Past-paper walk-through

Experimental design ▪ 12.1

eXercise

Questions in this set

- 0620/61 N25 Q1 ▪ 5 marks
- 0620/62 N25 Q1 ▪ 9 marks
- 0620/63 N25 Q1 ▪ 7 marks
- 0620/62 J25 Q1 ▪ 7 marks
- 0620/63 J25 Q1 ▪ 7 marks

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- // separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = "or words to that effect" – the wording need not match.

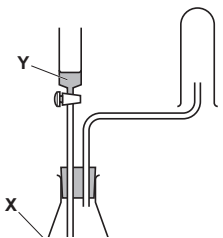
Question 1

0620/61 N25 ▪ Q1 ▪ 5 marks

1 Hot concentrated hydrochloric acid reacts with solid manganese(IV) oxide to make chlorine gas. Chlorine gas is toxic and more dense than air. Concentrated hydrochloric acid is corrosive.

Fig. 1.1 shows the apparatus used to make and collect a sample of chlorine gas.

There is **one** error in the way the apparatus has been set up in Fig. 1.1.



Question 1

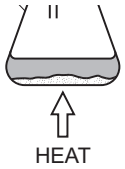


Fig. 1.1

(a) Name the item of apparatus labelled **X** in Fig. 1.1.

Question 1

(b) Identify the substance labelled **Y** in Fig. 1.1.

Question 1

(c) Name an item of apparatus that can be used to heat **X** in Fig. 1.1.

Question 1

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

Describe a change that needs to be made to the apparatus in Fig. 1.1 to correct this error.

Question 1

(e) Explain why this experiment should be carried out in a fume cupboard.

Question 1

[Total: 5]

Solution 1

(a)

Mark scheme

- (conical) flask
- 1

Solution 1

(b)

Mark scheme

- (concentrated) hydrochloric acid
- 1

Solution 1

(c)

Mark scheme

- Bunsen (burner)
- 1

Solution 1

(d) Mark scheme

- any one from:
- ▪
- collection tube needs to be the other way up
- ▪
- use downward delivery
- ▪
- use upward displacement of air
- ▪

Solution 1

- collect chlorine in a gas syringe
- 1

Solution 1

(e)

Mark scheme

- chlorine is toxic
- 1

Question 1

0620/62 N25 ▪ Q1 ▪ 9 marks

1 Eggshells are made from a mixture of calcium carbonate and other insoluble substances.

Calcium carbonate reacts with dilute hydrochloric acid. The equation for the reaction is shown.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

The other substances in eggshells do **not** react with dilute hydrochloric acid.

A student finds the percentage by mass of calcium carbonate in an eggshell.

Fig. 1.1 shows the first three steps of the method the student uses.

step 1	**step 2**	**step 3**
Grind the eggshell into small pieces.	Find the mass of the small pieces of eggshell.	Add the small pieces of eggshell to excess dilute hydrochloric acid and warm the mixture while stirring it with a glass rod.

Question 1

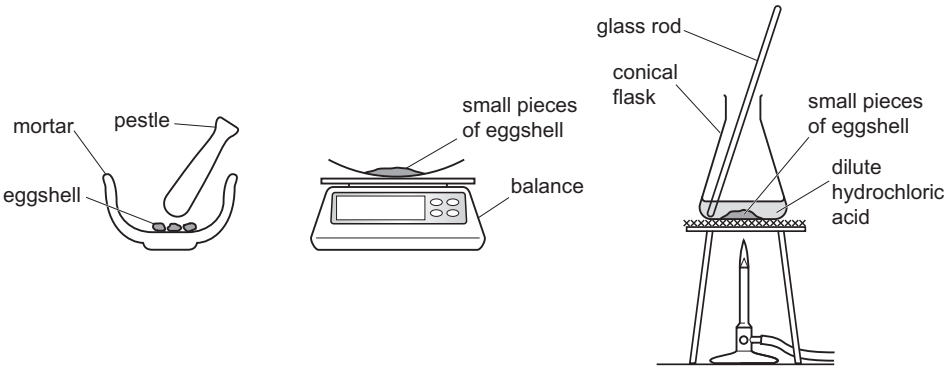


Fig. 1.1

(a) (i) Describe what is seen when the calcium carbonate in the eggshell reacts with dilute

Question 1

(d) (i) Describe what is seen when the calcium carbonate in the eggshell reacts with dilute hydrochloric acid.

Question 1

(ii) Describe what the student should do to make sure the acid is in excess and all of the calcium carbonate has reacted.

Question 1

(b) After **step 3**, the student filters the mixture to obtain the unreacted solid left from the eggshell.

(i) Draw a labelled diagram of the apparatus the student should use to filter the mixture.

Question 1

[2]

(ii) After the filtration, the student washes the residue.

Identify the **two** substances removed from the residue by washing.

Question 1

[2]

(iii) After washing the residue, the student dries the residue in an oven.
The student then measures the mass of the dry residue.

The masses the student records are shown in Table 1.1.

Table 1.1

mass of small pieces of eggshell / g	2.00
mass of dry residue after filtration / g	0.11

Use the data in Table 1.1 to calculate the percentage by mass of calcium carbonate in the eggshell.

Question 1

Question 1

Question 1

[Total: 9]

Solution 1

(a)(i)

Mark scheme

- effervescence/fizzing/bubbles
- 1

Solution 1

(a)(ii)

Mark scheme

- M1 test with universal indicator M2
- turns red/orange
- OR M1
- add (more) acid M2
- no fizzing/bubbles/effervescence
- 2

Solution 1

(b)(i)

Mark scheme

- M1 diagram showing filter paper in a funnel (both funnel and paper must be visible) M2
- labels
- 2

Solution 1

(b)(ii)

Mark scheme

- M1 (dilute) hydrochloric acid M2
- calcium chloride
- 2

Solution 1

(b)(iii)

Mark scheme

- M1 $2.00 - 0.11 = 1.89$ M2
- $(1.89 \div 2.00) \times 100 = 94.5$
- 2
- 0620/62
- October/November 2025

Question 1

0620/63 N25 ▪ Q1 ▪ 7 marks

1 A student uses the apparatus in Fig. 1.1 to show that water is formed as one of the products when a fuel is burned. The gases produced when the fuel is burned are passed through the apparatus using a suction pump.

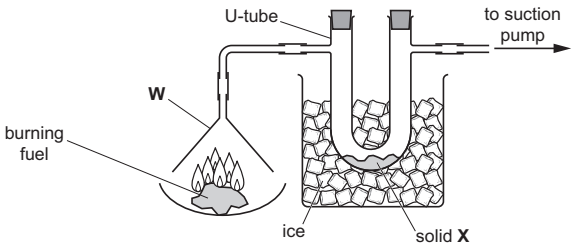


Fig. 1.1

Question 1

(a) Identify the item of apparatus labelled **W** in Fig. 1.1.

Question 1

(b) When the fuel is burned, the steam produced passes into the U-tube.

Suggest why the U-tube is surrounded by ice.

Question 1

(c) Water causes solid **X** in the U-tube to change colour.

Name solid **X** and state the colour change seen.

Question 1

Question 1

[2]

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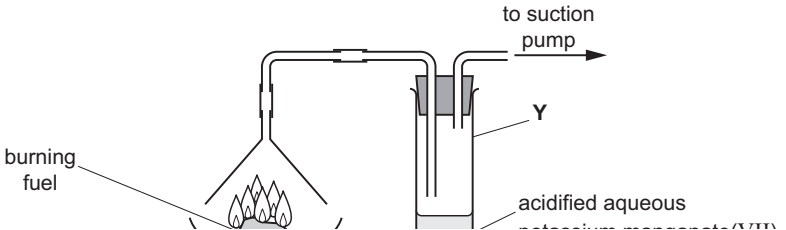
The student tries to use the apparatus in Fig. 1.2 to pass the gases produced through acidified aqueous potassium manganate(VII).

There is an error in the apparatus in Fig. 1.2 so that the gases produced will **not** pass through the acidified aqueous potassium manganate(VII).



Question 1

potassium manganate(VII)

Question 1

Fig. 1.2

(d) Identify the item of apparatus labelled **Y** in Fig. 1.2.

Question 1

(e) **On Fig. 1.2**, draw a circle around the error in the apparatus. [1]

(f) The error in the apparatus in Fig. 1.2 is corrected.
The student observes that the acidified aqueous potassium manganate(VII) changes colour from purple to colourless.

Suggest why this colour change occurs.

Question 1

[Total: 7]

Solution 1

(a)

Mark scheme

- funnel
- 1

Solution 1

(b)

Mark scheme

- to cool / to condense (AND) the water/steam/(water) vapour
- 1

Solution 1

(c)

Mark scheme

- M1 anhydrous cobalt(II) chloride / anhydrous copper(II) sulfate **M2**
- blue to pink if cobalt(II) chloride
- OR
- white to blue if copper(II) sulfate
- 1

Solution 1

(d)

Mark scheme

- boiling tube
- 1

Solution 1

(e)

Mark scheme

- circle must include the bottom of the left-hand tube but not the right-hand tube. It can overlap the surface of the liquid.
- 1

Solution 1

(f)

Mark scheme

- sulfur dioxide (made when the fuel is burned)
- 1
- 0620/63
- October/November 2025

Question 1

0620/62 J25 ▪ Q1 ▪ 7 marks

1 When heated, magnesium reacts with steam to make magnesium oxide and hydrogen gas.

Fig. 1.1 shows the apparatus a teacher uses to react clean magnesium ribbon with steam and collect the hydrogen gas produced.

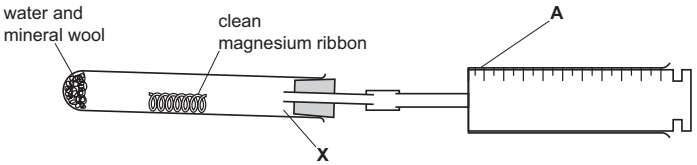


Fig. 1.1

(a) Name the item of apparatus labelled **A** in Fig. 1.1.

Question 1

Question 1

(b) Suggest how the magnesium ribbon should be cleaned before use.

Question 1

(c) State the purpose of the mineral wool.

Question 1

(d) Draw **two** arrows on Fig. 1.1 to show the **two** places where the apparatus should be heated. [2]

(e) During the reaction a colourless liquid collects at the point marked **X** on Fig. 1.1.

Suggest the identity of liquid **X**.

Question 1

(f) The gas collected in **A** is **not pure** hydrogen.

Suggest why the gas collected is **not pure**.

Question 1

[Total: 7]

Solution 1

(a)

Mark scheme

- (gas) syringe
- 1

Solution 1

(b)

Mark scheme

- (rub with) sand / emery / abrasive paper
- 1

Solution 1

(c)

Mark scheme

- to hold / absorb the water / to prevent the water running along the tube
- 1

Solution 1

(d)

Mark scheme

- 2

Solution 1

(e)

Mark scheme

- water / H2O
- 1

Solution 1

(f)

Mark scheme

- contains air (that was in the apparatus at the start)
- 1
- 0620/62
- May/June 2025

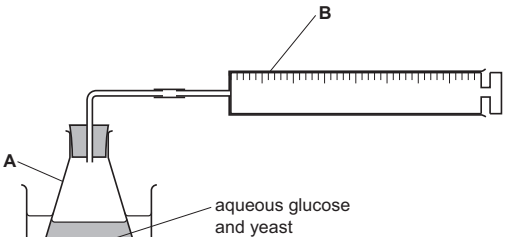
Question 1

0620/63 J25 ▪ Q1 ▪ 7 marks

1 Fermentation is a process in which yeast is used to convert aqueous glucose to ethanol and carbon dioxide. Fermentation takes place at a temperature of between 25 °C and 35 °C.

$$C_6H_{12}O_6(aq) \rightarrow 2C_2H_5OH(aq) + 2CO_2(g)$$

A student uses the apparatus shown in Fig. 1.1 to make carbon dioxide by fermentation.



Question 1

Fig. 1.1

(a) Name the items of apparatus labelled **A** and **B** in Fig. 1.1.

Question 1

Question 1

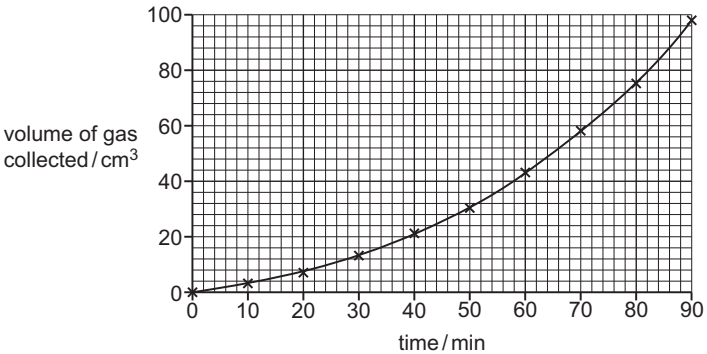
[2]

(b) Suggest why a water-bath is used.

Question 1

(c) The student measures the volume of gas that is collected every 10 minutes for 90 minutes.

Their results are shown in Fig. 1.2.



Question 1

Question 1

Fig. 1.2

Describe how the results in Fig. 1.2 show that the fermentation is **not** complete after 90 minutes.

Question 1

(d) The student repeats the experiment using the apparatus shown in Fig. 1.3.

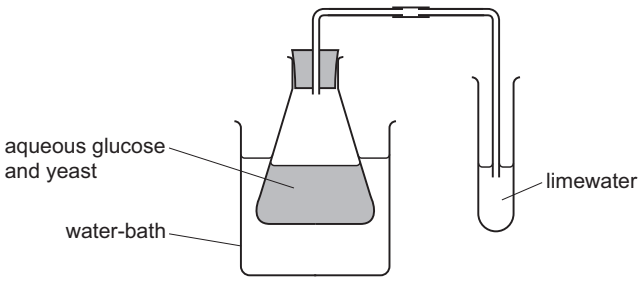


Fig. 1.3

(i) State what happens to the appearance of the limewater during fermentation.

Question 1

(ii) State **one** observation the student would make that shows that fermentation is complete.

Question 1

(e) State the method the student should use to obtain ethanol from the fermentation mixture.

Question 1

[Total: 7]

Solution 1

(a)

Mark scheme

- A
- (conical) flask
- 1
- B
- (gas) syringe
- 1

Solution 1

(b)

Mark scheme

- to keep (the contents of the flask) warm / at 25 oC to 35 oC
- 1

Solution 1

(c)

Mark scheme

- gas volume still increasing / gas volume not constant
- 1

Solution 1

(d)(i)

Mark scheme

- (turns) milky / cloudy
- 1

(d)(ii)

Mark scheme

- no more bubbles
- 1

Solution 1

(e)

Mark scheme

- (fractional) distillation
- 1
- 0620/63
- May/June 2025