

**0 4**

This question is about copper and fuels.

**0 4 . 1**

Copper is extracted from low-grade ores by phytomining.

Describe how copper metal is produced by phytomining.

**[4 marks]**

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**0 4 . 2**

Another method of extracting copper from low-grade ores is bioleaching.

A solution of copper sulfate ( $\text{CuSO}_4$ ) produced by bioleaching has a concentration of  $0.319 \text{ g/dm}^3$ Relative atomic masses ( $A_r$ ): Cu = 63.5 O = 16 S = 32Calculate the number of moles of copper that can be produced from  $1 \text{ dm}^3$  of this solution.**[3 marks]**

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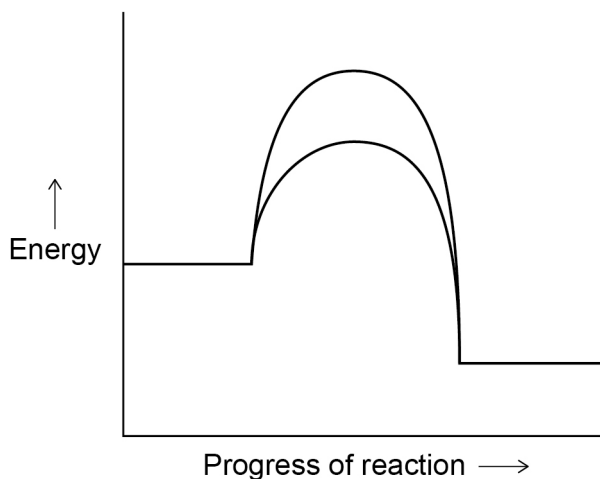
Number of moles of copper = \_\_\_\_\_ mol

**Turn over ►**

Copper is used as a catalyst.

**Figure 1** shows reaction profiles for a reaction with and without a catalyst.

**Figure 1**



0 4 . 3

How do the reaction profiles show that using a catalyst does **not** affect the overall energy change for the reaction?

[1 mark]

Tick (✓) **one** box.

Both reaction profiles show exothermic reactions.

☐

Both reaction profiles start at the same energy level and end at the same energy level.

☐

Both reaction profiles show the activation energy.

☐

The activation energy for the uncatalysed reaction is much lower than for the catalysed reaction.

☐


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Copper is a catalyst in a reaction to produce ethanol from carbon dioxide.

Ethanol ( $\text{C}_2\text{H}_5\text{OH}$ ) is used as a fuel.

Suggest why producing ethanol from carbon dioxide is sustainable.

**[2 marks]**

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Chemistry plays an important role in sustainable development.

What is sustainable development?

**[2 marks]**

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12
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**Turn over for the next question**

**Turn over ►**



Question	Answers	Extra information	Mark	AO / Spec. Ref.
<b>04.1</b>	growing plants (on low-grade ore)	allow named plant	1	AO1 5.10.1.4
	plants are burnt (to produce ash)		1	
	(ash dissolved in acid to produce) solution of a copper compound	allow named copper compound	1	
	electrolysis (of solution of a copper compound) <b>or</b> displacement (by adding scrap iron to a solution of a copper compound)	allow addition of scrap iron (to a solution of a copper compound)	1	
<b>04.2</b>	$M_r \text{ CuSO}_4 = 159.5$	an answer of 0.002 <b>or</b> $2 \times 10^{-3}$ (mol) scores <b>3</b> marks	1	AO2 5.3.2.1 5.3.2.5
	$\frac{0.319}{159.5}$	allow correct use of incorrectly calculated value for $M_r$	1	
	= 0.002 (mol)	allow $2 \times 10^{-3}$ (mol)	1	
<b>04.3</b>	both reaction profiles start at the same energy level and end at the same energy level.		1	AO3 5.6.1.4

<p><b>04.4</b></p>	<p>the amount of carbon dioxide used to produce the ethanol</p> <p>is the same as the amount of carbon dioxide given off when the ethanol is burned</p>	<p><b>alternative approach</b></p> <p>there is sufficient carbon dioxide (in the atmosphere) (1)</p> <p>because carbon dioxide is constantly produced from burning fossil fuels (1)</p> <p>if no other mark awarded allow for <b>1</b> mark burning ethanol produces carbon dioxide</p>	<p>1</p> <p>1</p>	<p>AO3</p> <p>5.9.2.2</p> <p>5.9.3.1</p>
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<b>04.5</b>	meets needs of current generation		1	AO1 5.10.1.1
	without compromising needs of future generations	allow so there are enough resources for future generations  ignore references to harming / damaging planet / environment	1	
<b>Total</b>			<b>12</b>	