Topical Past Paper Questions Workbook

IGCSE Chemistry (0620) Paper 6

[Alternative to Practical]

Exam Series: May 2012 – March 2022

Format Type B:
The answer to each question is provided right after the question

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Introduction

Each topical past paper questions workbook consists of hundreds of questions and their answer schemes, in the form of worksheets. Questions are assigned to each chapter according to their corresponding topic. Topics, in turn, are based on the items of the latest Cambridge IGCSE or AS/A level syllabus content. This book's specifications are as follows:

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Chapter 1

Experimental techniques

1.1 Measurement

1. 0620_m22_qp_62 Q: 4

Fizzy drinks contain carbon dioxide gas dissolved in a liquid. The carbon dioxide gas can be removed from the fizzy drink by heating.

Plan an investigation to find the volume of carbon dioxide gas in 1 dm^3 of a fizzy drink.
Include in your answer how you will calculate the volume of carbon dioxide gas dissolved in 1 dm^3 of a fizzy drink.

You are provided with a small sample (less than 1 dm^3) of the fizzy drink and common laboratory apparatus.
(1 dm^3 = 1000 cm^3)

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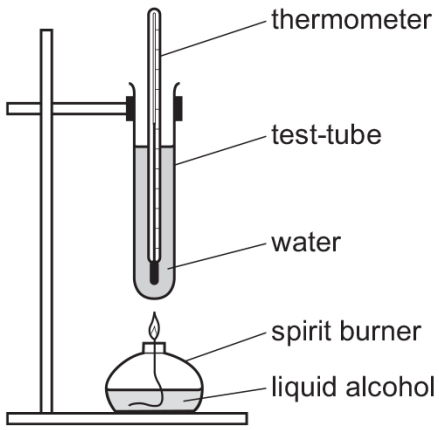
..... [6]

Answer:

Question	Answer	Marks
	1 mark each for any 6 from: • known/specified volume of fizzy drink • warmed/heated • in a suitable container • gas collected in inverted measuring cylinder over water or in a (gas) syringe • until no more gas collected / all carbon dioxide given off / no more bubbles • volume of gas measured / recorded • volume of gas in 1 dm^3 = volume collected × 1000 / volume used	**6**

2. 0620_s21_qp_63 Q: 4

The energy given out when different liquid alcohols are burned can be compared using the apparatus shown.



Describe how the apparatus shown can be used to compare the amount of energy given out by three different liquid alcohols, ethanol, propanol and butanol. Your answer should include how the results can be used to determine which fuel gives out the most energy.

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..... [6]

Answer:

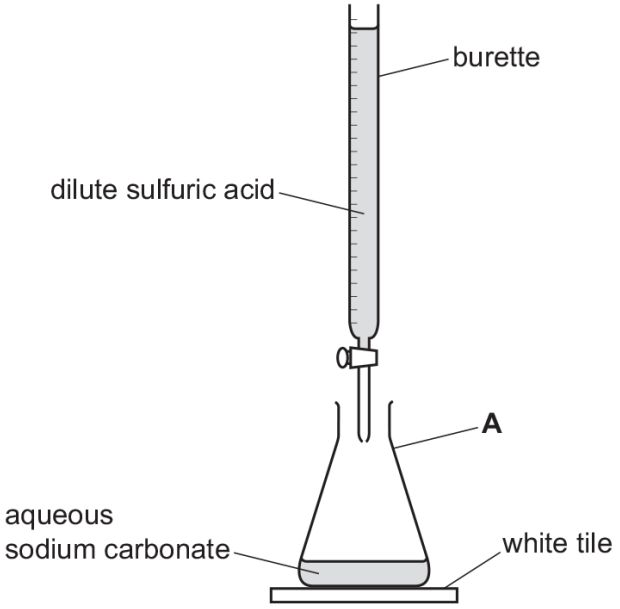
Question	Answer	Marks
	any 6 from: • specified / set volume / mass of water • measure start temperature of water • heat water using sprit burner for all three fuels **and** • start timing when heating started • heat to set temperature / set temperature rise • record time • shortest time gives out most energy **OR** • measure mass of fuel (plus spirit burner) at start • heat to set temperature / set temperature rise • measure mass of fuel (plus sprit burner) at end (and subtract from first mass to fine mass of fuel used) • smallest mass used gives out most energy **OR** • put specified mass / volume of fuel in spirit burner • burn until burner goes out • measure final temperature of water and calculate temperature rise • highest temperature (rise) gives out most energy **OR** • heat water for a specified time • measure final temp of water • calculate temperature rise • highest temperature (rise) is fuel that gives out most energy	**6**

3. 0620_w21_qp_61 Q: 1

A student investigated the volume of dilute sulfuric acid that would react with 25.0 cm^3 of aqueous sodium carbonate.

- A burette was rinsed with water and then with dilute sulfuric acid.
- The burette was filled with dilute sulfuric acid. Some of the dilute sulfuric acid was run out of the burette so that the level of the dilute sulfuric acid was on the burette scale.
- 25.0 cm^3 of aqueous sodium carbonate was poured into the apparatus labelled **A** in the diagram.
- Five drops of methyl orange indicator were added to the aqueous sodium carbonate in **A**.
- The apparatus labelled **A** was placed on a white tile.
- The dilute sulfuric acid was added slowly to the 25.0 cm^3 of aqueous sodium carbonate until the colour of the methyl orange changed from yellow to orange.

The apparatus was arranged as shown in the diagram.



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

..... [1]

(b) State **one** safety precaution that should be taken when using dilute sulfuric acid.

..... [1]

(c) Give a reason why the white tile is used.

..... [1]

(d) Describe what should be done to the apparatus labelled **A** as the dilute sulfuric acid is added to the aqueous sodium carbonate.

..... [1]

(e) State why the burette was rinsed with water and then with dilute sulfuric acid at the start of the experiment.

water .....

.....

dilute sulfuric acid .....

.....

[2]

[Total: 6]

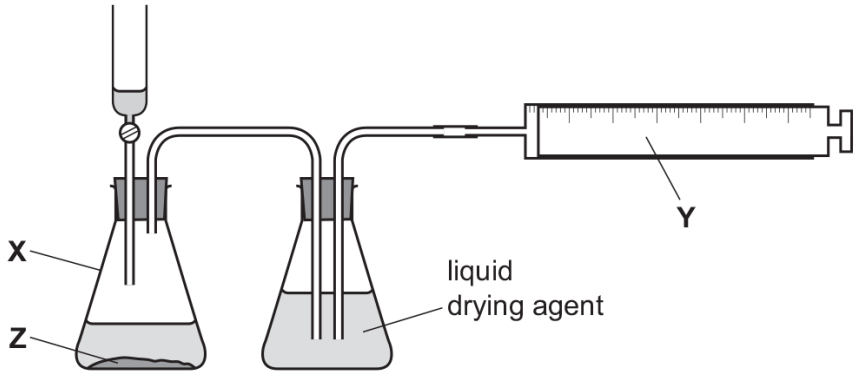
Answer:

Question	Answer	Marks
(a)	(conical) flask	1
(b)	safety glasses/goggles/gloves/lab coat	1
(c)	to see colour change clearly/easily/accurately/better	1
(d)	swirl the flask	1
(e)	water: to clean / to remove residue from previous experiment	1
	acid: to remove the water	1

4. 0620_w21_qp_63 Q: 1

Hot concentrated hydrochloric acid reacts with solid manganese(IV) oxide to make chlorine gas. Chlorine gas can be dried by bubbling it through a liquid drying agent.

The diagram shows the apparatus used to make and collect a sample of dry chlorine gas. There is one error in the diagram.



(a) Name the items of apparatus labelled **X** and **Y**.

X .....

Y .....
[2]

(b) Name the substance labelled **Z**.

..... [1]

(c) **On the diagram** draw **one** arrow to show where heat should be applied so that chlorine gas is made. [1]

(d) There is one error in the way the apparatus has been set up.

(i) **On the diagram** draw a circle around the error in the apparatus. [1]

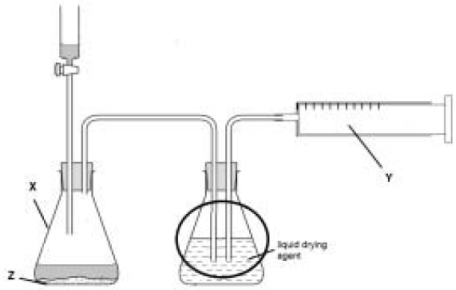
(ii) Describe what would happen if the apparatus is used before the error is corrected.

.....

..... [1]

[Total: 6]

Answer:

Question	Answer	Marks
(a)	**X** (conical) flask	**1**
	Y (gas) syringe	**1**
(b)	**Z** manganese(IV)oxide	**1**
(c)	arrow under and pointing at left hand conical flask	**1**
(d)(i)		**1**
(d)(ii)	liquid / drying-agent pushed out of flask	**1**

5. 0620_s20_qp_63 Q: 2

A student investigated the temperature change when aqueous sodium hydroxide neutralises dilute hydrochloric acid. The equation for the reaction is shown.

$$NaOH + HCl \rightarrow NaCl + H_2O$$

Eight experiments were done.

Experiment 1
- A polystyrene cup was placed into a 250 cm^3 beaker for support.
- Using a measuring cylinder, 5 cm^3 of aqueous sodium hydroxide was poured into the polystyrene cup.
- Using a measuring cylinder, 45 cm^3 of dilute hydrochloric acid was poured into the polystyrene cup.
- The mixture was stirred and the maximum temperature reached was measured using a thermometer.
- The polystyrene cup was rinsed with distilled water.

Experiment 2
- Experiment 1 was repeated using 10 cm^3 of aqueous sodium hydroxide and 40 cm^3 of dilute hydrochloric acid.

Experiment 3
- Experiment 1 was repeated using 15 cm^3 of aqueous sodium hydroxide and 35 cm^3 of dilute hydrochloric acid.

Experiment 4
- Experiment 1 was repeated using 20 cm^3 of aqueous sodium hydroxide and 30 cm^3 of dilute hydrochloric acid.

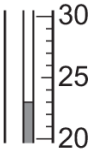
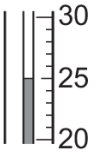
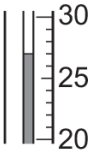
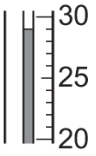
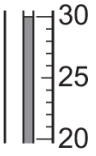
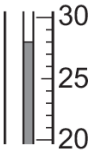
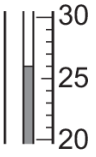
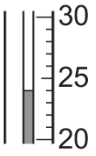
Experiment 5
- Experiment 1 was repeated using 30 cm^3 of aqueous sodium hydroxide and 20 cm^3 of dilute hydrochloric acid.

Experiment 6
- Experiment 1 was repeated using 35 cm^3 of aqueous sodium hydroxide and 15 cm^3 of dilute hydrochloric acid.

Experiment 7
- Experiment 1 was repeated using 40 cm^3 of aqueous sodium hydroxide and 10 cm^3 of dilute hydrochloric acid.

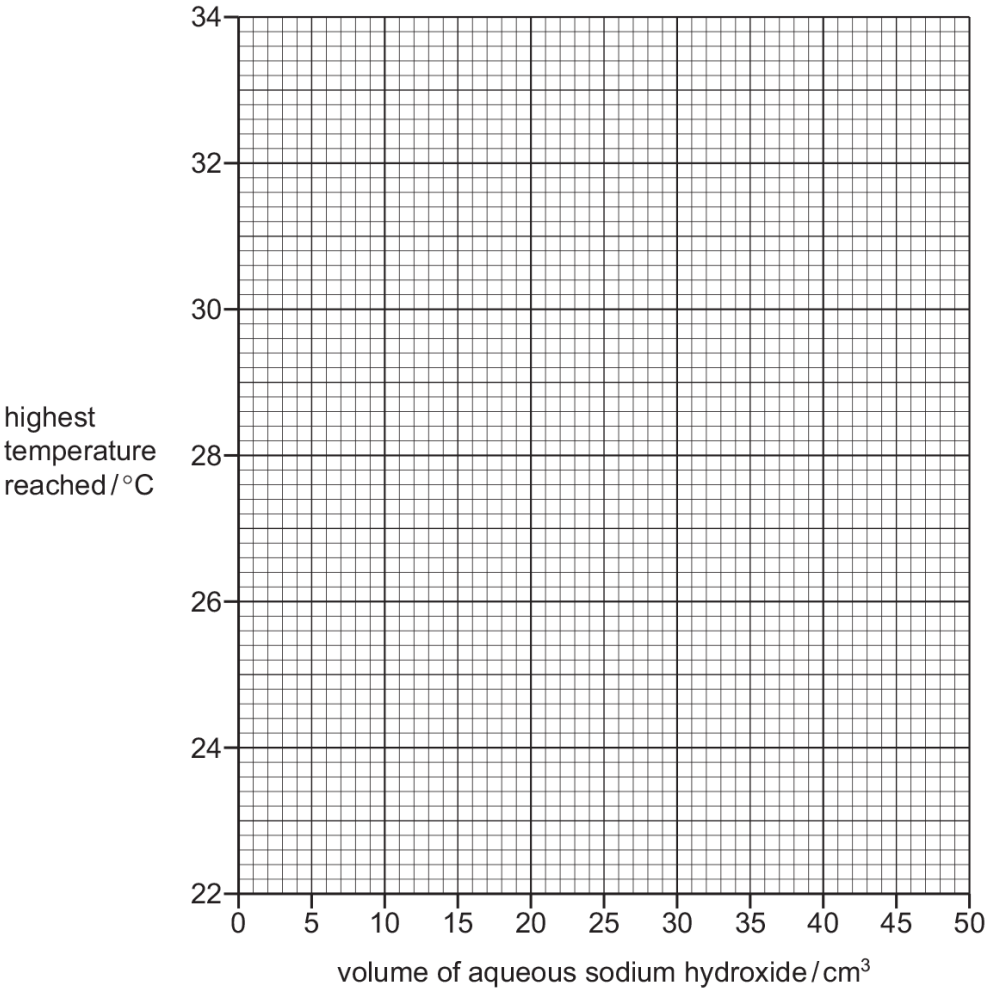
Experiment 8
- Experiment 1 was repeated using 45 cm^3 of aqueous sodium hydroxide and 5 cm^3 of dilute hydrochloric acid.

(a) Use the information in the description of the experiments and the thermometer diagrams to complete the table.

experiment	volume of aqueous sodium hydroxide / cm^3	volume of dilute hydrochloric acid / cm^3	thermometer diagram	highest temperature reached / °C
1	5			
2	10			
3	15			
4	20			
5	30			
6	35			
7	40			
8	45			

[4]

(b) Plot the results from Experiments 1 to 8 on the grid. Draw **two** straight lines through the points. Extend your straight lines so that they cross.



[4]

(c) The point on the graph where the two straight lines cross is where all of the aqueous sodium hydroxide reacts with all of the dilute hydrochloric acid to form a neutral solution.

(i) **Use your graph** to deduce the volume of aqueous sodium hydroxide and the volume of dilute hydrochloric acid that react together to produce a neutral solution.
Show your working **on the grid**.

volume of aqueous sodium hydroxide = ... cm^3

volume of dilute hydrochloric acid = ... cm^3
[3]

(ii) **Use your graph** to determine the highest temperature reached if the volumes in **(c)(i)** were mixed together.

highest temperature reached = ... [2]

(iii) Which solution, aqueous sodium hydroxide or dilute hydrochloric acid, was the most concentrated?
Use your answer to **(c)(i)** to explain why.

most concentrated solution .....

explanation .....

.....
[1]

(d) **On the graph**, sketch the lines you would expect to obtain if a copper can was used instead of a polystyrene cup. [2]

(e) Give **one** advantage and **one** disadvantage of using a burette, instead of a measuring cylinder, to add the dilute hydrochloric acid directly into the polystyrene cup.

advantage .....

.....

disadvantage .....

.....
[2]

(f) How could the reliability of the results of this investigation be checked?

.....

..... [1]

[Total: 19]

Answer:

Question	Answer	Marks
(a)	all volumes of dilute hydrochloric acid completed correctly (45, 40, 35, 30, 20, 15, 10, 5).	**2**
	all eight temperatures completed correctly (23, 25, 27, 29, 30, 28, 26, 24)	**2**
(b)	all eight points plotted correctly	**2**
	two suitable straight lines drawn	**1**
	straight lines extended so that they cross	**1**
(c)(i)	working shown on graph from where lines cross	**1**
	volume of aqueous sodium hydroxide correct for their graph	**1**
	volume of dilute hydrochloric acid correct based on their recorded volume of sodium hydroxide	**1**

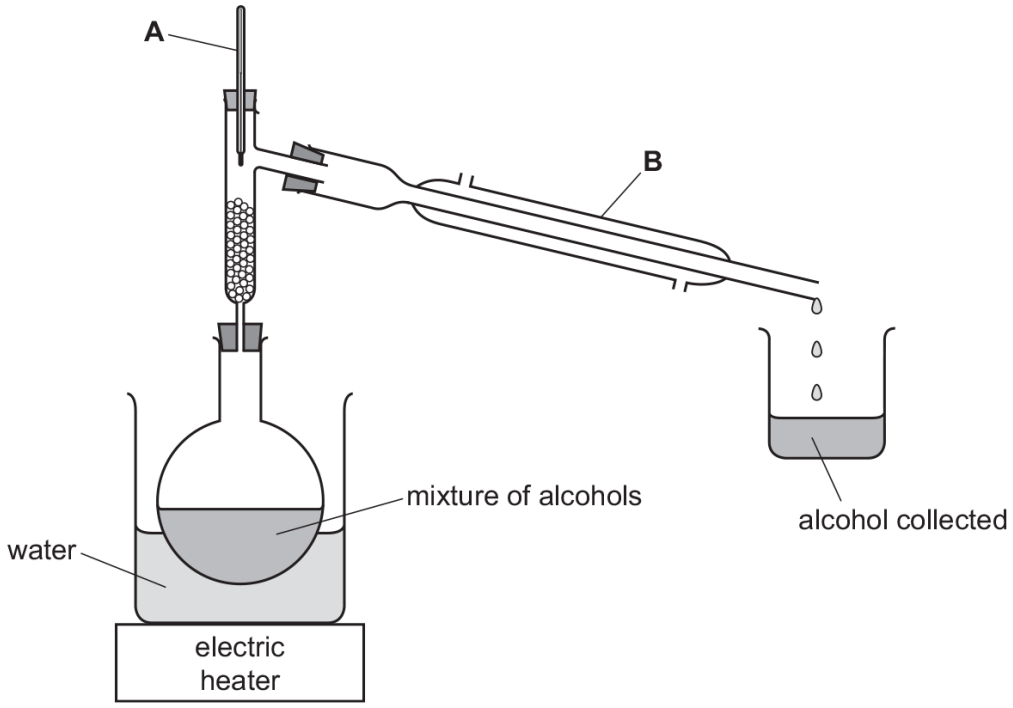
Question	Answer	Marks
(c)(ii)	correct value based on graph drawn	1
	°C	1
(c)(iii)	dilute hydrochloric acid **and** as volume less than sodium hydroxide	1
(d)	lines under plotted line	1
	maximum temperature at same volume as plotted line	1
(e)(i)	advantage: more accurate	1
	disadvantage: slower	1
(f)	repeat and compare	2

6. 0620_w20_qp_61 Q: 1

The table gives the boiling points of four alcohols.

alcohol	boiling point/°C
butanol	117
ethanol	79
pentanol	138
propanol	97

The apparatus shown can be used to obtain propanol from a mixture containing butanol, ethanol, pentanol and propanol.



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

A .....

B .....

[2]

(b) Name this method of separation.

..... [2]

(c) Explain why it is safer to heat the mixture of alcohols in the way shown rather than with a Bunsen burner.

..... [1]

(d) Describe how propanol can be obtained from the mixture. Use data from the table.

.....

.....

..... [2]

(e) Explain why the apparatus in the diagram **cannot** be used to obtain butanol from the mixture.

.....

..... [1]

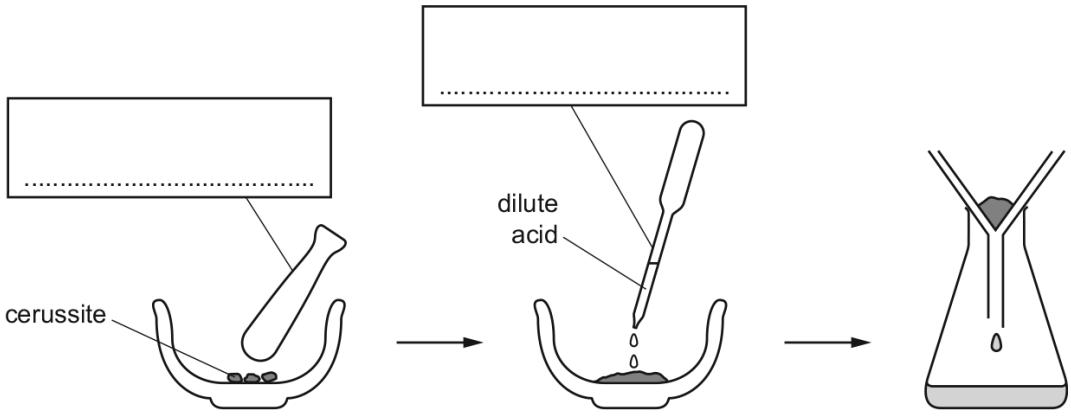
[Total: 8]

Answer:

Question	Answer	Marks
(a)	**A** thermometer	**1**
	B (Liebig) condenser	**1**
(b)	fractional	**1**
	distillation	**1**
(c)	alcohols are flammable	**1**
(d)	heat to remove the ethanol	**1**
	collect propanol at 97 °C	**1**
(e)	water boils at 100 °C / water bath will not go above 100 °C **OR** butanol boils at over 100 °C / butanol boils at 117 °C	**1**

7. 0620_w17_qp_63 Q: 1

Cerussite is a lead ore which contains lead(II) carbonate. A student obtained a solution of lead(II) nitrate from cerussite using the apparatus shown.



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

(b) Why was the cerussite crushed in **step 1**?

..... [1]

(c) Name the dilute acid used in **step 2**.

..... [1]

(d) What is the general name given to an insoluble solid left on a filter paper after filtration?

..... [1]

(e) Suggest how a sample of lead could be obtained from the solution of lead(II) nitrate.

.....

.....

.....

..... [2]

[Total: 7]

Answer:

(a)	pestle	1
	(teat) pipette	1
(b)	to increase surface area / make it dissolve faster	1
(c)	nitric (acid)	1
(d)	residue	1
(e)	**M1** add a more reactive metal (e.g. zinc / magnesium)	1
	M2 displaces lead / filter out lead	1

8. 0620_s15_qp_63 Q: 6

Methane hydrate is ice which contains trapped methane gas. Methane is released when the ice melts and is a useful fuel.
Plan an investigation to find the volume of methane gas trapped in 1 kg of this ice.
You are provided with a lump of the ice weighing between 100 g and 200 g and common laboratory apparatus.
You may include a diagram in your answer.

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..... [6]

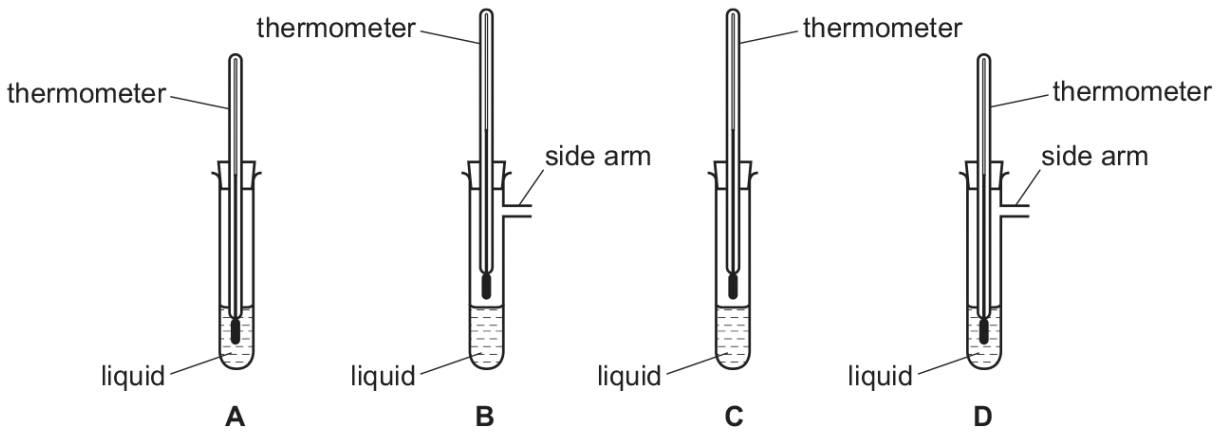
[Total: 6]

Answer:

	weighed piece of ice; melting method e.g. put into hot water; collection and measurement of gas e.g. measuring cylinder; filled with water; e.g. gas syringe (2 marks); measure volume of gas; calculate volume in 1000 g;	6	

9. 0620_w12_qp_63 Q: 1

The diagrams show four sets of apparatus, **A**, **B**, **C** and **D**.



(a) **(i)** Which set of apparatus would be most suitable to determine the boiling point of a liquid?

..... [1]

(ii) Indicate with an arrow on this diagram where heat should be applied. [1]

(b) What would be the effect if the liquid in **A** was heated strongly? Explain your answer.

effect .....

explanation ..... [2]

(c) The apparatus below can be used to prepare and collect a gas which is insoluble in water. Complete the diagram to show how this gas could be collected over water. Label the diagram.

[2]

[Total: 6]

Answer:

(a) **(i)** set B (1) **accept:** D or B and D [2]

(ii) arrow positioned anywhere towards liquid (1)

(b) effect bung shoots out/test-tube cracks/shatters/explodes (1) [2]

reference to pressure (1)

(c) diagram showing delivery tube into trough with water and collecting vessel (1) [2]

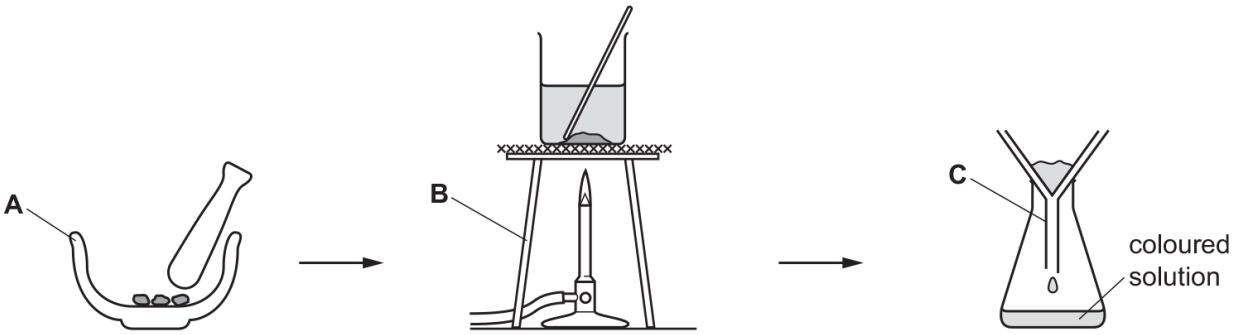
labelled (1) **note:** gas syringe = 0

1.2 Purity

10. 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 .....

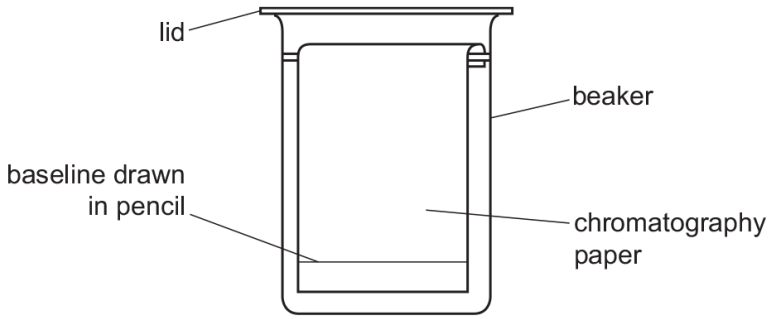
C .....

[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]

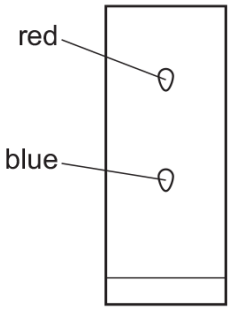
(ii) Explain why pencil is used to draw the baseline on the chromatography paper.

.....

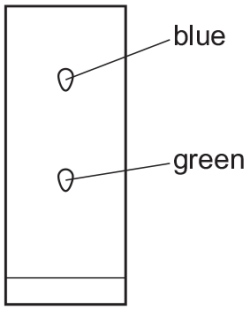
..... [1]

(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.

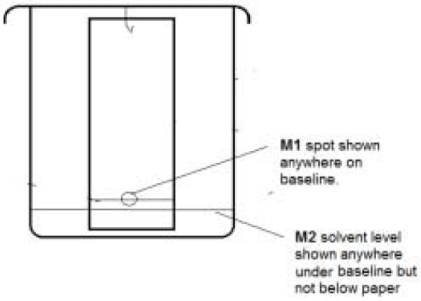
name of indicator	colour in acid	colour in alkali
anthocyanin	red	blue
bromothymol blue	yellow	blue
congo red	blue	red
methyl purple	purple	green

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

..... [1]

[Total: 8]

Answer:

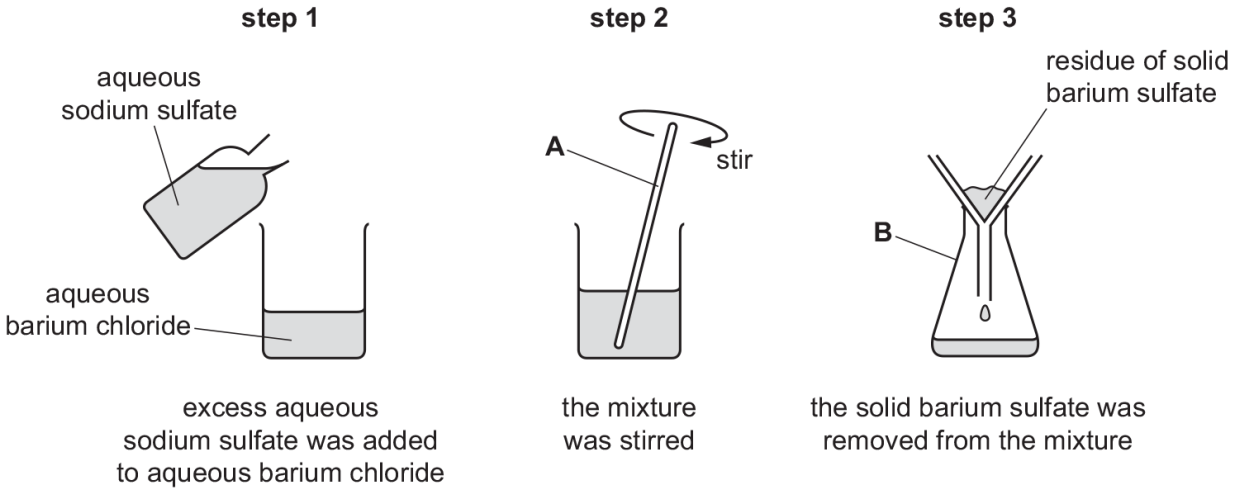
Question	Answer	Marks
(a)	**A** mortar	**1**
	B tripod	**1**
	C (filter) funnel	**1**
(b)(i)		**1** **1**
(b)(ii)	pencil is not soluble / pencil does not run / smudge / dissolve / change results	**1**
(c)(i)	two	**1**
(c)(ii)	anthocyanin	**1**

11. 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]

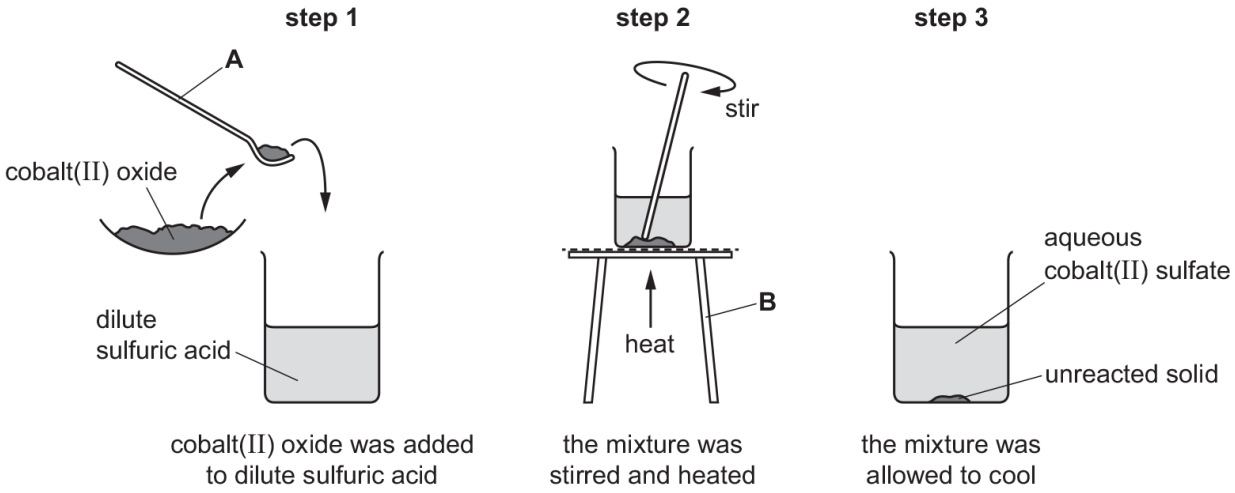
Answer:

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**

12. 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)**.

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..... [2]

[Total: 8]

Answer:

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

13. 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]

Answer:

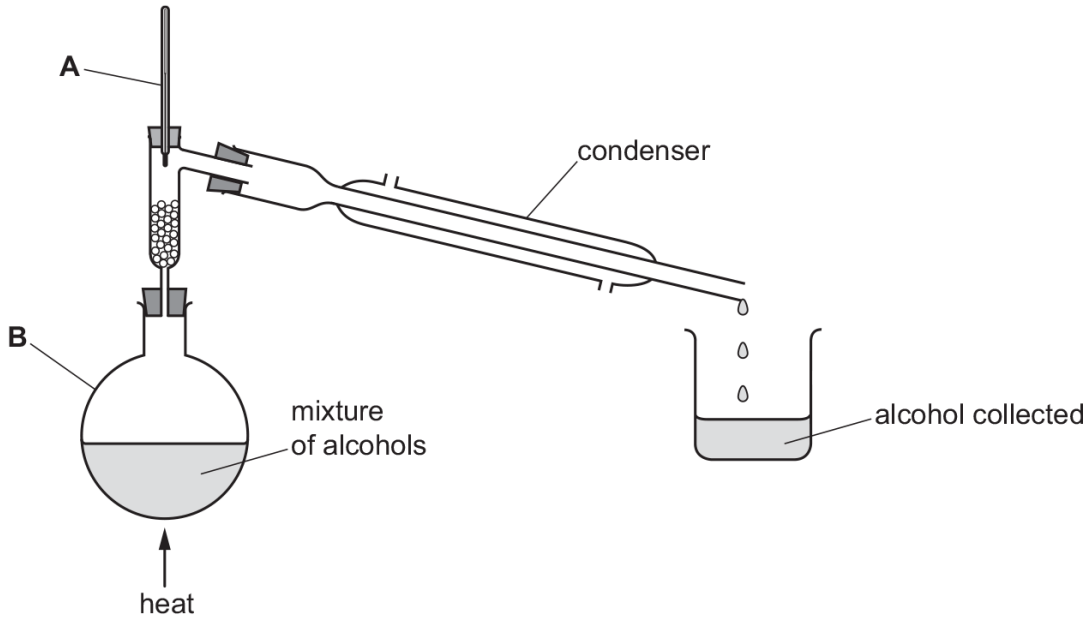
Question	Answer	Marks
	any six from: • dissolve sweet in solvent/water • carry out chromatography • place spot of sweet solution on chromatography paper • place spot of tartrazine on same level/baseline • place/stand paper in solvent/water • let solvent rise to near top of paper • compare height of spot 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**

14. 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]

Answer:

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

15. 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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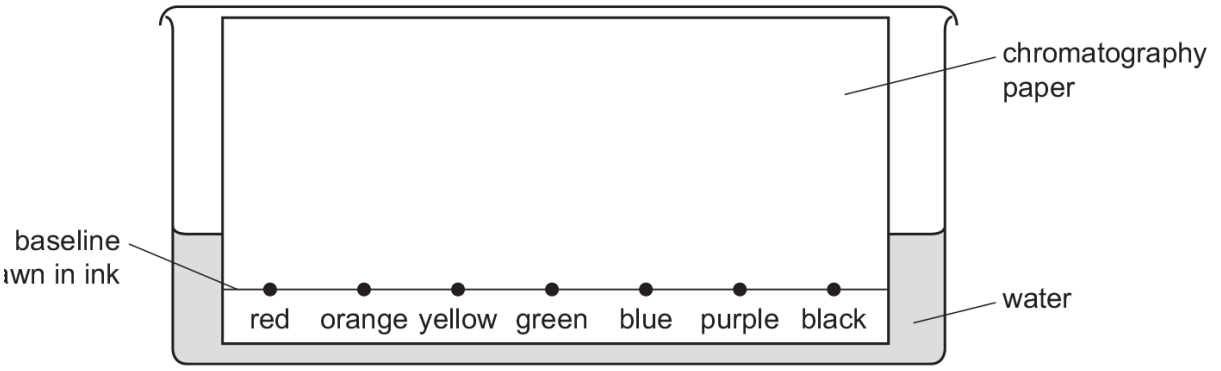
..... [6]

Answer:

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

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.

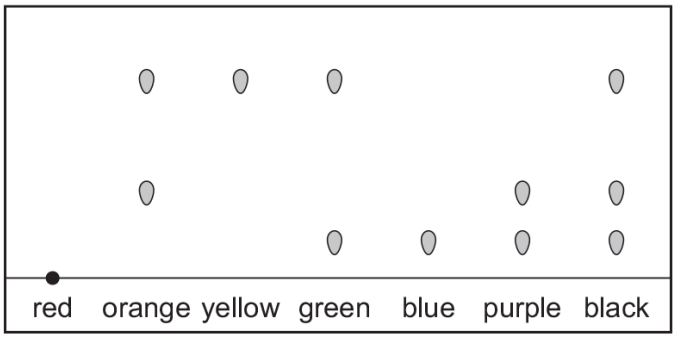
1 .....

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]

Answer:

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_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]

Answer:

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**

18. 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]

Answer:

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

19. 0620_s19_qp_61 Q: 2

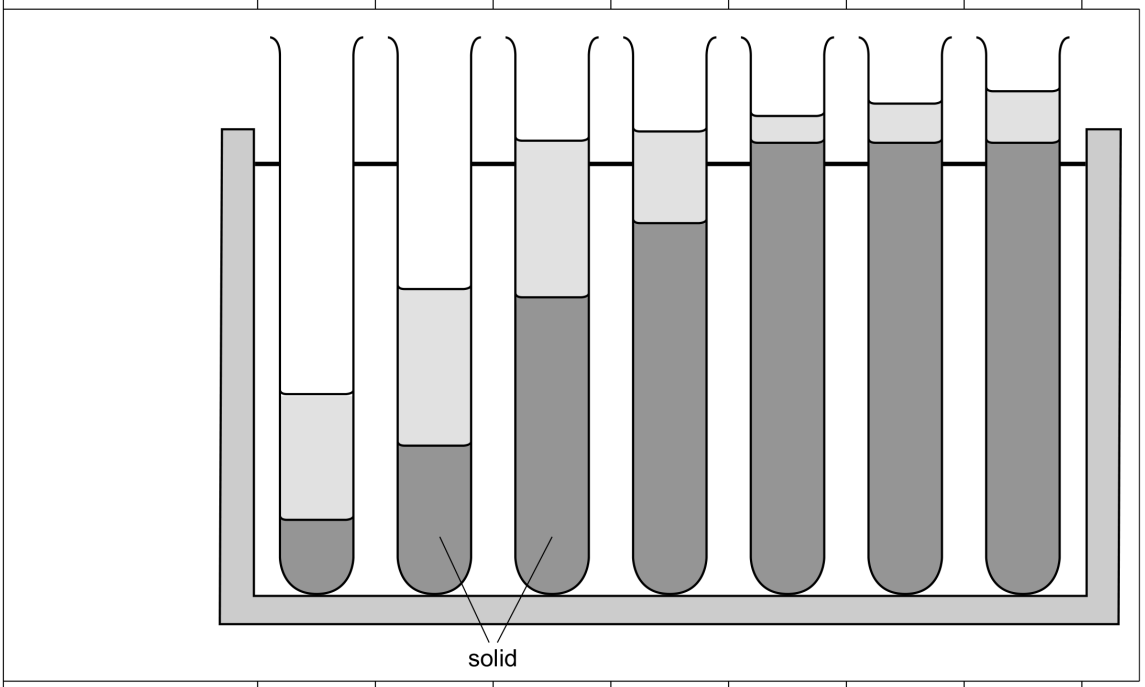
A student investigated the reaction between aqueous sodium carbonate and aqueous barium nitrate.

- 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.

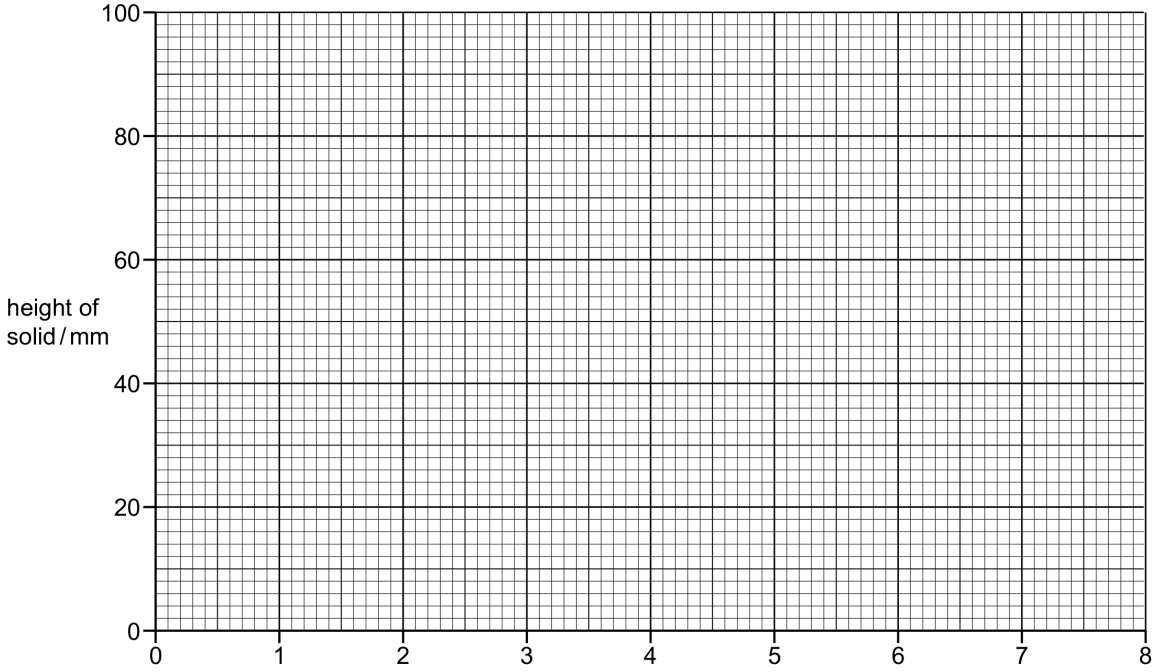
test-tube number	1	2	3	4	5	6	7
volume of aqueous sodium carbonate / cm^3							



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.

.....

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..... [3]

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

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..... [1]

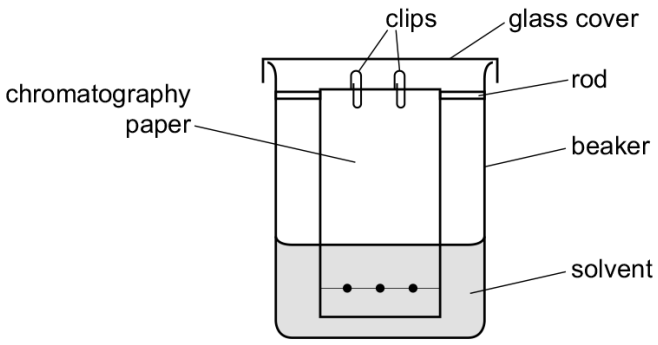
[Total: 18]

Answer:

(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**

20. 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.

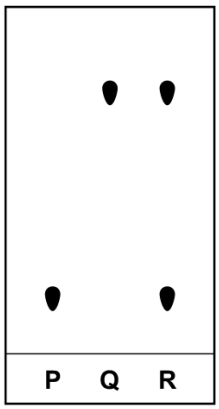
.....

..... [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]

Answer:

(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**

21. 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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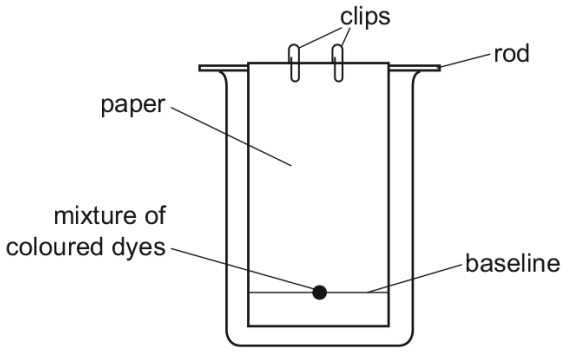
..... [6]

Answer:

	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**

22. 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?

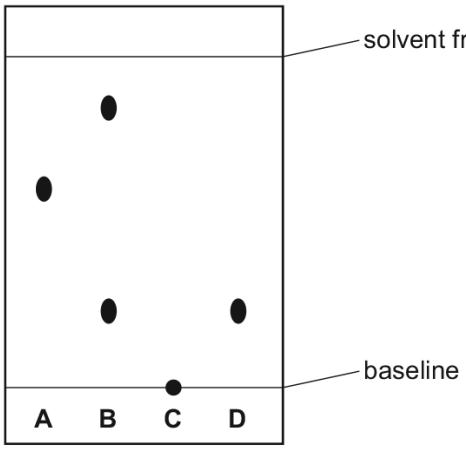
..... [1]

(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]

Answer:

(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**

23. 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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..... [6]

[Total: 6]

Answer:

	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**

24. 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]

Answer:

	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**