

**M1.(a)** both water vapour and ethanol will condense

*allow steam for water vapour*

*allow they both become liquids*

*allow ethane condenses at a lower temperature*

*allow some of the steam hasn't reacted*

*allow it is a reversible reaction / equilibrium*

1

(b) amount will decrease

1

because the equilibrium will move to the left

1

(c) more ethanol will be produced

1

because system moves to least / fewer molecules

1

[5]

- M2.(a) because sulfur dioxide causes acid rain 1
- which kills fish / aquatic life **or** dissolves / damages statues / stonework **or** kills / stunts growth of trees
- if no other mark awarded then award 1 mark for sulfur dioxide is toxic or causes breathing difficulties.*
- 1
- (b) (i) electrons are lost 1
- (ii)  $\text{Cu}^{2+} + 2\text{e}^{-} \rightarrow \text{Cu}$
- allow  $\text{Cu}^{2+} \rightarrow \text{Cu} - 2\text{e}^{-}$*
- ignore state symbols*
- 1
- (iii) copper sulfate
- allow any ionic copper compound*
- 1
- (c) (lattice of) positive ions 1
- delocalised electrons
- accept sea of electrons*
- 1
- (electrostatic) attraction between the positive ions and the electrons 1
- electrons can move through the metal / structure **or** can flow
- allow electrons can carry charge through the metal / structure*
- if wrong bonding named or described or attraction between oppositely charged ions then do not award M1 or M3 – MAX 2*
- 1
- (d) (copper compounds are absorbed / taken up by) plants 1
- allow crops*
- which are burned 1

the ash contains the copper compounds

*do not award M3 if the ash contains copper (metal)*

1

(e)

/ A <sub>r</sub>	55.6 / 63.5	16.4 / 56	28.0 / 32
moles	0.876	0.293	0.875
ratio	3	1	3
formula	Cu <sub>3</sub> FeS <sub>3</sub>		

*award 4 marks for Cu<sub>3</sub>FeS<sub>3</sub> with some correct working*

*award 3 marks for Cu<sub>3</sub>FeS<sub>3</sub> with **no** working*

*if the answer is not Cu<sub>3</sub>FeS<sub>3</sub> award up to 3 marks for correct steps from the table apply ecf*

*if the student has inverted the fractions award 3 marks for an answer of CuFe<sub>3</sub>S*

4

[16]

M3.(a) (i) the products are at a lower energy level than the reactants

*accept products have less energy / less energy at the end than the beginning*

1

(ii) because a catalyst provides an alternative / different pathway / mechanism / reaction route

*accept adsorption or 'increases concentration at the surface'*

*ignore absorption*

1

(that has) lower activation energy

*allow weakens bonds*

*allow idea of increased successful collisions.*

*DO NOT ALLOW answers stating catalysts provide energy for M1 and M2*

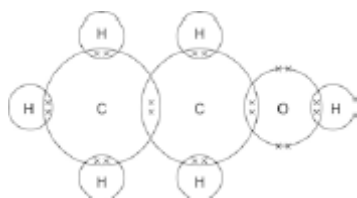
1

(b) one pair of electrons in each overlap (8 pairs in total)

*allow any combination of dots, crosses or other symbols*

1

the rest of the diagram correct with four non-bonding electrons on the oxygen giving a total of eight electrons in oxygen outer energy level.



*gains 2 marks*

1

(c) (i)  $\pm 3024$  (J)

*correct answer with or without working gains 3 marks*

*if the answer is incorrect, award up to 2 marks for the following steps:*

- $\Delta T = 14.4(^{\circ}\text{C})$
- $50 \times 4.2 \times 14.4$

*allow ecf for incorrect  $\Delta T$*

3

(ii) 0.015(2173913)

correct answer with or without working gains **3** marks

if answer is incorrect, allow 1 mark each for any of the following steps up to a max of 2.

- 0.70g
- $M_r$  of ethanol = 46
- $0.70 / 46$

allow ecf in final answer for arithmetical errors

3

(iii)  $\pm 198\,720$  (J / mole)

$c(i) \div c(ii)$

allow ecf from **(c)(i)** and **(c)(ii)**

0.015 gives 201600

0.0152 gives 198947

0.01522 gives 198686

1

(d) (as the molecules get bigger **or** the number of carbon atoms increases) the intermolecular forces

allow intermolecular bonds

1

(intermolecular forces) increase

allow more / stronger (intermolecular forces)

1

and therefore require more (heat) energy to overcome

breaking covalent bonds or unspecified bonds max **1** mark (M3)

1

[15]

- M4.(a) (i) silver nitrate  
*allow AgNO<sub>3</sub>* 1
- (ii) potassium carbonate **or**  
*allow K<sub>2</sub>CO<sub>3</sub>*  
 sodium carbonate  
*allow Na<sub>2</sub>CO<sub>3</sub>* 1
- (b) base  
*allow ionic*  
*ignore insoluble or soluble*  
*ignore alkali* 1
- (c) (i) evaporate  
**or**  
 crystallise  
*allow heat or boil or leave (to evaporate)*  
*allow cool*  
*ignore filtration unless given as an alternative*  
*do **not** accept freeze or solidify* 1
- (ii) 2 (HNO<sub>3</sub>)  
*accept multiples* 1
- (iii) 9  
*accept nine* 1
- (d) 6.21 / 207      0.72 / 16  
*1 mark for dividing mass by A,* 1
- = 0.03      = 0.045  
*1 mark for correct proportions (allow multiples)* 1

2

3

**1** mark for correct whole number ratio (allow multiples). Can be awarded from formula.

**1**

Pb<sub>2</sub>O<sub>3</sub>

allow O<sub>3</sub>Pb<sub>2</sub>

**ecf** allowed throughout if sensible attempt at step 1

correct formula with no working gains **1** mark

**1**

**[10]**

M5.(a) lattice / giant structure

*max 3 if incorrect structure or bonding or particles*

1

ionic **or** (contains) ions

1

Na<sup>+</sup> and Cl<sup>-</sup>

*accept in words or dot and cross diagram: must include type and magnitude of charge for each ion*

1

electrostatic attraction

*allow attraction between opposite charges*

1

(b) hydrogen

*allow H<sub>2</sub>*

1

sodium hydroxide

*allow NaOH*

1

(c) any **one** from, eg:

- people should have the right to choose
- insufficient evidence of effect on individuals
- individuals may need different amounts.

*allow too much could be harmful*

*ignore religious reasons*

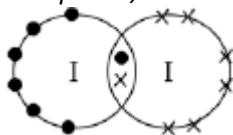
*ignore cost*

*ignore reference to allergies*

1

(d) (i) one bonding pair of electrons

*accept dot, cross or e or – or any combination, eg*



1



6 unbonded electrons on each atom	1
(ii) simple molecules	
<i>max 2 if incorrect structure or bonding or particles</i>	
<i>accept small molecules</i>	
<i>accept simple / small molecular structure</i>	1
with intermolecular forces	
<i>accept forces between molecules</i>	
<i>must be no contradictory particles</i>	1
which are weak <b>or</b> which require little energy to overcome – must be linked to second marking point	
<i>reference to weak covalent bonds negates second and third marking points</i>	1
(iii) iodine has no delocalised / free / mobile electrons or ions	1
so cannot carry charge	
<i>if no mark awarded iodine molecules have no charge gains 1 mark</i>	1
	<b>[14]</b>