1.1 Measurement

01.0620_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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02. 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]

03. 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.

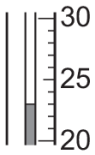
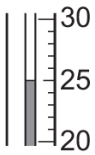
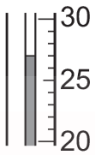
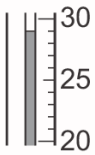
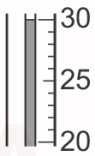
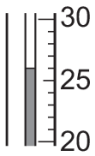
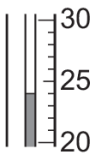
Experiment 5
- Experiment 1 was repeated using 30 cm^3 of aqueous sodium hydroxide and 20 cm^3 of dilute hydrochloric acid.

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.

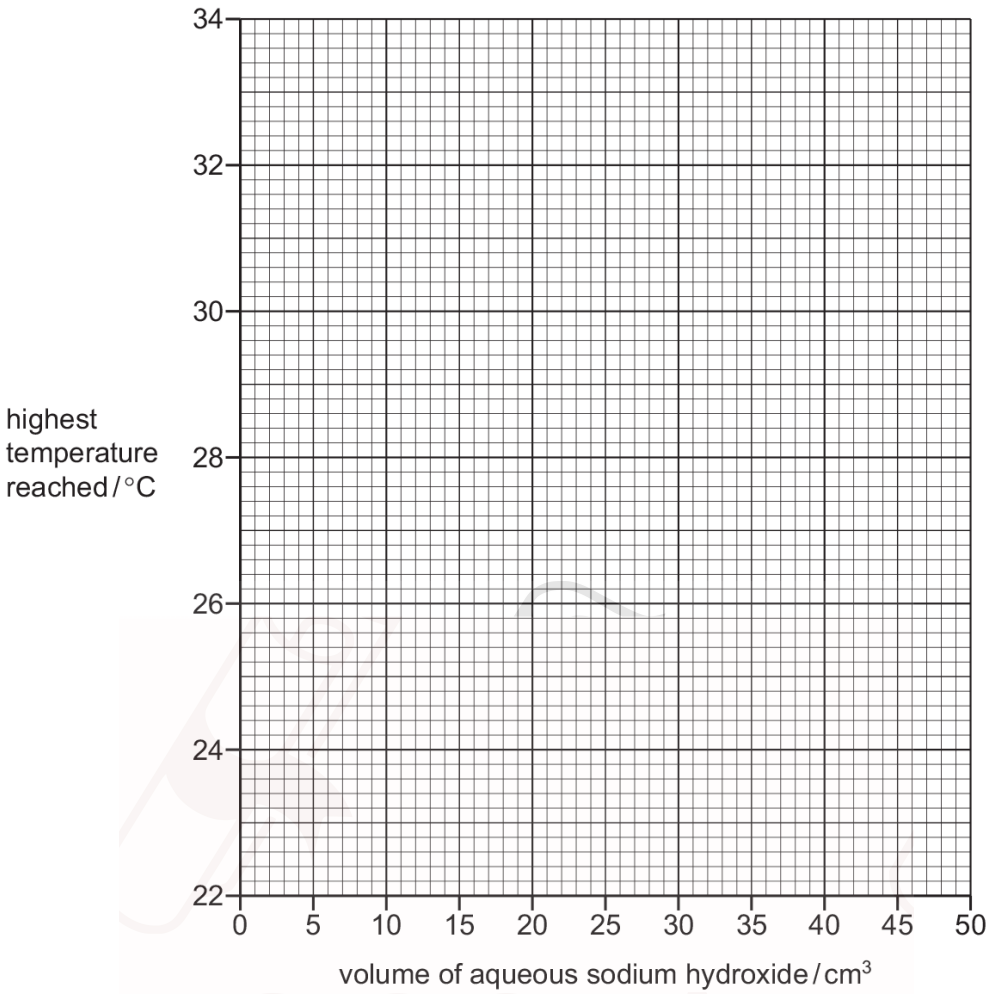
Experiment 8
- Experiment 1 was repeated using 45 cm^3 of aqueous sodium hydroxide and 5 cm^3 of dilute hydrochloric acid.

(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?

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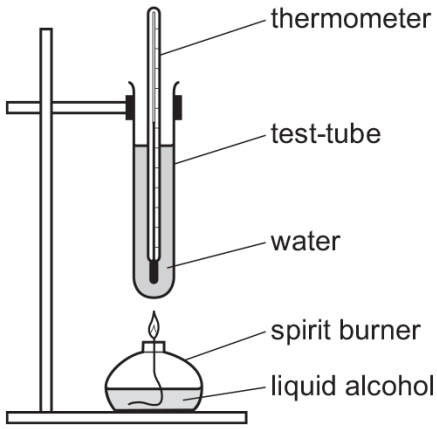
..... [1]

[Total: 19]

04. 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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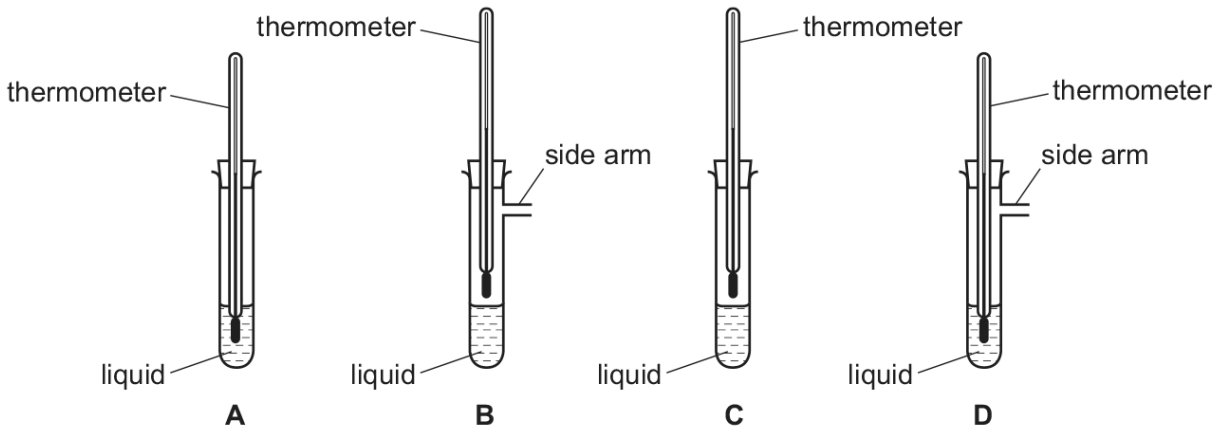
..... [6]

05. 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]

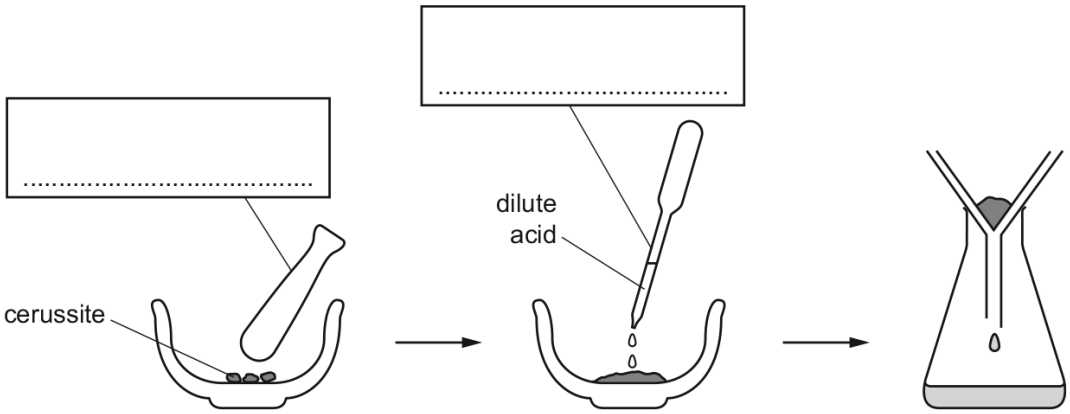
(c) The apparatus below can be used to prepare and collect a gas which is insoluble in water. Complete the diagram to show how this gas could be collected over water. Label the diagram.

[2]

[Total: 6]

06.0620_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.



step 1 **step 2** **step 3**

(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.

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..... [2]

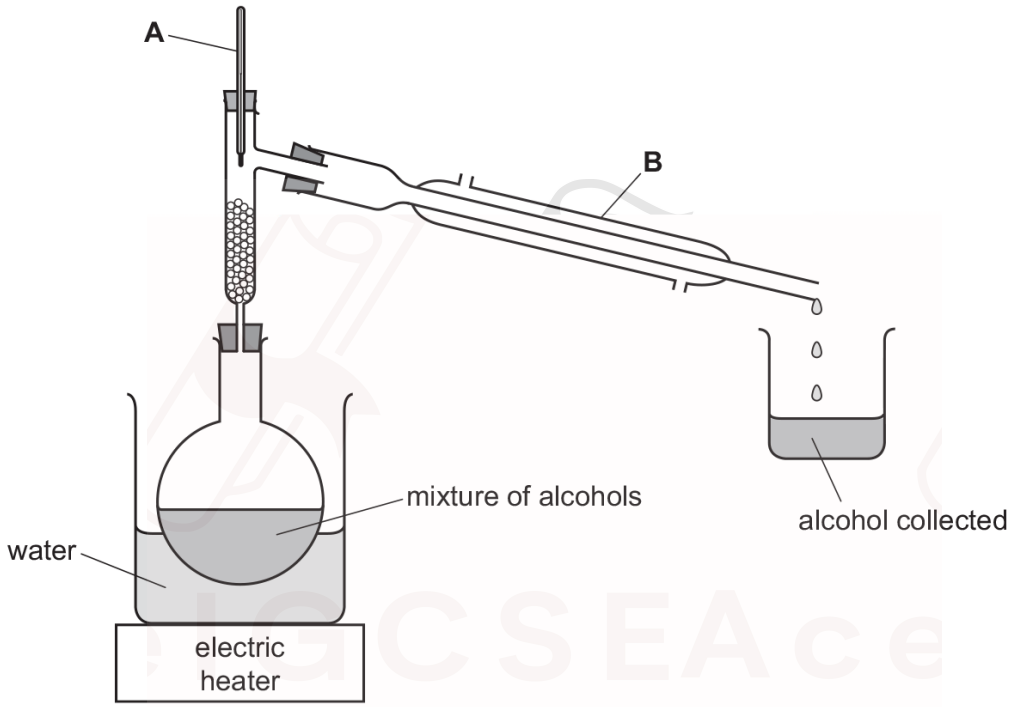
[Total: 7]

07.0620_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.

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..... [2]

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

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..... [1]

[Total: 8]

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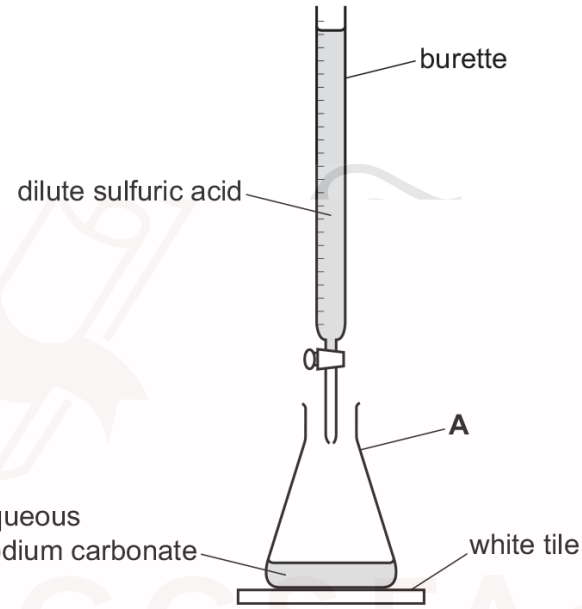
08. 0620_w21_qp_61 Q: 1

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]

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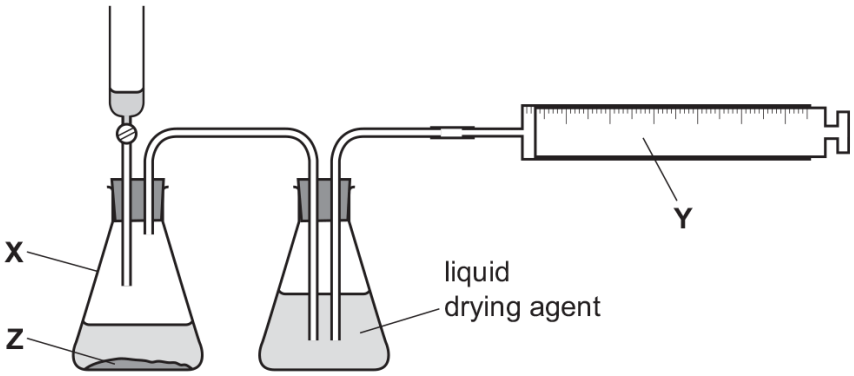
09. 0620_w21_qp_63 Q: 1

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.

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..... [1]

[Total: 6]

Appendix A

Answers

01. 0620_m22_ms_62 Q: 4

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

02. 0620_s15_ms_63 Q: 6

	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	

03. 0620_s20_ms_63 Q: 2

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

04. 0620_s21_ms_63 Q: 4

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

05. 0620_w12_ms_63 Q: 1

(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

06. 0620_w17_ms_63 Q: 1

(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

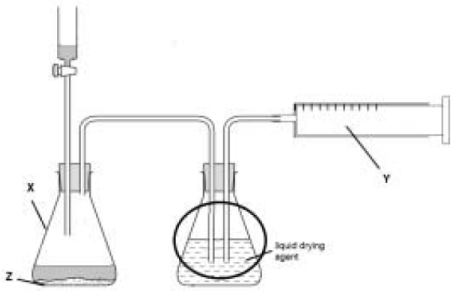
07. 0620_w20_ms_61 Q: 1

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

08. 0620_w21_ms_61 Q: 1

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

09.0620_w21_ms_63 Q: 1

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