1.2 Purity

01. 0620_m15_qp_62 Q: 6

Ethanedioic acid dihydrate, $H_2C_2O_4.2H_2O$, is a white crystalline solid. This acid is water-soluble and is found in rhubarb leaves.

Plan an investigation to obtain crystals of ethanedioic acid dihydrate from some rhubarb leaves. You are provided with common laboratory apparatus, water and sand.

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.....

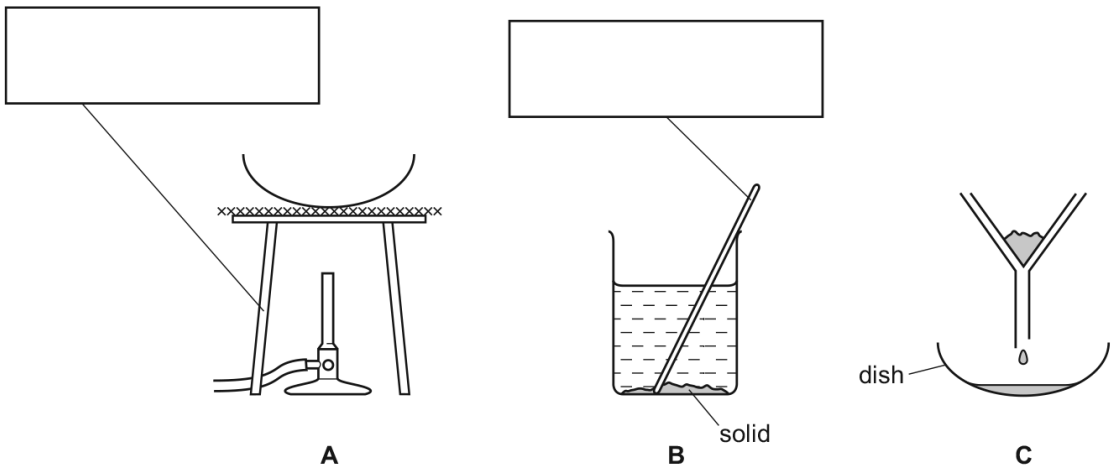
.....

..... [7]

[Total: 7]

02. 0620_m16_qp_62 Q: 1

The diagrams show the apparatus used to obtain crystals of calcium chloride from a mixture of solid calcium chloride and solid calcium carbonate.
Calcium chloride is soluble in water and calcium carbonate is insoluble in water.



(a) Complete the boxes to name the apparatus. [2]

(b) (i) Write down the order in which the apparatus should be used in this experiment.

..... [1]

(ii) Name the separation process in **C**.

..... [1]

(c) (i) What has been added to the mixture in **B**?

..... [1]

(ii) What is the general name given to the liquid in the dish in **C**?

..... [1]

(d) How would you know when to stop heating the dish in **A**?

.....

..... [1]

[Total: 7]

03. 0620_m16_qp_62 Q: 4

The label on a bottle of orange drink stated 'contains no artificial colours'. A scientist thought that the orange colour in the drink was a mixture of two artificial colours:

- Sunset Yellow E110
- Allura Red E129

Plan an investigation to show that the orange colour in the drink did **not** contain these two artificial colours.
You are provided with samples of E110, E129 and the orange colouring from the drink. You are also provided with common laboratory apparatus.
You may draw a diagram to help answer the question.

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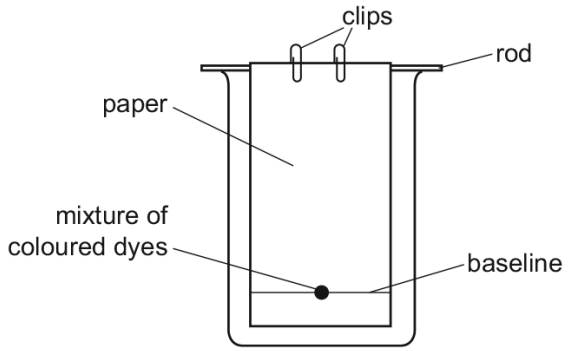
..... [6]

[Total: 6]

04. 0620_m18_qp_62 Q: 1

A student used paper chromatography to separate a mixture of coloured dyes. The diagram shows the apparatus used.



(a) (i) Draw a line on the diagram to show the level of the solvent. [1]

(ii) Suggest a suitable solvent that could be used.

..... [1]

(b) What could be used to put the mixture of coloured dyes onto the paper?

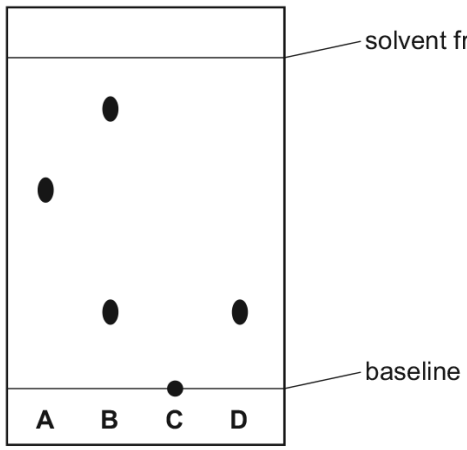
..... [1]

(c) The clips hold the paper in position.

Why is this important for the chromatography experiment?

..... [1]

The diagram shows the chromatogram obtained from four dyes, **A**, **B**, **C** and **D**.



(d) Give **one** conclusion that can be drawn about dye **B**.

..... [1]

(e) Suggest why dye **C** remained on the baseline.

.....

..... [1]

(f) R_f values are used to identify compounds.

$$R_f = \frac{\text{distance travelled by the compound}}{\text{distance travelled by the solvent}}$$

Calculate the R_f value of dye **A**.

R_f = ... [2]

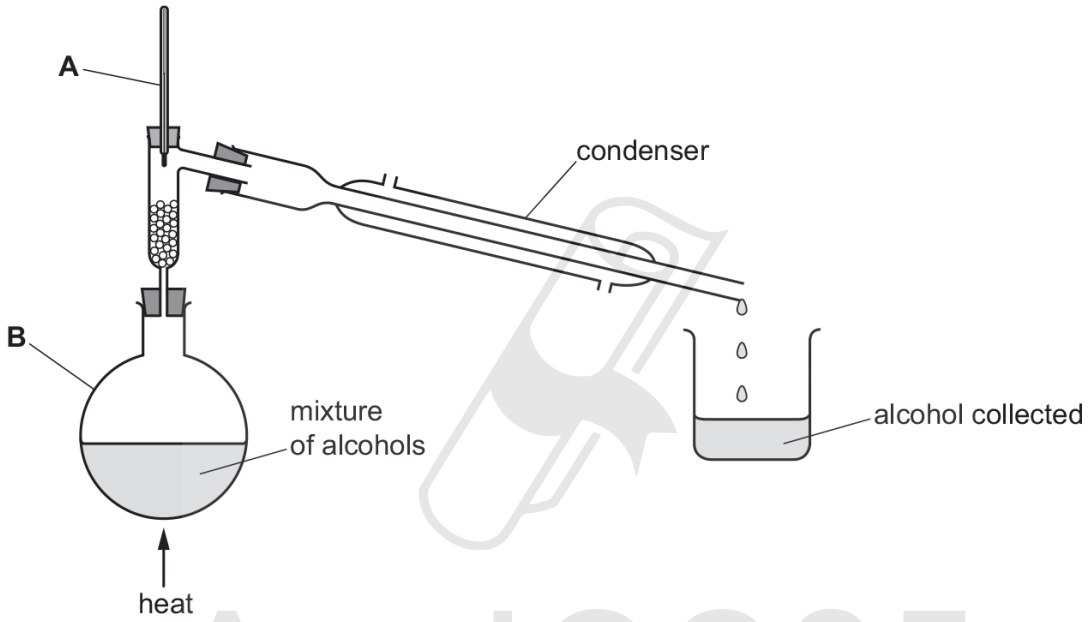
[Total: 8]

05. 0620_m20_qp_62 Q: 1

The table gives the boiling points of four alcohols.

alcohol	boiling point / °C
methanol	65
ethanol	79
propan-1-ol	97
butan-1-ol	117

The apparatus shown can be used to separate a mixture of the four alcohols shown in the table.



(a) Name the apparatus labelled **A** and **B**.

A .....

B .....

[2]

(b) Add to the diagram **one** arrow to show where water enters the condenser. [1]

(c) **(i)** Why is it **not** safe to heat the mixture of alcohols with a Bunsen burner?

..... [1]

(ii) Suggest how the mixture of alcohols can be heated safely?

..... [1]

(d) Describe how the condenser allows the alcohol to be collected as a liquid.

.....

..... [1]

(e) Which alcohol would be collected first?
Explain your answer.

alcohol collected first .....

explanation .....

.....
[2]

[Total: 8]

06. 0620_m20_qp_62 Q: 4

A black dye can be obtained from some plant roots.

Plan an investigation to determine how many different coloured substances are contained in a black dye obtained from plant roots.

You must include how the results you obtain will tell you how many different coloured substances are contained in the black dye.

You have access to plant roots and all normal laboratory apparatus.

.....

.....

.....

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.....

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.....

..... [6]

07. 0620_s12_qp_61 Q: 3

Coffee beans contain caffeine and other compounds. Caffeine is soluble in water and in trichloromethane, an organic solvent.
A student obtained crystals of caffeine by the following method.

Stage 1 Some coffee beans were crushed into small pieces.

Stage 2 Hot water was added to the crushed beans to dissolve the soluble substances.

Stage 3 The crushed beans were separated from the liquid solution.

Stage 4 The liquid was allowed to cool and shaken with trichloromethane to extract the caffeine from the water.

Stage 5 The caffeine was crystallised from the trichloromethane solution.

Stage 6 The caffeine crystals were checked for purity.

(a) What apparatus should be used to crush the beans in Stage 1?

..... [2]

(b) How could the dissolving process in Stage 2 be speeded up?

..... [1]

(c) Draw a diagram of the apparatus used in Stage 3.

[2]

(d) How should Stage 5 be carried out?

.....

..... [2]

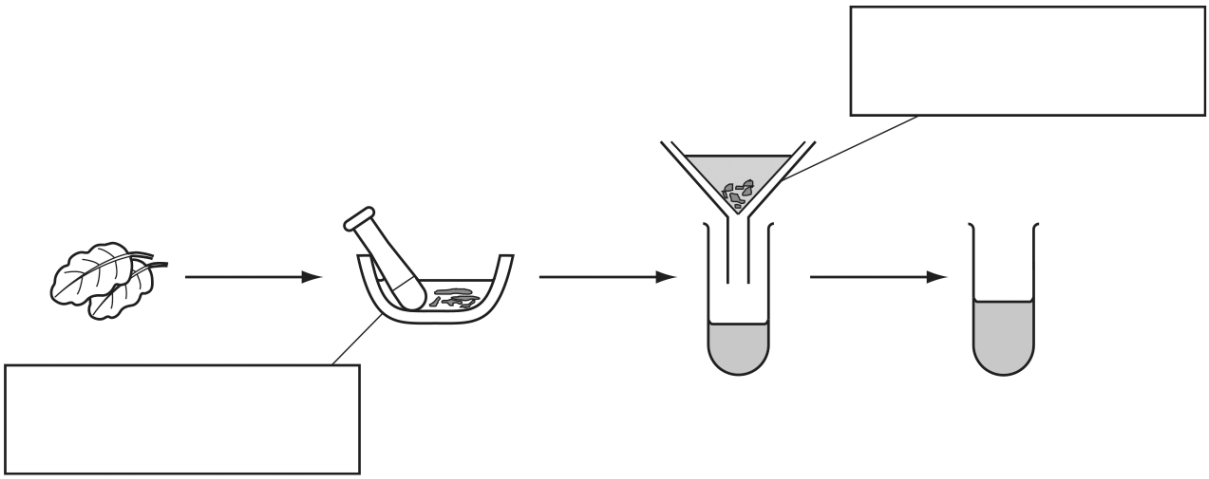
(e) What method could be used to check the purity of the crystals in Stage 6?

..... [1]

[Total: 8]

08. 0620_s13_qp_62 Q: 1

A student extracted the colours present in some leaves using the apparatus below.



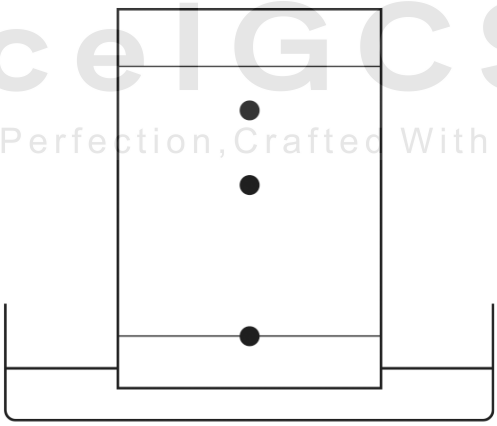
(a) Complete the boxes to identify the pieces of apparatus used. [2]

(b) Use labelled arrows to indicate

(i) the solvent,

(ii) the solution of colours. [2]

(c) Chromatography was used to separate the colours. The chromatogram obtained is shown.



(i) On the diagram, label the solvent front. [1]

(ii) How many colours were present?

..... [1]

[Total: 6]

09. 0620_s13_qp_63 Q: 6

The table gives information about the solubility of three different solids, **W**, **X** and **Y**, in two different solvents.

substance	solubility in cold water	solubility in hot water	solubility in cyclohexane
W	insoluble	insoluble	very soluble
X	insoluble	very soluble	insoluble
Y	very soluble	very soluble	insoluble

You are provided with a mixture of the three substances, **W**, **X** and **Y**. Plan a method which could be used to separate pure dry samples of **W**, **X** and **Y** from the mixture.

.....

.....

.....

.....

.....

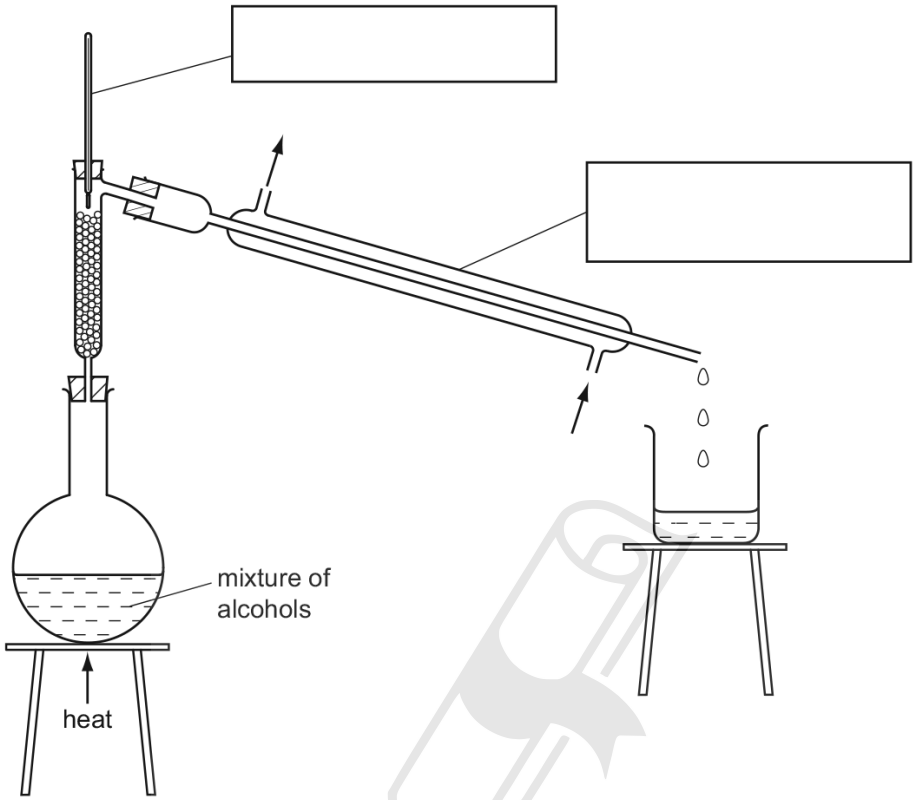
.....

..... [6]

[Total: 6]

10. 0620_s14_qp_61 Q: 1

A student separated a mixture of two alcohols, ethanol (boiling point 78 °C) and butanol (boiling point 118 °C).
The apparatus used is shown below.



(a) Complete the boxes to identify the pieces of apparatus labelled. [2]

(b) Label the arrows. [1]

(c) State the name of this separation process.

..... [2]

(d) (i) Which liquid is first to collect in the beaker?

..... [1]

(ii) How would the student know when all of this liquid had collected?

.....

..... [1]

(e) Identify and explain a possible hazard in this experiment.

.....

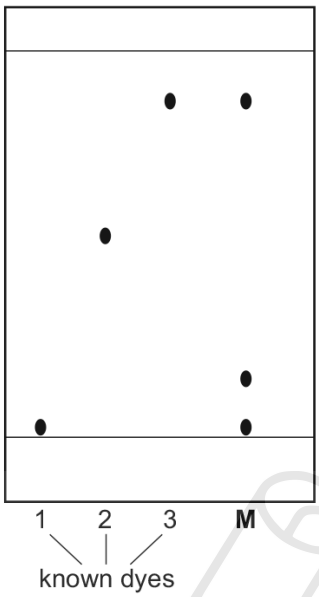
..... [2]

[Total: 9]

---

11. 0620_s15_qp_61 Q: 3

A mixture of coloured dyes, **M**, was separated by chromatography. The dyes were insoluble in water.
The chromatogram below shows the result of separating the mixture and the chromatography of three known dyes 1, 2 and 3.



(a) On the diagram, label the base line (origin). [1]

(b) Name a solvent that could be used in this separation.

..... [1]

(c) How many dyes were there in the mixture, **M**?

..... [1]

(d) What are your conclusions about the identity of the dyes in the mixture, **M**?

.....

.....

..... [3]

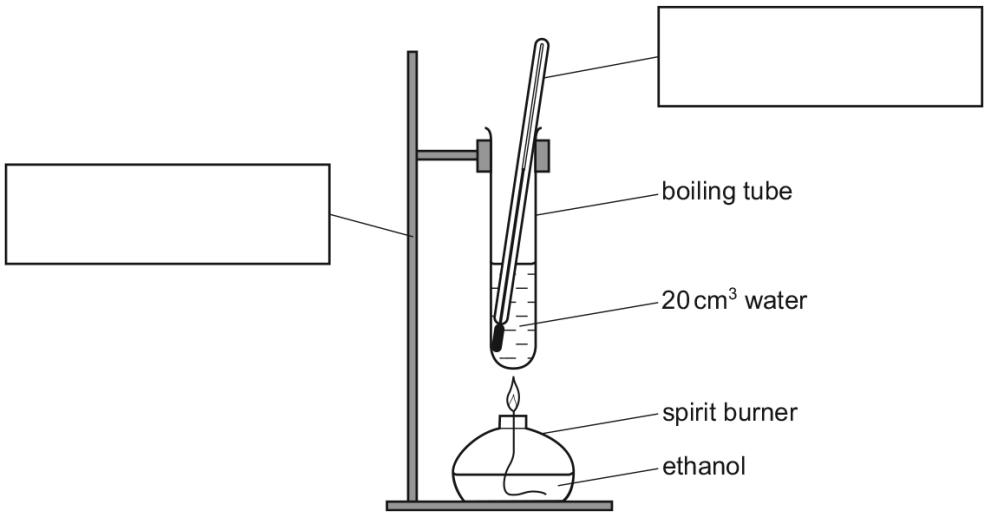
(e) How could the reliability of the results be checked?

..... [1]

[Total: 7]

12. 0620_s15_qp_62 Q: 1

A student did an experiment to measure the energy produced by burning ethanol.
The apparatus used is shown.



The ethanol was burned for one minute. The temperature of the water was then measured and recorded.

(a) Complete the boxes to name the pieces of apparatus. [2]

(b) Give three other measurements the student should have taken.

1 .....

2 .....

3 .....
[3]

(c) The experiment was repeated using 40 cm³ of water. What effect would this have on the results?

..... [1]

(d) Another student did this experiment using a copper can instead of a boiling tube.
Give one advantage of this change to the apparatus.

..... [1]

[Total: 7]

13. 0620_s18_qp_63 Q: 4

Some trees have purple leaves. The purple colour is a mixture of coloured pigments.

Plan an experiment to extract and separate the coloured pigments present in the purple leaves.

You are provided with some purple leaves, sand, ethanol and common laboratory apparatus.
You may draw a diagram to help you answer the question.

.....

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.....

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.....

.....

..... [6]

[Total: 6]

14. 0620_s19_qp_61 Q: 2

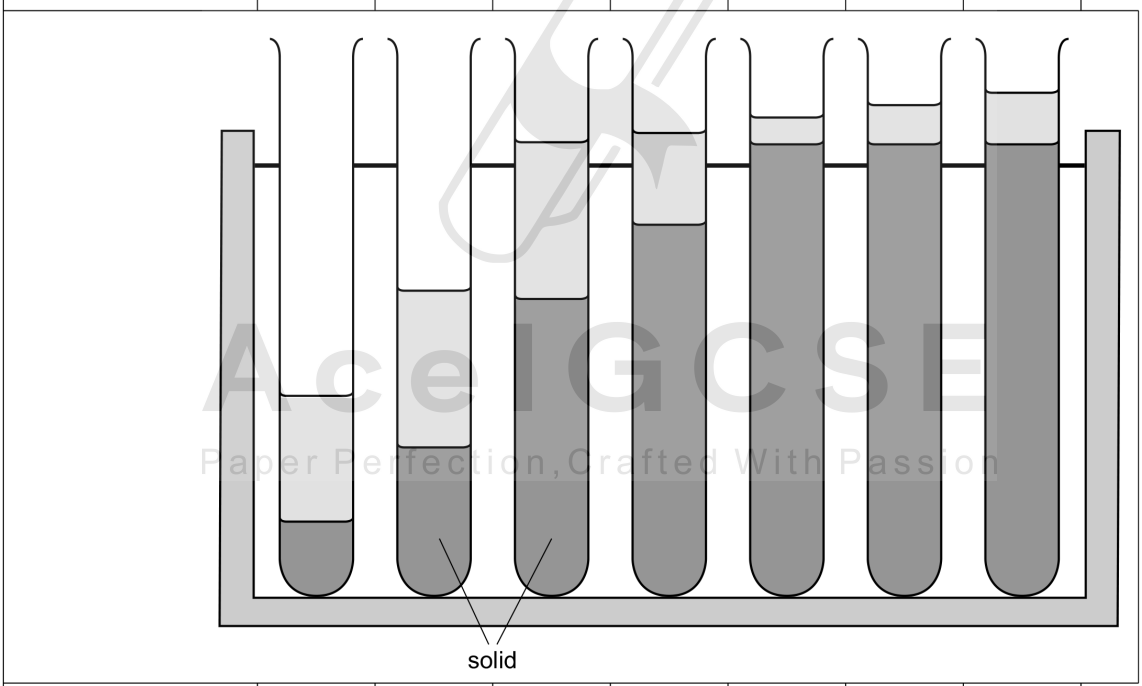
A student investigated the reaction between aqueous sodium carbonate and aqueous barium nitrate.

- A burette was filled with aqueous sodium carbonate.
- Seven test-tubes were labelled 1, 2, 3, 4, 5, 6 and 7.
- A measuring cylinder was used to pour 6 cm^3 of aqueous barium nitrate into each of the seven test-tubes in a test-tube rack.
- 1.0 cm^3 of aqueous sodium carbonate was added from the burette to test-tube 1.
- 2.0 cm^3 of aqueous sodium carbonate was added from the burette to test-tube 2.
- 4.0 cm^3 of aqueous sodium carbonate was added from the burette to test-tube 3.
- 5.0 cm^3 of aqueous sodium carbonate was added from the burette to test-tube 4.
- 6.0 cm^3 of aqueous sodium carbonate was added from the burette to test-tube 5.
- 7.0 cm^3 of aqueous sodium carbonate was added from the burette to test-tube 6.
- 8.0 cm^3 of aqueous sodium carbonate was added from the burette to test-tube 7.

A glass rod was used to stir the contents of each of the test-tubes. The contents of the test-tubes were left to stand until the solid formed had settled. A ruler was used to measure the height of the solid formed in each test-tube.

(a) Use a ruler to measure the heights of the solid formed in each test-tube shown in the diagram. Record the heights of the solid formed in the table and complete the table.

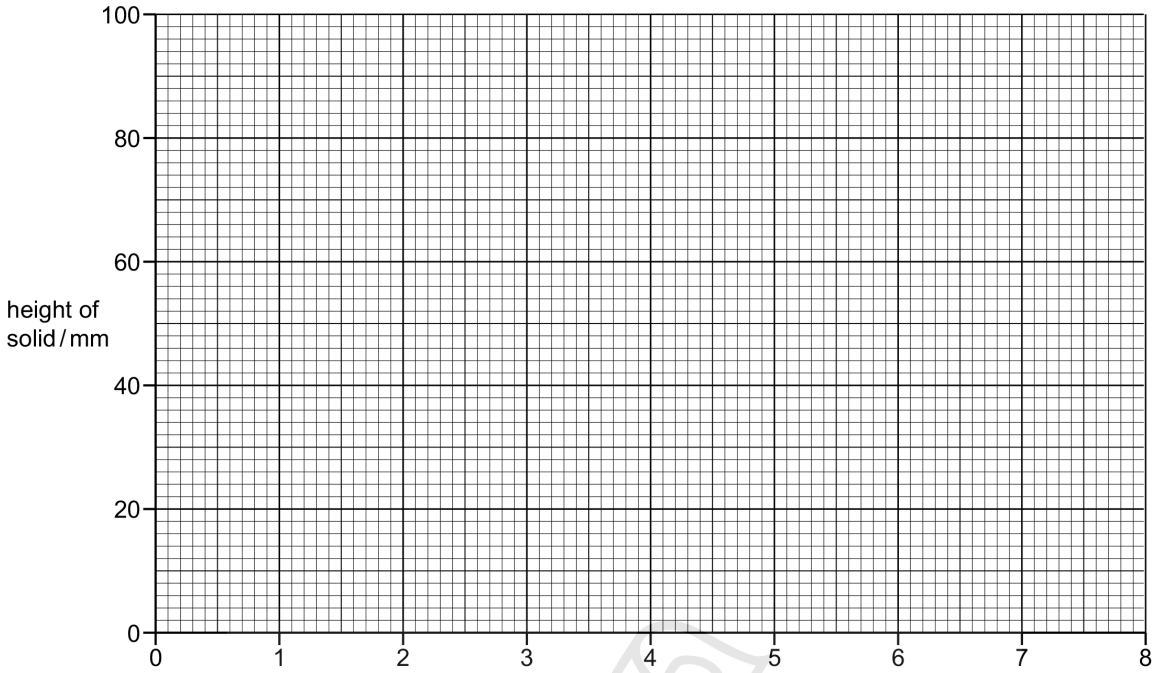
test-tube number	1	2	3	4	5	6	7
volume of aqueous sodium carbonate / cm^3							



height of solid / mm							

[3]

(b) Plot the results on the grid. Draw **two** intersecting lines of best fit. Label the *x*-axis.



[4]

(c) **From your graph**, deduce the height of the solid formed when 3.0 cm^3 of aqueous sodium carbonate is added to 6 cm^3 of aqueous barium nitrate.

Show clearly **on the grid** how you worked out your answer.

..... mm [2]

(d) Describe the trend in the heights of the solids formed in test-tubes 1–7.

.....

.....

..... [2]

(e) Predict what would happen if the experiment were continued using three further test-tubes each containing 6 cm^3 of aqueous barium nitrate and separately adding 9.0 cm^3, 10.0 cm^3 and 11.0 cm^3 of aqueous sodium carbonate to each one.
Explain your answer.

.....

.....

..... [2]

(f) Suggest **one** change to the **apparatus** used which could be made to obtain more accurate results.

..... [1]

(g) Suggest a **different** method to measure the amount of solid formed during the experiment.

.....

.....

.....

..... [3]

(h) Suggest how the reliability of the results could be checked.

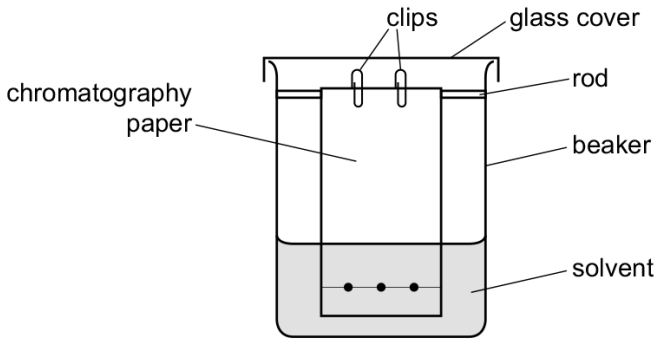
.....

..... [1]

[Total: 18]

15. 0620_s19_qp_63 Q: 1

A student investigated the colours present in three hair dyes, **P**, **Q** and **R**, using chromatography. **P**, **Q** and **R** are insoluble in water. The student suggested setting up the apparatus for the experiment as shown.



(a) Why is a lid necessary on top of the beaker?

..... [1]

(b) (i) Identify **one** mistake in the student's diagram.

..... [1]

(ii) Suggest why this mistake would stop the experiment working.

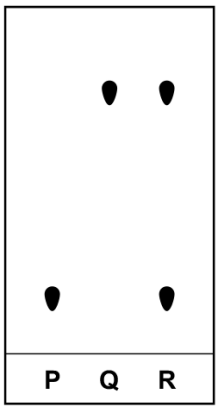
.....

..... [1]

(c) Name a suitable solvent that could be used in this experiment.

..... [1]

(d) A separate chromatography experiment was done using the hair dyes **P**, **Q** and **R**. The chromatogram obtained is shown.



State **three** conclusions about the hair dyes **P**, **Q** and **R** which can be deduced from the chromatogram.

1 .....

2 .....

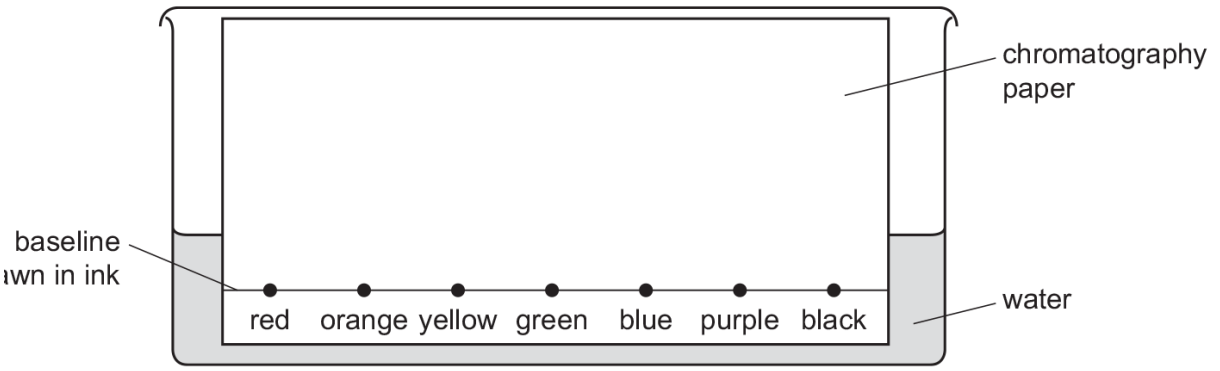
3 .....

[3]

[Total: 7]

16. 0620_s20_qp_61 Q: 1

A student investigated the dyes contained in different coloured inks using chromatography. Water was the solvent. The diagram shows how the student set up the apparatus.



(a) Identify **two** errors in the way the student set up the apparatus.

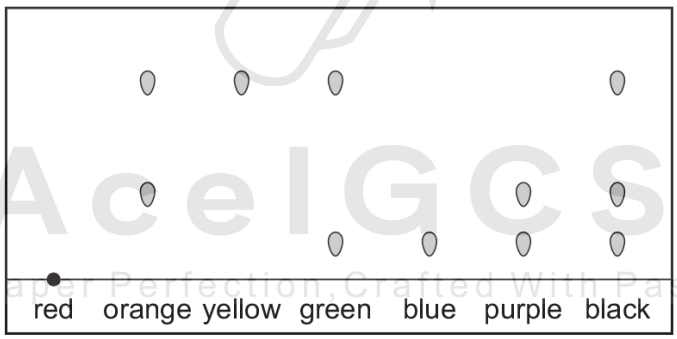
1 .....

2 .....

[2]

(b) The student then carried out the chromatography correctly.

The diagram shows the results.



(i) Which ink contains the greatest number of soluble dyes?

..... [1]

(ii) Which **two** inks are made of a single soluble dye?

..... and .....

[1]

(iii) From the chromatogram it is **not** possible to tell if the red ink contains different dyes.

Suggest how the experiment could be changed to find out if the red ink contains different dyes.

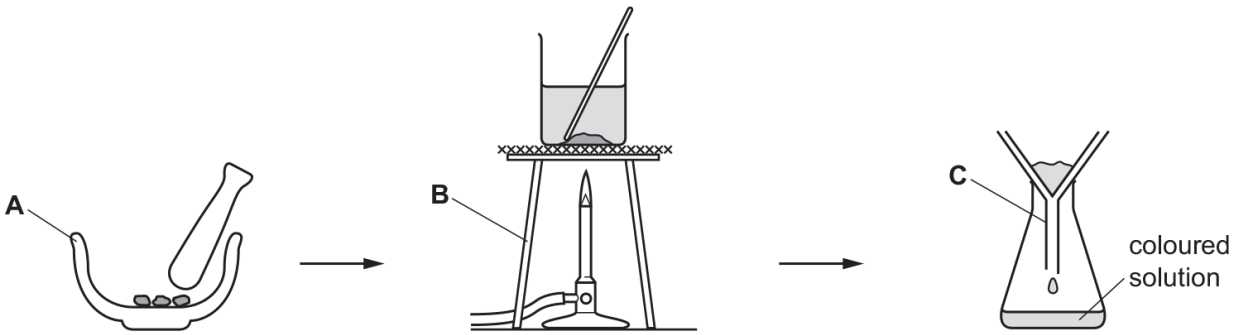
..... [1]

[Total: 5]

17. 0620_s21_qp_61 Q: 1

Many indicators are coloured substances obtained from plants.

A student extracted the coloured substances from some berries using the method shown.



the berries were crushed

the crushed berries were heated in water to form a coloured solution

the solid was removed from the coloured solution

(a) Name the items of apparatus labelled **A**, **B** and **C**.

A .....

B .....

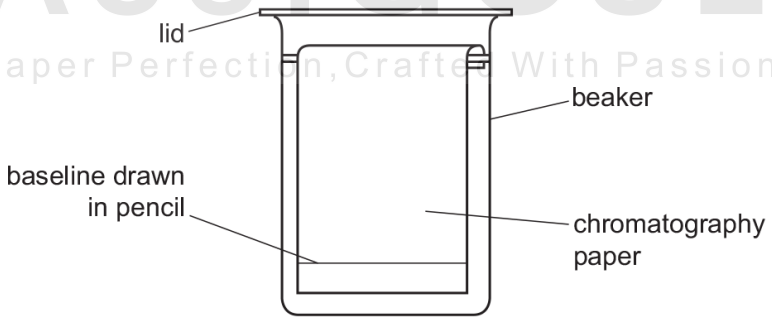
C .....

[3]

(b) The student analysed the coloured solution using chromatography.

(i) Complete the diagram to show:

- where the spot of coloured solution should be placed on the paper
- the level of the solvent in the beaker.



[2]

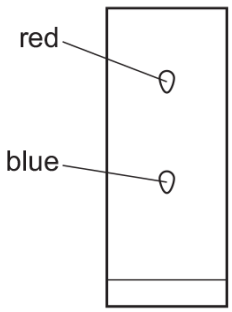
(ii) Explain why pencil is used to draw the baseline on the chromatography paper.

.....

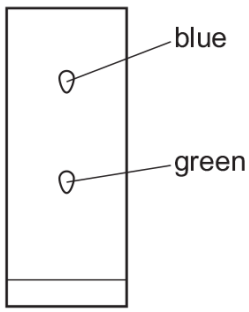
..... [1]

(c) The student made two chromatograms. After chromatography, one chromatogram was dipped in dilute hydrochloric acid and one was dipped in aqueous sodium hydroxide.

The results are shown.



chromatogram dipped in dilute hydrochloric acid



chromatogram dipped in aqueous sodium hydroxide

(i) Determine the number of coloured substances in the solution obtained from the berries.

..... [1]

(ii) The table gives the colours of some indicators in acid and alkali.

name of indicator	colour in acid	colour in alkali
anthocyanin	red	blue
bromothymol blue	yellow	blue
congo red	blue	red
methyl purple	purple	green

Use the data in the table and the results to give a possible identity for **one** indicator in the berries.

..... [1]

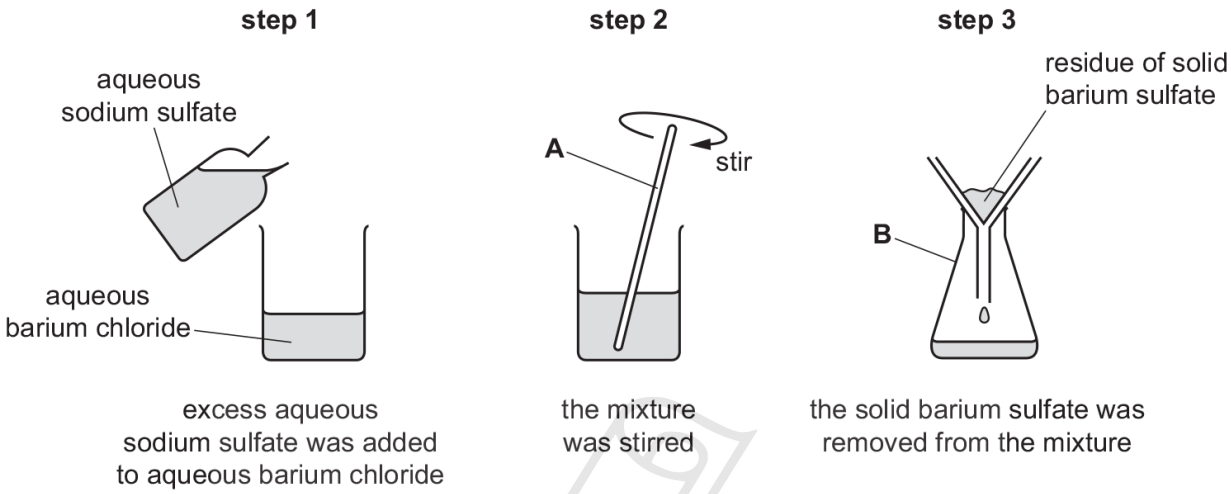
[Total: 8]

18. 0620_s21_qp_62 Q: 1

Barium sulfate is an insoluble salt. Barium sulfate can be made by reacting excess aqueous sodium sulfate with aqueous barium chloride.

sodium sulfate + barium chloride → sodium chloride + barium sulfate

A student made a sample of barium sulfate using the following steps.



(a) Name the items of apparatus labelled **A** and **B**.

A .....

B .....
[2]

(b) Name the process shown in **step 3**.

..... [1]

(c) The general name for the solid in **step 3** is residue.

State the general name for the solution obtained from the process in **step 3**.

..... [1]

(d) Two more steps, **step 4** and **step 5**, are needed to obtain a pure sample of barium sulfate. In each of these steps something is removed from the residue.

State what is done in each of **step 4** and **step 5** and identify the substance removed from the barium sulfate.

step 4 .....

.....

substance removed .....

step 5 .....

.....

substance removed .....

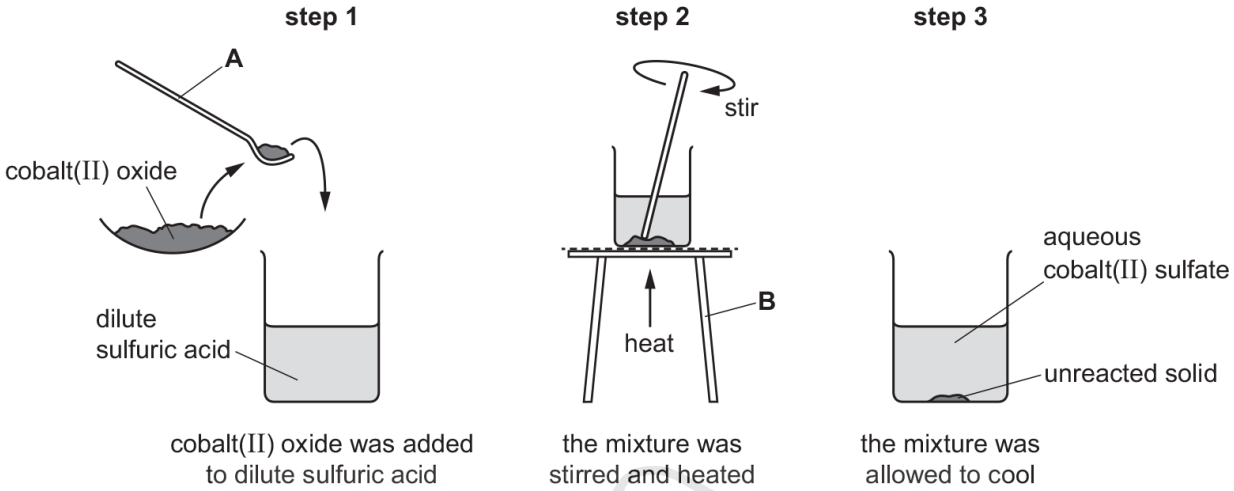
[4]

[Total: 8]

19. 0620_s21_qp_63 Q: 1

Cobalt(II) sulfate is a soluble salt. It can be made by reacting insoluble cobalt(II) oxide with dilute sulfuric acid.

A student made a sample of hydrated cobalt(II) sulfate using the following steps.



(a) Name the items of apparatus labelled **A** and **B**.

A .....

B .....

[2]

(b) **(i)** Suggest why the mixture was heated in **step 2**.

.....

..... [1]

(ii) Name an item of apparatus that can be used to heat the mixture in **step 2**.

..... [1]

(c) Name the reactant which was in excess.
Explain your answer.

.....

..... [1]

(d) Additional steps are required to obtain pure cobalt(II) sulfate.

(i) The unreacted solid is removed from the aqueous cobalt(II) sulfate.

Name the process used to remove the unreacted solid.

..... [1]

(ii) Describe how crystals of hydrated cobalt(II) sulfate could be made from the solution obtained in **(i)**.

.....

.....

.....

..... [2]

[Total: 8]

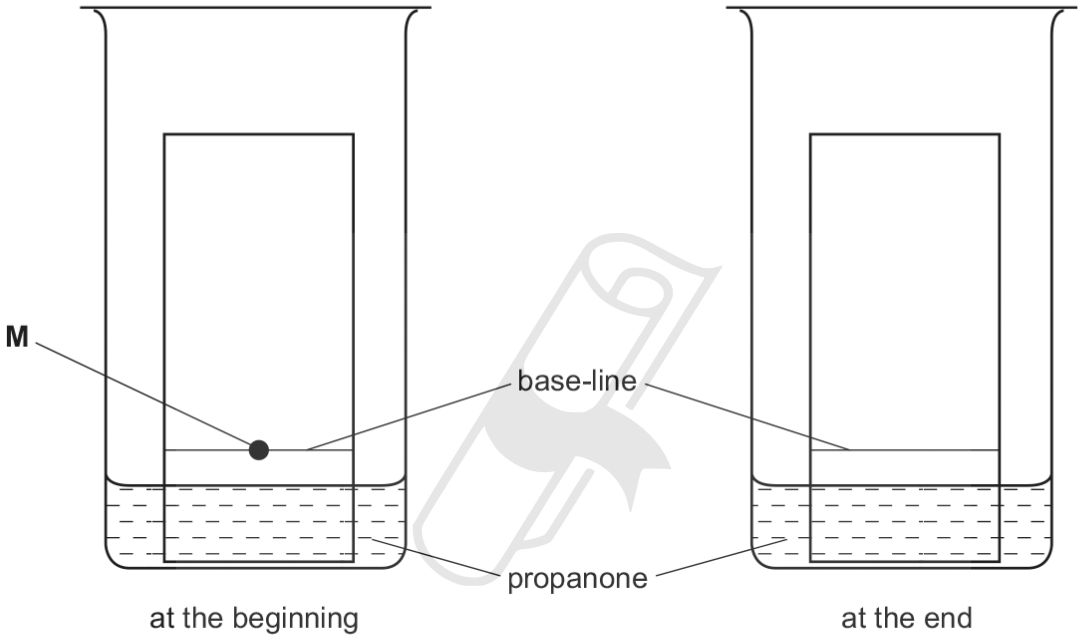
20. 0620_w13_qp_62 Q: 2

Substance **M** is a mixture of four dyes. Three of the dyes have different solubilities in propanone. The fourth dye is insoluble in propanone.

(a) Name the process that could be used to separate these dyes.

..... [1]

(b) Sketch on the right hand diagram the results you would expect if **M** was analysed as shown.



[2]

(c) Why is the base-line not drawn in ink?

.....

..... [1]

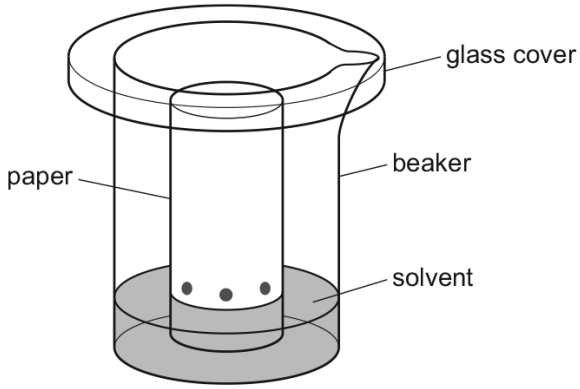
(d) Why must the level of the propanone be below the base-line?

..... [1]

[Total: 5]

21. 0620_w14_qp_61 Q: 3

A student investigated the colours present in a fruit drink. The fruit drink was tested to check that no artificial colours had been added. The apparatus below was used.



(a) (i) Name the method used.

..... [1]

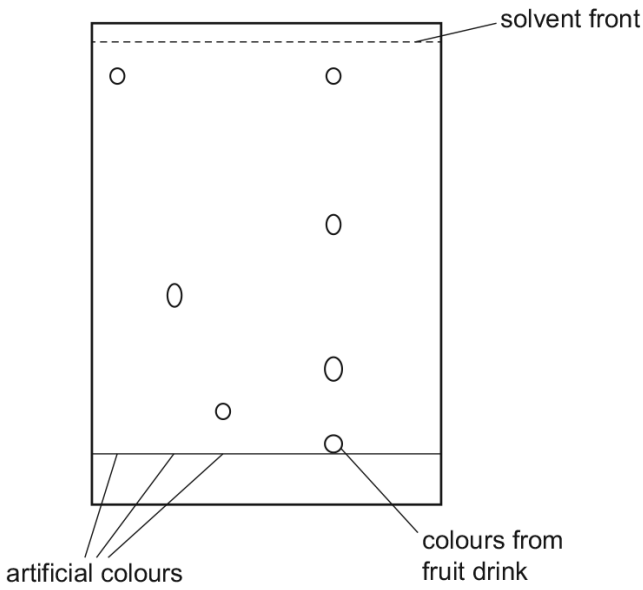
(ii) Why is there a glass cover on the beaker?

..... [1]

(b) When should the paper be removed from the beaker?

..... [1]

(c) The diagram shows the results of the experiment.



(i) How many different coloured compounds were present in the fruit drink?

..... [1]

(ii) Are there any of the artificial colours present in the fruit drink? Explain your answer.

.....

.....

..... [2]

[Total: 6]

22. 0620_w15_qp_61 Q: 6

Toothbright

Toothbright toothpaste contains three compounds, sodium fluoride, calcium carbonate and water.
Calcium carbonate is insoluble in water and sodium fluoride is soluble in water.

Plan an investigation to find out the percentage of calcium carbonate present in this toothpaste.
You are provided with common laboratory apparatus.

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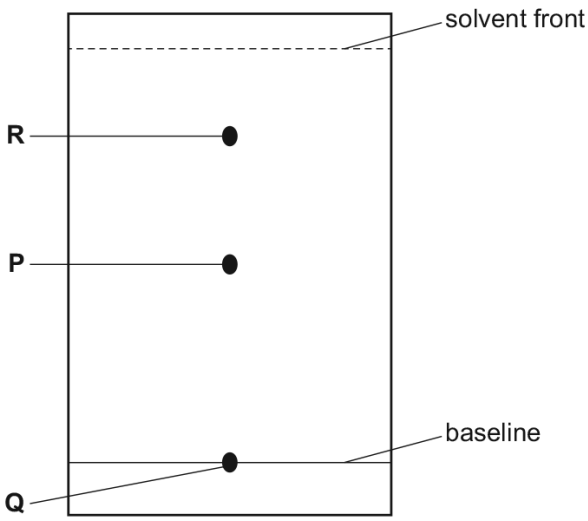
..... [7]

[Total: 7]

23. 0620_w15_qp_62 Q: 2

A mixture of three compounds, **P**, **Q** and **R**, was separated using a piece of paper.



(a) Name this method of separation.

..... [1]

(b) What could have been used to apply the mixture onto the paper?

..... [1]

(c) Suggest a possible solvent that could be used for this separation.

..... [1]

(d) Suggest why compound **Q** remained on the baseline.

.....

..... [1]

(e) R_f values are used to identify compounds.

$$R_f = \frac{\text{distance travelled by compound}}{\text{distance travelled by the solvent}}$$

Use the diagram to work out the R_f value of compound **R**.

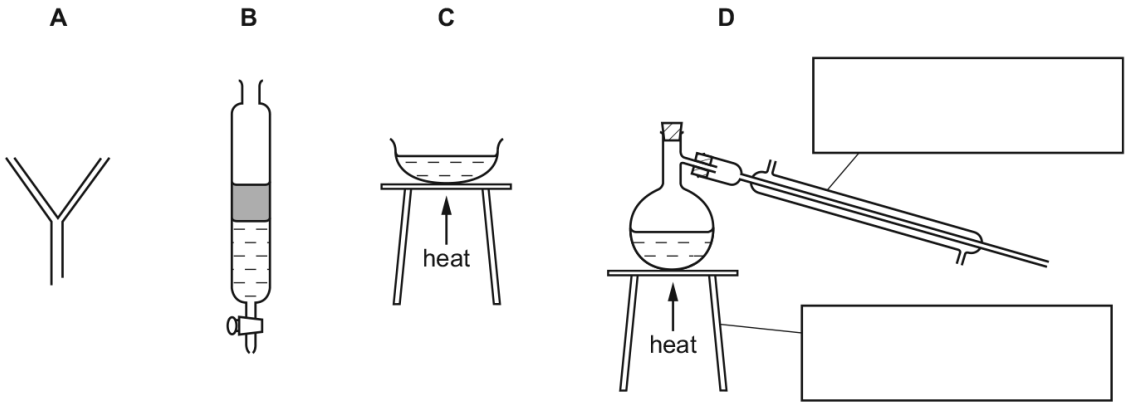
.....

..... [2]

[Total: 6]

24. 0620_w16_qp_62 Q: 1

This question is about the separation of mixtures.
The diagram shows four sets of apparatus that can be used to separate mixtures.



(a) Complete the boxes to name the apparatus. [2]

(b) The table shows four different mixtures.

Complete the table to show which set of apparatus should be used to obtain the substance listed. The first one has been completed for you. Each set of apparatus can be used once, more than once or not at all.

mixture	to obtain	use apparatus
petroleum and water	petroleum	**B**
sodium chloride dissolved in water	sodium chloride crystals	.....
sodium chloride dissolved in water	water	.....
insoluble silver chloride and water	silver chloride	.....

[3]

(c) Put a ring around the separation method that should be used to separate a mixture of coloured dyes.

centrifugation chromatography condensation evaporation

[1]

[Total: 6]

25. 0620_w16_qp_63 Q: 4

A liquid cleaner is a mixture of three substances. These substances are shown in the table.

name of substance	properties of substance
water	liquid, boiling point 100 °C
sodium carbonate	solid, soluble in water
silica	solid, insoluble in water

Plan an experiment to obtain separate pure samples of each substance from the mixture in the liquid cleaner. You are provided with common laboratory apparatus.

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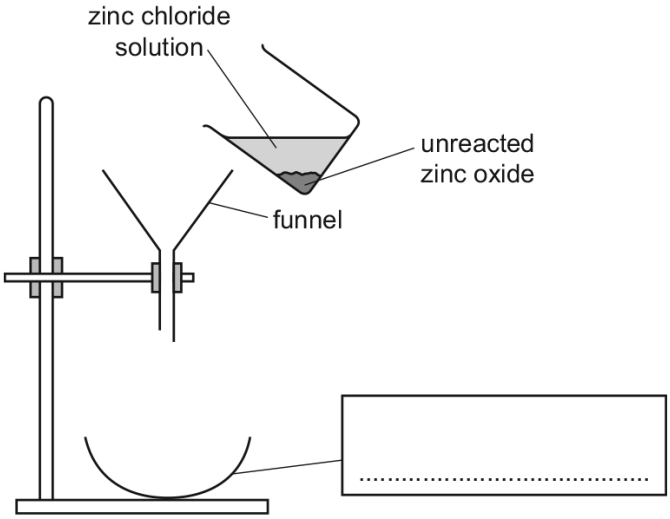
..... [6]

[Total: 6]

26. 0620_w17_qp_61 Q: 1

A student reacted dilute hydrochloric acid with zinc oxide to prepare zinc chloride solution.
The diagram shows part of the procedure.



(a) Complete the box to name the apparatus. [1]

(b) Which of the reactants was in excess?

..... [1]

(c) **(i)** Name the separation process this apparatus is used for.

..... [1]

(ii) Suggest why this apparatus would **not** work.

.....

..... [1]

(d) Describe how crystals of zinc chloride could be obtained from the zinc chloride solution.

.....

.....

..... [3]

[Total: 7]

27. 0620_w18_qp_63 Q: 4

Some cleaning products are mixtures. The three substances present in a cleaning product are listed in the table.

substance	state at room temperature	physical property
sodium carbonate	solid	melts at 858 °C
ethanol	liquid	boils at 78 °C
limonene	liquid	boils at 176 °C

Use the information in the table to plan an experiment to obtain a sample of each substance from a mixture of the three substances.

You are provided with a mixture of the three substances and common laboratory apparatus.

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..... [6]

[Total: 6]

28. 0620_w19_qp_62 Q: 4

The table gives some information about the properties of three substances found in a hand cream.

substance	reaction with dilute nitric acid
polystyrene beads	no reaction
calcium carbonate	reacts and dissolves
sodium fluoride	dissolves

Use the information in the table to plan an experiment to obtain a pure, dry sample of polystyrene beads from this mixture of substances.

You are provided with a mixture of the three substances and common laboratory apparatus.

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..... [6]

29. 0620_w20_qp_61 Q: 4

A mixture contains three solid compounds:
- copper(II) sulfate
- cetyl alcohol
- silicon dioxide.

The table gives some information on the solubility of these three solids.

name of compound	solubility in water	solubility in propanone
copper(II) sulfate	soluble	insoluble
cetyl alcohol	insoluble	soluble
silicon dioxide	insoluble	insoluble

Plan a method to obtain a pure sample of each of the three solids, copper(II) sulfate, cetyl alcohol and silicon dioxide, from the mixture.

You have access to normal laboratory apparatus.

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..... [6]

30. 0620_w20_qp_62 Q: 4

Brass is a mixture of two metals, copper and zinc.

Copper does not react with dilute sulfuric acid. Zinc reacts with hot dilute sulfuric acid to form the soluble salt zinc sulfate.

Plan an investigation to find the percentage by mass of zinc in a sample of brass.
In your answer you should include how to calculate the percentage by mass of zinc.

You have access to normal laboratory apparatus.

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..... [6]

31. 0620_w21_qp_61 Q: 4

Tartrazine is used as a yellow food colouring.

Plan an investigation to find out if a yellow sweet contains tartrazine. Explain how your results will tell you if the sweet contains tartrazine.

You have access to all normal laboratory materials, a yellow sweet and a sample of tartrazine.

You may draw a labelled diagram as part of your answer.

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..... [6]

01. 0620_m15_ms_62 Q: 6

any **seven** from:

extraction

cut leaves up / small pieces / grind / crush (1)

use of pestle / mortar (1)

add water (1)

sand (1)

boil / heat / stir / mix / shake (1)

separation

decant / filter (1)

obtaining crystals

evaporate / heat solution (1)

to crystallising point / until crystals start to form (1)

leave to cool (1) [7]

---

02. 0620_m16_ms_62 Q: 1

(a)	tripod; stirring rod / stirrer;	**2**
(b)(i)	B C A;	**1**
(b)(ii)	filtration;	**1**
(c)(i)	water;	**1**
(c)(ii)	filtrate;	**1**
(d)	solid / crystals appearing on edge / glass rod test;	**1**

03. 0620_m16_ms_62 Q: 4

	any **6** from: chromatography; (pencil) baseline / origin; apply orange colour to paper; and samples of both E110 and E129; solvent / named solvent; check heights of spots of E colours against orange drink; conclusion / allow comparison to known R_f values;	**6**

04. 0620_m18_ms_62 Q: 1

(a)(i)	line drawn on diagram between base line and bottom of paper and below dot	**1**
(a)(ii)	water	**1**
(b)	dropper / teat pipette	**1**
(c)	so mixture is above / not in contact/does not run/dissolve in solvent	**1**
(d)	is two substances / contains **D**	**1**
(e)	insoluble	**1**
(f)	2.8 to 3.2 / 5	**1**
	0.56–0.64	**1**

05. 0620_m20_ms_62 Q: 1

Question	Answer	Marks
(a)	thermometer	**1**
	(round bottom) flask	**1**
(b)	arrow to bottom entry to water jacket on condenser	**1**
(c)(i)	flammable	**1**
(c)(ii)	water bath / electric heater / heating mantle/ oil bath	**1**
(d)	cools (the vapour / alcohol)	**1**
(e)	methanol	**1**
	lowest boiling point	**1**

06. 0620_m20_ms_62 Q: 4

Question	Answer	Marks
	Any 6 from: • crush / grind root • with pestle / mortar • with water / solvent • place (drop of) liquid / colour on paper • conduct chromatography • (bottom of) paper placed in a suitable solvent / water • number of coloured substances = number of spots	**6**

07. 0620_s12_ms_61 Q: 3

(a) pestle (1) mortar (1) [2]

(b) stir/mix/shake (1) allow: heat/boil [1]

(c) diagram showing funnel (1)
indication of filter paper (1) note: labels not necessary [2]

(d) heat/evaporation (1)
to crystallising point or description (1)
in fume cupboard (1) max 2 [2]

(e) melting point/description of (1) **allow**: chromatography **ignore**: bp [1]

[Total: 8]

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08. 0620_s13_ms_62 Q: 1

(a) pestle and / or mortar (1) filter / funnel (1) [2]

(b) **(i)** labelled arrow at liquid in mortar (1)

(ii) labelled arrow at liquid in either tube or liquid in funnel or any combination (1) [2]

(c) **(i)** top line labelled (1) [1]

(ii) three (1) [1]

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09. 0620_s13_ms_63 Q: 6

variety of ways that could be used

generally appropriate solvent for named solid (1)

evaporate off solvent (1)

mention of these three terms at least once

filter (1) wash (1) dry (1)

appropriate solvent for second named solid (1) and filter

lastly wash and dry remaining solid (1)

example; add cyclohexane to the mixture to dissolve **W** (1)

filter (1) wash (1)

evaporate off cyclohexane (1)

to residue add cold water to dissolve **Y** (1) evaporate off water (1)

wash (1) dry (1) residue is **X** (1)

max 6 [6]

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10. 0620_s14_ms_61 Q: 1

(a) thermometer (1)

condenser (1)
allow condensing tube, condensating tube, etc. [2]

(b) arrows labelled – water (in) and water (out) (1) [1]

(c) fractional (1)

distillation (1) [2]

(d) **(i)** ethanol (1) [1]

(ii) temperature would rise (above 78 °C) (1) [1]

(e) alcohols are (in)flammable / catch fire / burn (1)
ignore: explode

Bunsen burner / flame / heat (1) [2]

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11. 0620_s15_ms_61 Q: 3

(a)	base line / origin clearly labelled on diagram;	**1**	
(b)	any organic solvent / ethanol / alcohol / acetone;	**1**	**R** water / acids
(c)	3;	**1**	
(d)	1 and 3 present; 2 not present; unknown dye present;	**3**	**I** reference to properties of dyes 1, 2 and 3
(e)	repeat the experiment / use a different solvent / measure R_f values;	**1**	

12. 0620_s15_ms_62 Q: 1

(a)	stand; thermometer;	**2**	
(b)	initial temperature (of water) / room temperature / temperature change; initial mass of burner / ethanol; final mass of burner / ethanol;	**3**	
(c)	half / lower temperature change / water would take longer to heat up / slower;	**1**	
(d)	higher temperature change / water would heat up quicker / copper is a better conductor;	**1**	**I** less heat loss **I** comments on strength of copper

13. 0620_s18_ms_63 Q: 4

	any **6** from: □ cut leaves into small pieces □ grind / crush with sand / ethanol □ using pestle/mortar □ decant / pour-off / filter liquid □ chromatography □ apply extract to paper (in correct location) □ description of separating colours	**Max 6**

14. 0620_s19_ms_61 Q: 2

(a)	table of results volumes of aqueous sodium carbonate boxes completed correctly 1, 2, 4, 5, 6, 7, 8 (1) heights of solid boxes completed 12, 24, 48, 60, 73, 73, 73 (1) in mm (1)	**3**
(b)	x-axis labelled as "volume of aqueous sodium carbonate / cm^3 (1) all 7 points plotted correctly (2) two intersecting straight line graphs drawn with a ruler (1)	**4**
(c)	working shown on graph in correct place (1) value from graph (1)	**2**
(d)	height increases / proportional to volume / more solid (1) level off / becomes constant (1)	**2**
(e)	same heights / at 73 mm (1) all barium nitrate reacted (1)	**2**
(f)	use burette / pipette to measure out aqueous barium nitrate / instead of measuring cylinder	**1**
(g)	filter (1) dry (1) weigh solid (1)	**3**
(h)	repeat **and** compare	**1**

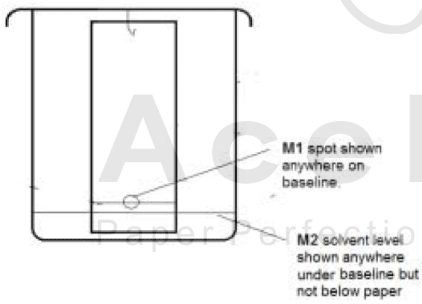
15. 0620_s19_ms_63 Q: 1

(a)	to prevent evaporation / loss of solvent	1
(b)(i)	solvent level above spots / hair dye samples	1
(b)(ii)	dyes would mix / dissolve with solvent / wash off paper	1
(c)	organic solvent / named organic solvent	1
(d)	any **three** from: □ R contains P / Q □ R is a mixture / contains 2 colours □ P is a single colour / pure substance □ Q is a single colour / pure substance □ P and Q are different colours	max 3

16. 0620_s20_ms_61 Q: 1

Question	Answer	Marks
(a)	spots / baseline below solvent level	1
	baseline drawn in ink	1
(b)(i)	black	1
(b)(ii)	yellow (and) blue	1
(b)(iii)	use an organic solvent / different solvent	1

17. 0620_s21_ms_61 Q: 1

Question	Answer	Marks
(a)	**A** mortar	1
	B tripod	1
	C (filter) funnel	1
(b)(i)		1 1
(b)(ii)	pencil is not soluble / pencil does not run / smudge / dissolve / change results	1
(c)(i)	two	1
(c)(ii)	anthocyanin	1

18. 0620_s21_ms_62 Q: 1

Question	Answer	Marks
(a)	**A** glass / stirring rod	1
	B (conical) flask	1
(b)	filtration	1
(c)	filtrate	1
(d)	step 4: wash / rinse (with water)	1
	to remove sodium sulfate / sodium chloride	1
	step 5: dry	1
	water	1

19. 0620_s21_ms_63 Q: 1

Question	Answer	Marks
(a)	**A** spatula	1
	B tripod	1
(b)(i)	to increase the rate of reaction	1
(b)(ii)	Bunsen (burner)	1
(c)	cobalt(II) oxide **and** solid left at end	1
(d)(i)	filtration	1
d(ii)	heat (to evaporate water)	1
	until half evaporated / point of crystallisation / until saturated (then leave to cool)	1

20. 0620_w13_ms_62 Q: 2

(a) chromatography (1) [1]

(b) 3 dots above the line and must be vertical (1)
1 dot on base-line (1) [2]
allow: 1 mark for 4 dots above the base-line and must be vertical

(c) interferes with results / ink spreads / ink is soluble / owtte (1) [1]

(d) dyes would wash off / dissolves in propanone (1) [1]

21. 0620_w14_ms_61 Q: 3

(a) **(i)** chromatography (1) [1]

(ii) to prevent loss / evaporation of solvent (1) [1]

(b) when the solvent is near the top of the paper / before the solvent reaches the top of the paper (1) [1]

(c) (i) 4 (1) [1]

(ii) yes, one artificial dye (1)
at same height / matches (1) [2]

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22. 0620_w15_ms_61 Q: 6

	7 from: • weighed amount / *x*g of toothpaste; • add water; • stir / heat; • filter (to obtain calcium carbonate); • wash; • dry; • weigh residue; • calculate percentage calcium carbonate;	7	

23. 0620_w15_ms_62 Q: 2

(a)	chromatography;	1	
(b)	(teat) pipette / capillary tube;	1	**A:** dropper / glass rod
(c)	water / organic solvent;	1	
(d)	compound Q is insoluble;	1	**R:** it reacts with the solvent
(e)	between (4.7 and 5.1) divided by (6.2 or 6.3); answer: between 0.74 and 0.82;	1 1	correct answer with no working scores 2

24. 0620_w16_ms_62 Q: 1

(a)	(liebig) condenser tripod	1 1
(b)	sodium chloride crystals: **C** water: **D** silver chloride: **A**	1 1 1
(c)	chromatography	1

25. 0620_w16_ms_63 Q: 4

	silica filter (the cleaner) wash the residue dry the residue **water** heat (the filtrate / cleaner) condense the vapour **sodium carbonate** heat to dryness / no liquid left (then solid) sodium carbonate is left **OR** heat until saturated then cool to crystallise / leave to crystallise	6

26. 0620_w17_ms_61 Q: 1

(a)	evaporating basin / dish	1
(b)	zinc oxide	1
(c)(i)	filtration	1
(c)(ii)	no filter paper	1
(d)	heat / boil / evaporate	1
	to crystallising point	1
	cool / leave to stand	1

27. 0620_w18_ms_63 Q: 4

	marks may be awarded from labelled diagrams **Ignore any process done to single substances**. If candidates make the mixture up for themselves then carry on marking. **Method 1** 1 heat the mixture 2 using a Bunsen / electric heater / oil bath 3 in a suitable container (flask / boiling tube / test-tube) 4 ethanol boils / evaporates first / at 78 °C 5 limonene boils next / at 176 °C (and collects / condenses) 6 use of the term (fractional) distillation 7 use of a condenser 8 sodium carbonate residue left	**max 6**
	Method 2 (assuming sodium carbonate does not dissolve 1 filter (to obtain sodium carbonate) 2 heat the filtrate 3 using a Bunsen / electric heater / oil bath 4 in a suitable container (flask / boiling tube / test-tube) 5 ethanol boils / evaporates first / at 78 °C 6 limonene boils next / at 176 °C (and collects / condenses) / is the residue 7 use of the term (fractional) distillation 8 use of a condenser	**max 6**
	Method 3 (assuming sodium carbonate does not dissolve and liquids do not mix). 1 filter (to obtain sodium carbonate) 2 use of separating funnel 3 run / let one liquid out 4 by opening the tap 5 leave other liquid in separating funnel	**max 5**

28. 0620_w19_ms_62 Q: 4

	any six from: □ add dilute nitric acid to the mixture □ in named container □ stir □ until reaction stops / fizzing stops / excess acid □ filter □ wash residue with water □ dry residue between pressed filter papers / drier	**max 6**

29. 0620_w20_ms_61 Q: 4

Question	Answer	Marks
	M1 whatever method is used, suitable apparatus – such as a flask or beaker – has been used. *Copper(II) sulfate first* **M2** add water (to dissolve copper sulfate) **and** later adds propanone (to dissolve cetyl alcohol) **M3** stir / swirl / mix **M4** filter (to remove silicon dioxide and cetyl alcohol) **M5** evaporate solvent from filtrate or description. This must be done for the solutions obtained using both solvents. **M6** filter and wash / rinse residue after adding the second solvent **M7** dry residue (silicon dioxide) **OR** *cetyl alcohol first* **M2** add propanone (to dissolve cetyl alcohol) **and** later adds water (to dissolve copper(II) sulfate) **M3** stir / swirl / mix **M4** filter (to remove silicon dioxide and copper(II) sulfate) **M5** evaporate solvent from filtrate or description. This must be done for the solutions obtained using both solvents. **M6** filter and wash residue after adding the second solvent **M7** dry residue (silicon dioxide) **max 6**	**6**

30. 0620_w20_ms_62 Q: 4

Question	Answer	Marks
	Any 6 from: • weigh brass / known mass of brass • add (dilute) sulfuric acid and heat / hot / warm • excess acid • filter • wash and dry residue / solid • weigh (copper) residue / solid (copper) • percentage zinc calculated correctly	**6**

31. 0620_w21_ms_61 Q: 4

Question	Answer	Marks
	any six from: • dissolve sweet in solvent/water • carry out chromatography • place spot of sweet solution on chromatography paper • place spot of tartrazine on same level/baseline • place/stand paper in solvent/water • let solvent rise to near top of paper • compare height of spot from sweet and tartrazine, if the same sweet contains tartrazine **OR** • compare R_f value of spot from sweet with R_f for tartrazine, if the same then sweet contains tartrazine **max 6**	**6**