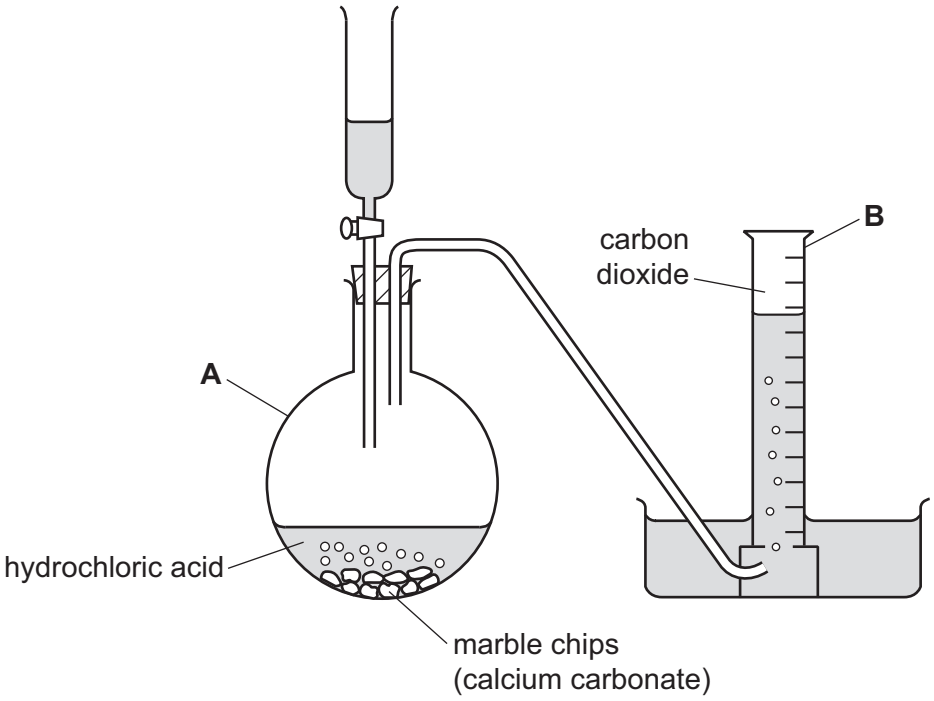
..... [3]

(c) The student used water as a solvent. Suggest a different solvent that she could use.

..... [1]

[Total: 7]

30 Carbon dioxide can be prepared in the laboratory using the apparatus shown below.



Carbon dioxide is slightly soluble in water.
What effect will this have on the volume of carbon dioxide collected?
Tick **one** box.

The volume is lower than expected; ☐

The volume is higher than expected. ☐

The volume is the same as expected. ☐

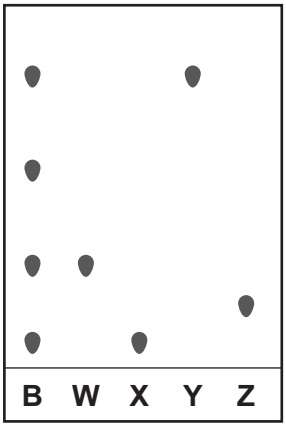
No carbon dioxide is collected. ☐

[1]

[Total: 1]

31 A student used chromatography to separate the dyes in the blue ink from a ball-point pen.

The diagram below shows the results of the chromatography using the blue ink, **B**, and several pure dyes, **W**, **X**, **Y** and **Z**.



(a) Which of the dyes, **W**, **X**, **Y** and **Z**, were in the blue ink?

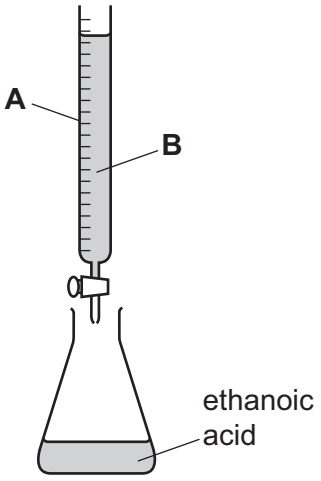
..... [1]

(b) How many dyes in the ink had been separated by this chromatography?

..... [1]

[Total: 2]

32 The concentration of ethanoic acid can be determined by titration using the apparatus shown below.



(a) State the name of the piece of glassware labelled **A**.

..... [1]

(b) Liquid **B** is an alkali.

Which **one** of the following compounds is also an alkali?
Put a ring around the correct answer.

calcium carbonate

calcium sulfate

sodium chloride

sodium hydroxide

[1]

(c) Describe how you would carry out this titration.

.....

.....

.....

..... [2]

[Total: 4]

33 Describe how simple distillation is used to separate water from an aqueous solution of sodium sulfate.
In your answer, refer to:

- the apparatus used,
- changes in state,
- differences in boiling points.

You may use a diagram.

.....

.....

.....

.....

.....

.....

..... [5]

[Total: 5]

34 Zinc oxide reacts with sulfuric acid to form zinc sulfate.

$$\text{zinc oxide} + \text{sulfuric acid} \rightarrow \text{zinc sulfate} + \text{water}$$

Zinc sulfate is soluble in water.
Some insoluble impurities in the zinc oxide do not react with the sulfuric acid.

Suggest how these insoluble impurities are removed from the zinc sulfate solution.

..... [1]

[Total: 1]

35 River water contains a variety of ions and gases, and insoluble materials such as soil particles.

Describe how you could remove the insoluble materials from a sample of river water.
Include a labelled diagram.

.....

.....

.....

..... [4]

[Total: 4]

36 Ethanol is an alcohol.

Ethanol can be manufactured by fermentation or by the hydration of ethene.

What conditions are needed for the manufacture of ethanol from ethene?
Tick **two** boxes.

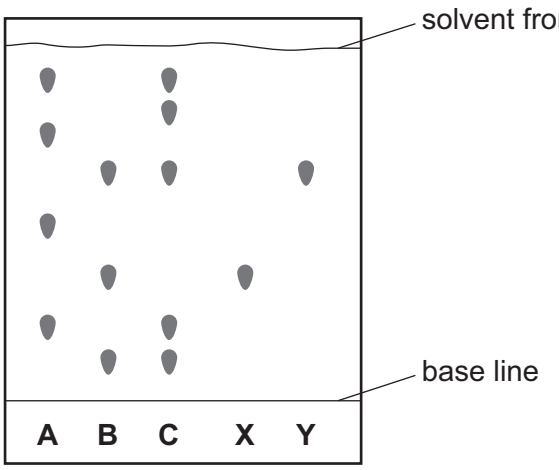
temperature above 100 °C	☐
room temperature	☐
presence of inorganic catalyst	☐
presence of yeast	☐
presence of hydrogen	☐

[2]

[Total: 2]

37 Chromatography is used to separate a mixture of coloured dyes.

Three different dye mixtures, **A**, **B** and **C**, were spotted onto a piece of chromatography paper.
Two pure dyes, **X** and **Y**, were also spotted onto the same piece of paper.
The diagram below shows the results of the chromatography.



(a) State the name of a piece of apparatus that could be used to spot the dyes onto the paper.

..... [1]

(b) Suggest why the base line was drawn in pencil and not in ink.

..... [1]

(c) Which dye mixture contains **both** dye **X** and dye **Y**?

..... [1]

(d) Which dye mixture does **not** contain dye **X** or dye **Y**?

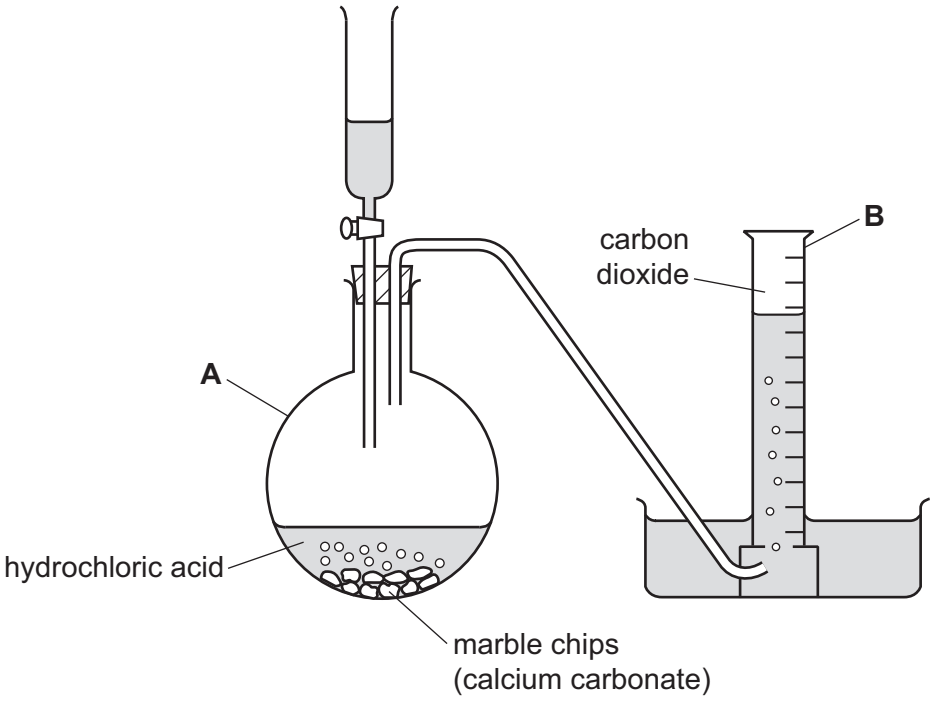
..... [1]

(e) In which mixture, **A**, **B** or **C**, has the greatest number of dyes been separated?

..... [1]

[Total: 5]

38 Carbon dioxide can be prepared in the laboratory using the apparatus shown below.



State the names of the pieces of apparatus labelled **A** and **B**.

A .....

B .....

[2]

[Total: 2]

39 In many regions, drinking water is obtained by the distillation of sea-water. Explain how distillation separates the water from sea-water.

.....

..... [2]

[Total: 2]

40 A student was provided with only a thermometer, a stopwatch and a beaker.

What could the student measure?

A 10.5 g solid and 24.8 cm^3 liquid

B 10.5 g solid and 25 °C

C 24.8 cm^3 liquid and 45 seconds

D 25 °C and 45 seconds

[1]

[Total: 1]