

# Candidate evidence

## Question 1(b)(i)

### Candidate 1

$$5 \text{ days} \xrightarrow{\frac{1}{2}} 10 \text{ days} \xrightarrow{\frac{1}{4}} \underline{\underline{20 \text{ days}}}$$

### Candidate 2

$$\begin{array}{ccc}
 \cancel{5 \text{ days}} & \xrightarrow{\div 2} & 2.5 \text{ days} & \xrightarrow{\div 2} & 1.25 \text{ days} \\
 \frac{1}{\frac{4}{2}} & & \frac{1}{\frac{4}{4}} & & \frac{1}{\frac{4}{8}} \\
 & & \underline{\underline{1.25 \text{ days}}} & & 
 \end{array}$$

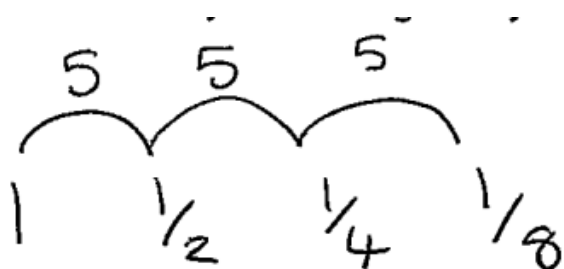
### Candidate 3

$$(5 \div 8) \times 24 = 0.625$$

$$5 \times \overset{24}{\cancel{24}} = 120 \text{ hours in } 5 \text{ days.}$$

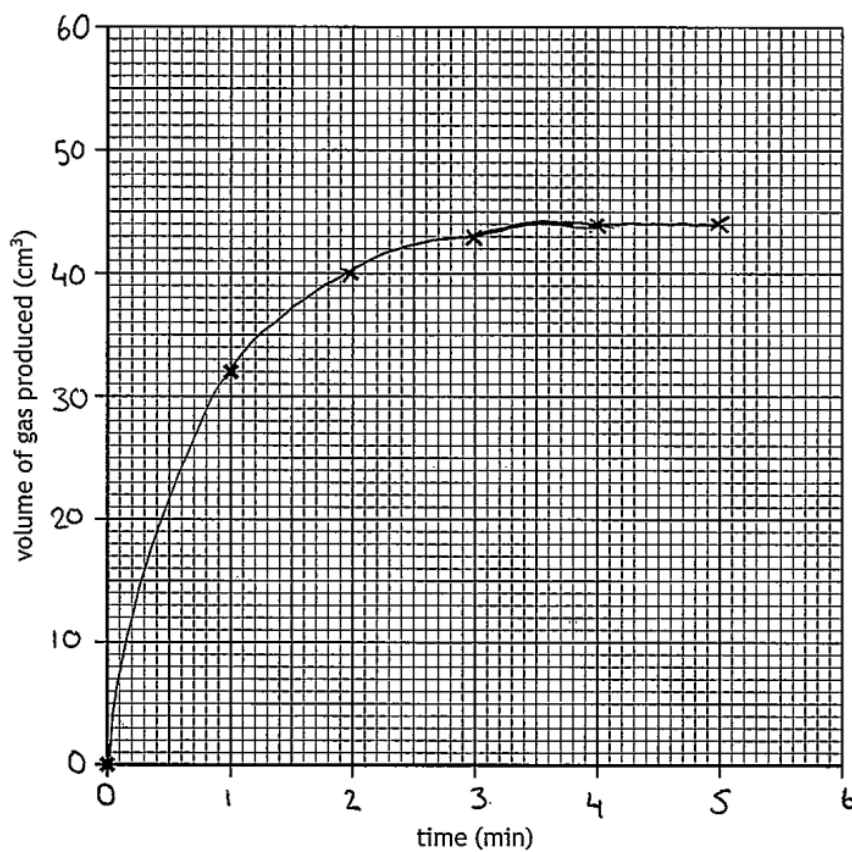
$$\underline{\underline{15 \text{ hours}}}$$

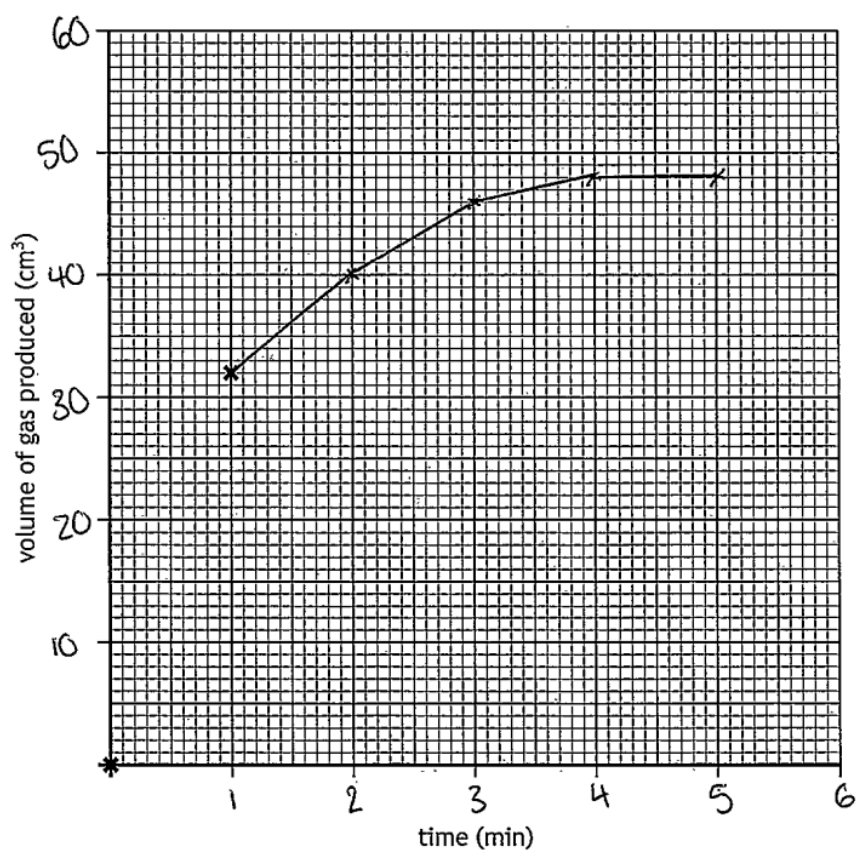
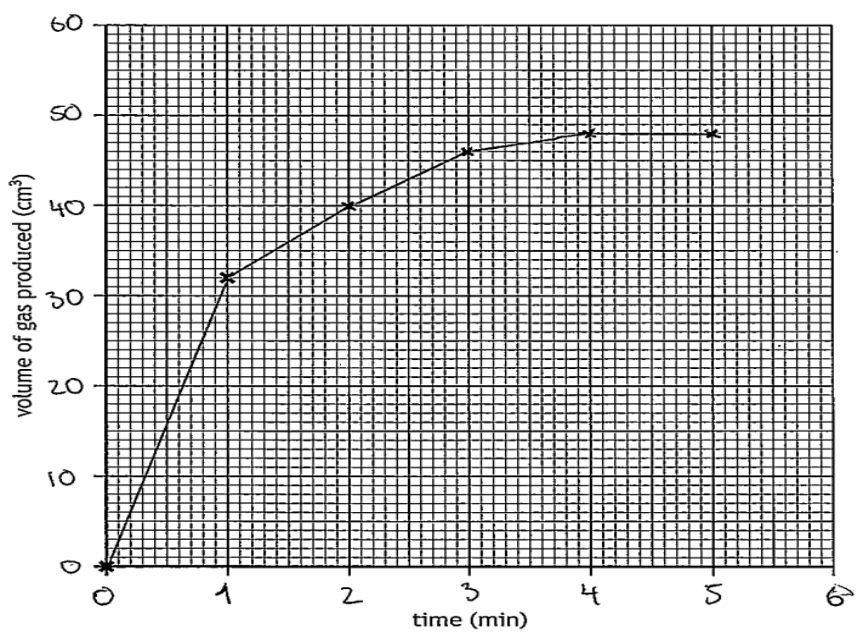
$$\frac{120}{8} = 15$$

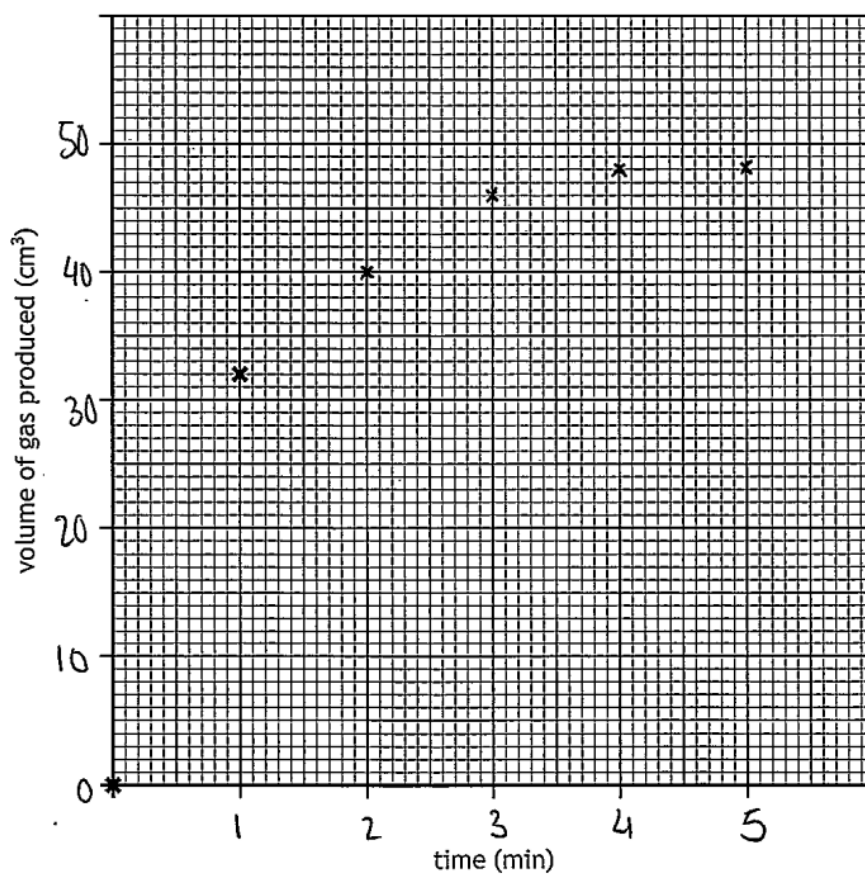
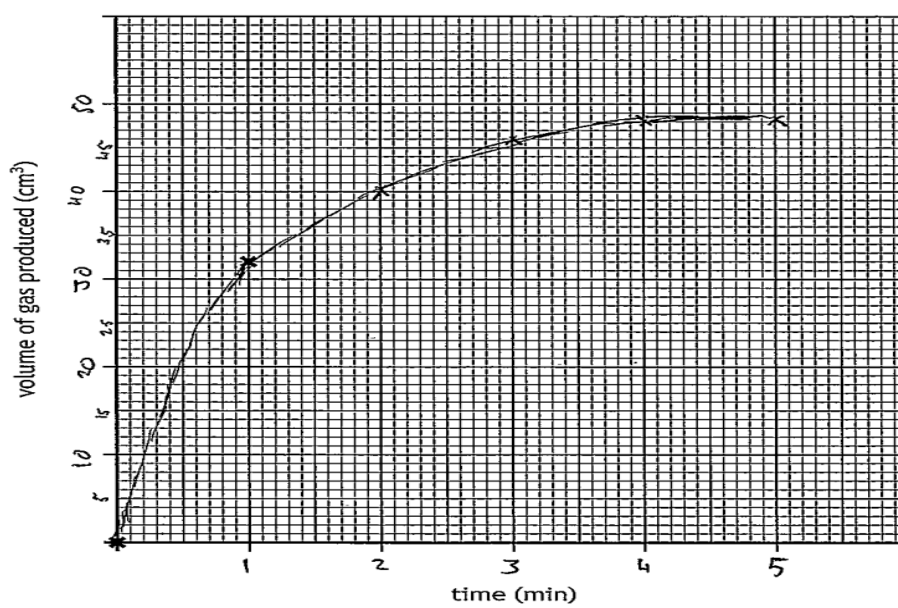
**Candidate 4**

$$5 \times 3 = 15$$

15 days.

**Question 2(a)****Candidate 1**

**Candidate 2****Candidate 3**

**Candidate 4****Candidate 5**

## Question 2(b)

### Candidate 1

$$\begin{aligned}\text{average rate} &= \frac{\Delta \text{quantity}}{\Delta \text{time}} \\ &= \frac{16}{4} \\ &= 4 \text{ cm}^3 \text{ min}^{-1}\end{aligned}$$

### Candidate 2

$$\begin{aligned}32 + 40 + 46 + 48 &= 166 \\ 166 \div 4 &= \underline{\underline{41.5}}\end{aligned}$$

### Candidate 3

$$\begin{aligned}\text{rate of reaction} &= \frac{\Delta \text{quantity}}{\Delta \text{time}} = \frac{48 - 32}{4 - 1} = \frac{16}{3} = 5.3 \\ &= \underline{\underline{5.3 \text{ cm}^3 \text{ min}^{-1}}}\end{aligned}$$

### Question 3(e)(ii)

#### Candidate 1

$$\begin{aligned}
 N \times 2 &= 14 \times 2 = 28 \\
 H \times 4 \times 2 &= 1 \times 8 = 8 \\
 H \times 1 &= 1 \times 1 = 1 \\
 P \times 1 &= 31 \times 1 = 31 \\
 O \times 4 &= 16 \times 4 = 64 \\
 &= 132 \text{ gfm} \\
 &= 132 \text{ gfm}
 \end{aligned}$$

$$\% N = \frac{28}{132} = \underline{\underline{0.21\%}}$$

#### Candidate 2

$$\begin{aligned}
 \% \text{ mass} &= \frac{m}{\text{GFM}} \times 100 \\
 &= \frac{14}{106} \times 100 \\
 &= \underline{\underline{13.21\%}}
 \end{aligned}$$

$$\begin{aligned}
 &\text{GFM} = 106 \\
 &(\text{NH}_4)_2\text{HPO}_4 \\
 &\quad 16 \times 4 = 64 + \\
 &\quad 31 \times 1 = 31 + \\
 &\quad 1 \times 1 = 1 + \\
 &\quad 1 \times 4 \times 2 = 8 + \\
 &\quad \underline{14 \times 2 = 28} \\
 &\quad \underline{\underline{106}} \\
 &\text{mass} = 14
 \end{aligned}$$

## Candidate 3

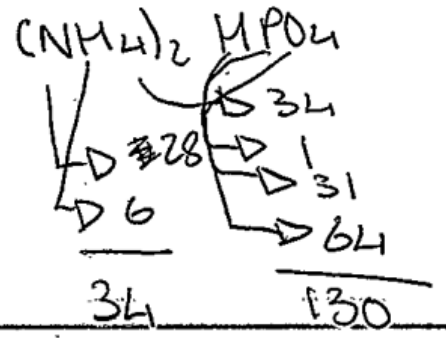
$$\frac{m}{gfm} \times 100$$

$$= \frac{14}{130} \times 100$$


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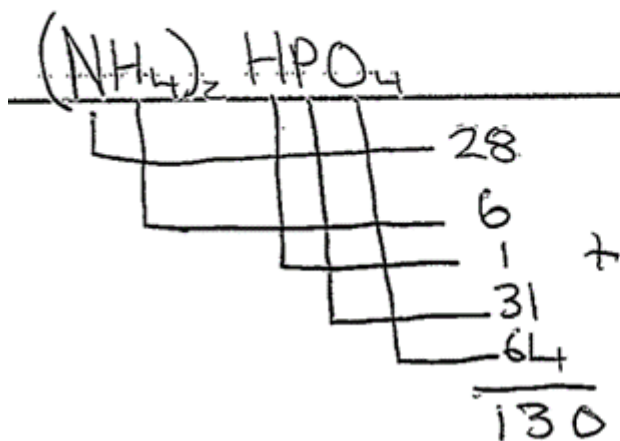

$$= 10.769\dots$$

$$= 10.8\%$$

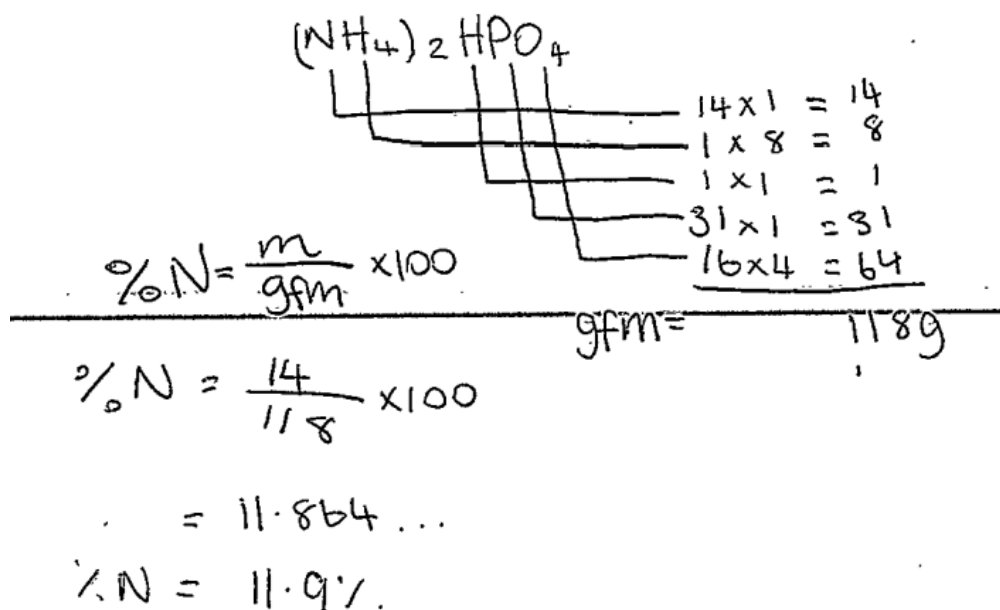
$gfm = (NH_4)_2 HPO_4$   


## Candidate 4

$$\% \text{ by mass} = \frac{m}{gfm} \times 100 = \frac{28}{130} \times 100 = 21.5\%$$

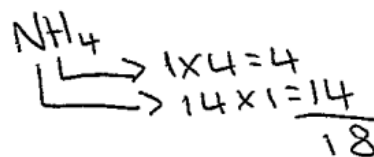


## Candidate 5

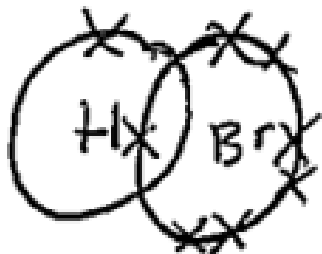
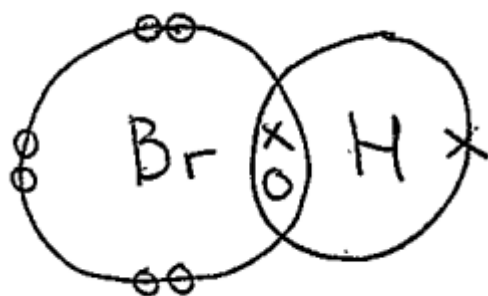
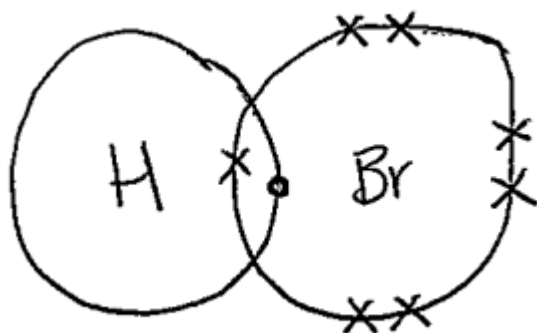


## Candidate 6

$$\begin{aligned} \% \text{ by mass} &= \frac{m}{\text{GFM}} \times 100 \\ &= \frac{2}{18} \times 100 \\ &= 11.111\dots \\ &= \underline{\underline{11.11\%}} \end{aligned}$$





**Question 4(a)(ii)****Candidate 1****Candidate 2****Candidate 3**

**Question 6(b)(iii)****Candidate 1**

$$E_H = cm\Delta t$$

$$= 4.18 \times 0.2 \times 15$$

$$= 12.54 \text{ kJ}$$

**Candidate 2**

$$E_h = cm\Delta T$$

$4.18 \quad \frac{275.6 - 224.8}{4.8} = 10.8 \quad 35 - 23 = 12$

$$E_h = 4.18 \times 0.8 \times 12$$

$$\underline{E_h = 40.128 \text{ kJ}}$$

$$E_h = 40.128 \text{ kJ}$$

**Candidate 3**

$$C = 4.18 \text{ kJ kg}^{-1} \text{ } ^\circ\text{C}^{-1}$$

$$= 4.18 \times \overset{2000}{\cancel{2000}} \times \cancel{0.8} \times 12$$

$$= 80.256 \text{ kJ}$$

**Candidate 4**

$$E_h = cm \Delta T$$

$$E_h = 274.8 \times 200 \times 12 = 659520$$

$$m = 200$$

$$\Delta T = 35 - 23 = 12$$

$$c =$$

$$659520$$

$$\underline{659.52 \text{ kJ}}$$

**Candidate 5**

$$E_h = cm \Delta t$$

$$E_h = 4.18 \times 0.2 \times 12$$

$$= \underline{10.032 \text{ kJ}}$$

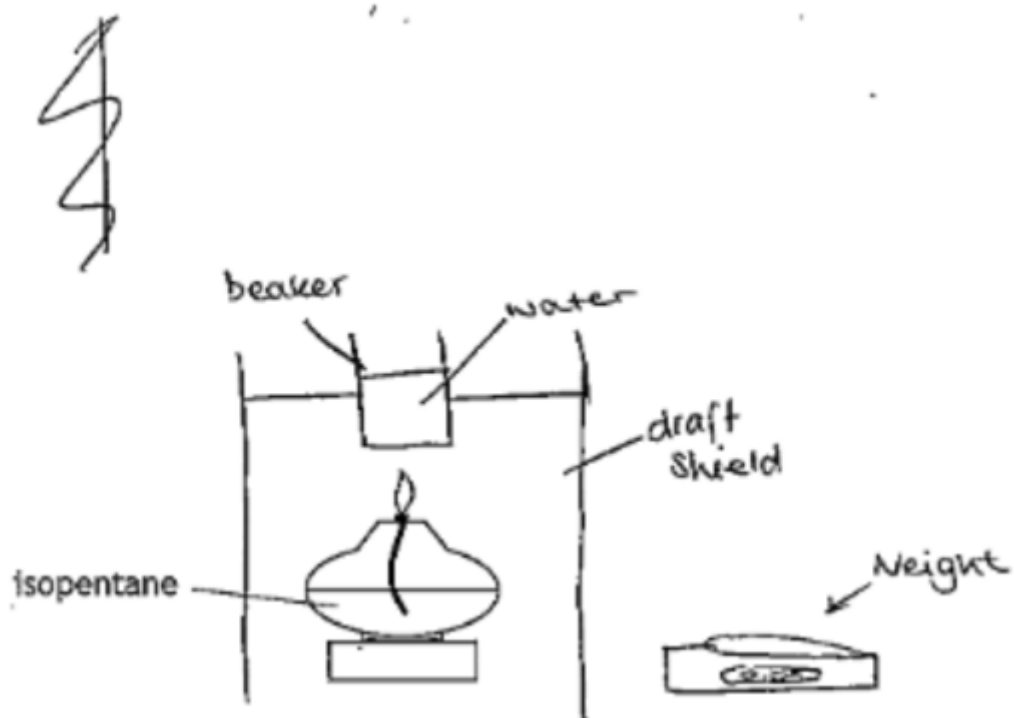
$$c = 4.18$$

$$m = 200 \text{ g} \rightarrow 0.2 \text{ kg}$$

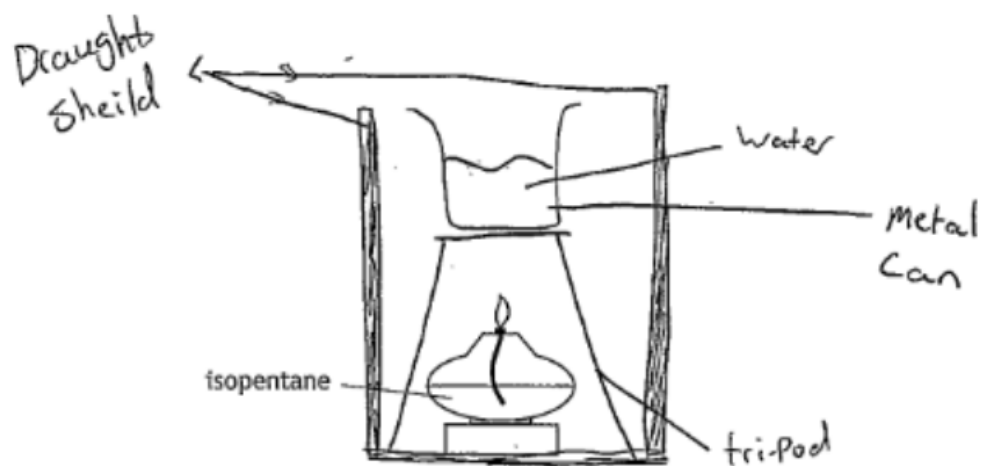
$$\Delta t = 12^\circ\text{C}$$

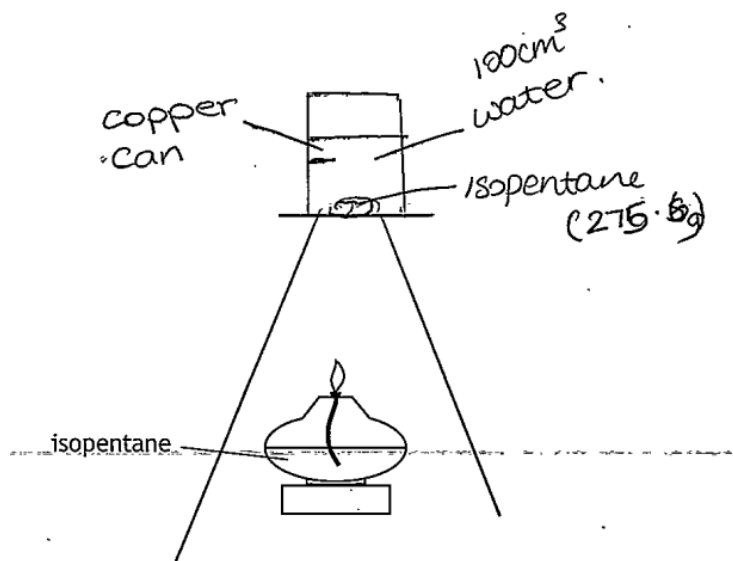
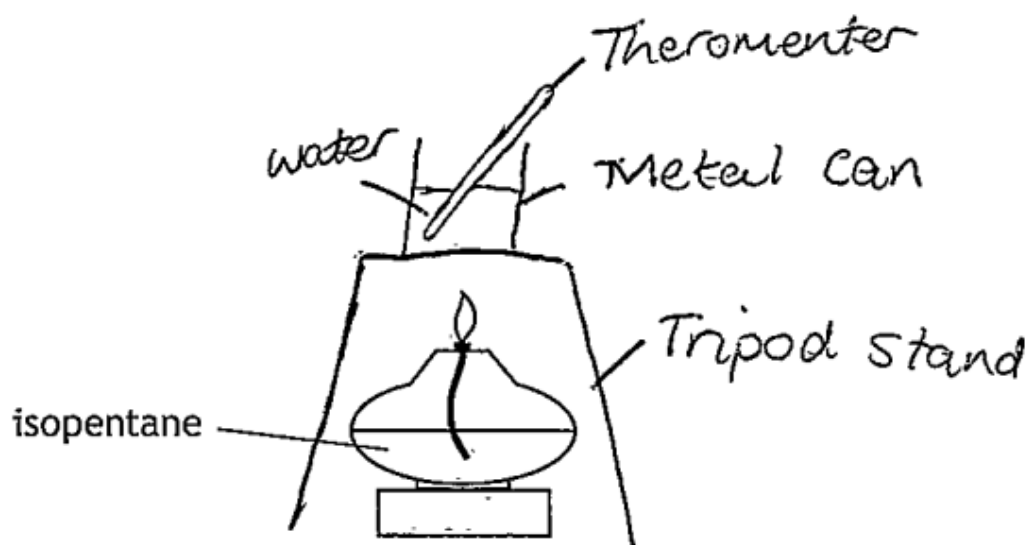
## Question 6(b)(iv)

Candidate 1



Candidate 2



**Candidate 3****Candidate 4**

## Question 7(a)(i)

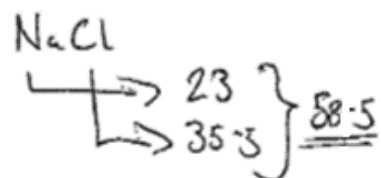
### Candidate 1

$$m = n \times \text{GFM}$$

$$m = 1.5 \times 58.5$$

$$\underline{\underline{m = 87.75 \text{ g}}}$$

$$\begin{matrix} m \\ n \times \text{GFM} \end{matrix}$$



### Candidate 2

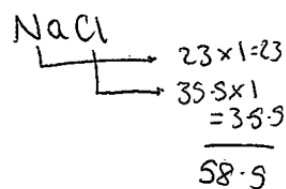
$$\begin{aligned} n &= CV \\ &= 1.5 \times 0.5 \frac{500}{1000} = 0.5 \\ &= 0.75 \text{ moles} \end{aligned}$$

(solid)  
NaCl

(solution)  
NaCl

$$\begin{array}{l} 1.5 \text{ mol l}^{-1} \\ 500 \text{ cm}^3 \end{array}$$

$$\begin{aligned} m &= n \times \text{GFM} \\ &= 0.75 \times 58.5 \\ &= 102.38 \text{ g} \end{aligned}$$



**Candidate 3**

$$\begin{aligned} & \text{NaCl} \\ n &= cV \\ V &= \frac{500 \text{ cm}^3}{1000} \\ &= 0.5 \text{ litres} \\ c &= 1.5 \text{ mol l}^{-1} \\ n &= 0.5 \times 1.5 \\ &= 0.075 \text{ mol} \end{aligned}$$

$$\begin{aligned} m &= n \times \text{GFM} \\ n &= 0.075 \text{ mol} \\ \text{NaCl} \\ \text{Na} \times 1 &= 23 \times 1 = 23 \\ \text{Cl} \times 1 &= 35.5 \times 1 = 35.5 \\ & \quad 58.5 \text{ amu} \\ &= 58.5 \text{ GFM} \end{aligned}$$

$$\begin{aligned} M &= 0.075 \times 58.5 \\ &= 4.3875 \\ &= \underline{\underline{4.39 \text{ g}}} \end{aligned}$$

**Question 7(b)(i)****Candidate 1**

$$\begin{aligned} (105 + 107 + 108) &\div 3 \\ &= 106.6^\circ\text{C} \\ &= \underline{\underline{107^\circ\text{C}}} \end{aligned}$$

**Candidate 2**

$$\frac{107 + 108}{2} = \underline{\underline{107.5^\circ\text{C}}}$$

**Candidate 3**

106.7°

**Question 7(b)(ii)****Candidate 1**

	average boiling point (°C)
0.5 mol L <sup>-1</sup>	101.3
1.0 mol L <sup>-1</sup>	104.0°C
1.5 mol L <sup>-1</sup>	107.5°C

**Candidate 2**

0.5 mol L<sup>-1</sup> = 101.3°C  
1.0 mol L<sup>-1</sup> = 104.0°C  
1.5 mol L<sup>-1</sup> = ~~107.5~~ 106.6°C



## Candidate 3

Average boiling point	Sodium Chloride solution ( $\text{mol l}^{-1}$ )
106.7°C	1.5
104.0°C	1.0
101.3°C	0.5

## Candidate 4

	AVG Boiling point
1.5 $\text{mol l}^{-1}$	106.6°C
1 $\text{mol l}^{-1}$	104.0°C
0.5 $\text{mol l}^{-1}$	101.3°C

Concentration

## Candidate 5

Concentrations	Average boiling point
0.5 $\text{mol l}^{-1}$	101.3°C
1.0 $\text{mol l}^{-1}$	104.0°C

## Question 8(e)

### Candidate 1

When the reaction has  
a pH of 7 as it is neutral.

### Candidate 2

a salt is made

### Candidate 3

When an acid reacts with a substance to  
create a ~~salt~~ solution with a  
neutral pH, by balancing  $H^+$  and  $OH^-$   
ions.

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### Candidate 4

a reaction when an ~~acid is added to~~  
acid and base are combined to produce water  
and a salt

## Question 9(a)

### Candidate 1

a ~~str~~ compound with the same general formula but a different structural formula.

### Candidate 2

a ~~molecule~~ number of molecules with the same atomic number but different mass numbers

### Candidate 3

Molecules with the same molecular formula but different structural formula.

### Candidate 4

particles with the same atomic number, but different mass numbers (same number of protons, different number of neutrons)

### Question 9(c)(iii)(B)

Candidate 1

$$\begin{array}{l}
 \text{NiF}_2 \\
 \left\{ \begin{array}{l} 58.5 \\ 19 \times 2 (38) \end{array} \right. \rightarrow 96.5 \\
 \\
 10 \times 69.40 \\
 \underline{\underline{\pounds 694}}
 \end{array}$$

Candidate 2

$$\begin{array}{l}
 \frac{35\text{g}}{10\text{g}} = 3.5\text{g} \\
 \pounds 69.40 \times 3.5\text{g} = \pounds 242.90
 \end{array}$$

Candidate 3

$$\begin{array}{r}
 \pounds 69.40 \\
 \div 10 \\
 \hline
 \pounds 6.94 \text{ per } g
 \end{array}
 \qquad
 \begin{array}{r}
 69.40 \\
 \times 4 \\
 \hline
 \underline{\underline{\pounds 277.6}}
 \end{array}$$

## Question 10(a)

### Candidate 1

a series of compounds with the same general formula but different structural formulas

### Candidate 2

~~same~~ similar chemical formula different chemical properties

### Candidate 3

Molecules that can be identified by certain chemical properties. They can be grouped.

### Candidate 4

A family of molecules with similar chemical properties and similar structural formulae

### Candidate 5

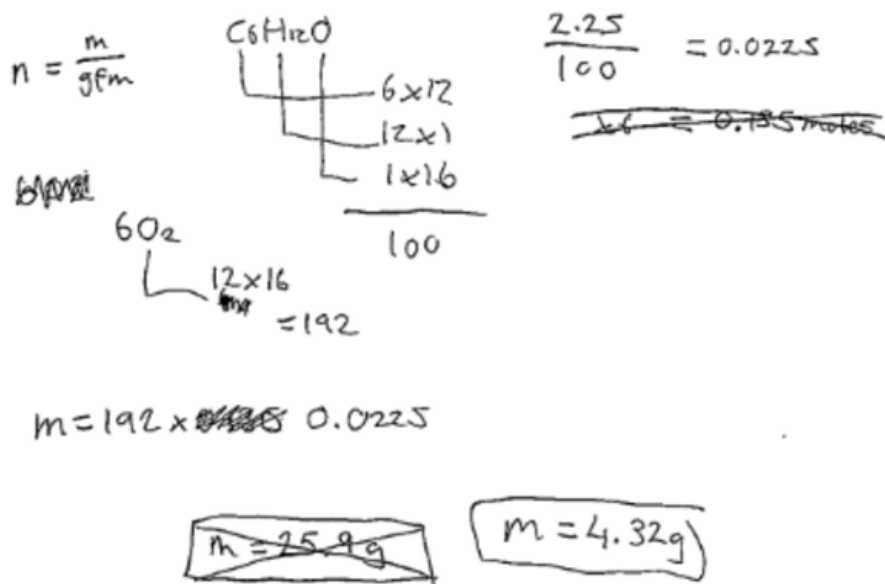
A group of elements that have similar chemical properties and that can be identified using a general formula.

**Candidate 6**

a family of compounds with the same general formula and similar chemical structures.

**Candidate 7**

Homologous series is a group of compounds which share the same general formula and have similar chemical properties.

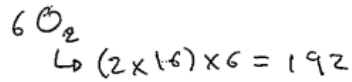
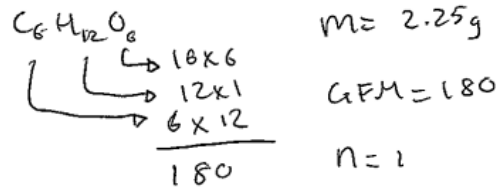
**Question 11(c)****Candidate 1**

## Candidate 2

$$m = ?$$

$$GFM = 180$$

$$n = 0.075$$



$$n = \frac{m}{GFM}$$

$$n = \frac{2.25}{180}$$

Ratio

$$1 : 6$$

$$0.0125 : 0.075$$

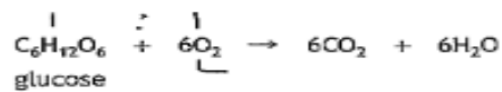
$$n = 0.0125$$

$$m = n \times GFM$$

$$m = 0.075 \times 192$$

$$m = 14.4$$

## Candidate 3



Calculate the mass, in grams, of oxygen required to react completely with 2.25 g of glucose,  $C_6H_{12}O_6$ .

$$n = \frac{m}{GFM}$$

$$n = \frac{2.25}{180}$$

$$n = 0.0125$$

$$m = n \times GFM$$

$$m = 0.0125 \times 32$$

$$m = 0.4 \text{ g}$$

$$12 \times 6 \quad 12 \times 12 \quad 16 \times 6$$

$$72 + 12 + 96$$

$$= 180$$

$$n = 0.0125$$

3

## Candidate 4

$$M = n \times GFM$$

$$n = 2.25$$

$$GFM = 180$$

$$C = 12 \times 6 = 72$$

$$H = 1 \times 12 = 12$$

$$O = 16 \times 6 = 96$$

$$M = 2.25 \times 180 = 405 \text{ g}$$

## Candidate 5

