



# **GCSE Chemistry**

## **Life Cycle Assessments**

### **Mark Scheme**

**Time available: 50 minutes**

**Marks available: 47 marks**

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**1.** (a) **Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

5–6

**Level 2:** Some logically linked reasons are given. There may also be a simple judgement.

3–4

**Level 1:** Relevant points are made. They are not logically linked.

1–2

**No relevant content**

0

**Indicative content**

**raw materials**

- crude oil finite **or** will run out (so will be unavailable for other uses)
- wood is a renewable resource
- wood involves land use for forestry (so less available for agriculture / food)
- wood may involve deforestation (so reduces biodiversity)

**manufacturing**

- both require energy which may be derived from finite fuels (so they run out more quickly)
- paper more energy intensive (so more pollution is possible)
- the need for more energy for paper potentially releases more carbon dioxide to the atmosphere (so increases global warming)
- paper involves higher water usage (so increases the potential for water pollution)
- paper cups are heavier to transport (so have higher energy requirement)
- packaging requirements similar (so neither has an advantage)

**usage**

- both single-use (so neither has an advantage)

**disposal**

- paper releases more energy if incinerated (so more energy can be used for other purposes)
- paper will decompose (so will not remain in landfill)
- poly(styrene) could release toxins on incineration
- poly(styrene) will not decompose (so will remain in landfill)
- poly(styrene) can be used to manufacture other products (so conserves energy **or** finite resources)
- both can cause litter **or** visual pollution

(b)  $\frac{1000}{8.3} \times 550 \text{ (kJ)}$

1

=  $6.63 \times 10^4 \text{ (kJ)}$

*allow  $6.6265060240963 \times 10^4 \text{ (kJ)}$  correctly rounded*

*allow  $66265.060240963 \text{ (kJ)}$  correctly rounded for 1 mark*

*an answer of  $6.63 \times 10^4 \text{ (kJ)}$  scores 2 marks*

1

(c) (melamine is a) thermosetting (polymer)

1

(which) contains crosslinks / bonds (between polymer chains)

*do **not** accept reference to intermolecular forces*

*allow (so) it decomposes*

1

[10]

2.

(a) (i) (thermal) decomposition

*allow decomposes or endothermic*

1

(ii) copper oxide

1

(b) (i) the (potassium) carbonate did not decompose/change/react (when heated)

*allow temperature not high enough*

*do **not** allow potassium did not decompose*

*ignore references to reactivity*

1

the mass did not change or the limewater did not go cloudy

1

because no carbon dioxide produced

1

(ii) the less reactive the metal the more (easily) its carbonate will decompose/react or vice versa

*needs to be a relative comparison*

2

*allow max 1 mark where the distinction between a metal and its carbonate is not clear*

*allow 1 mark for carbonates of reactive metals do not decompose or vice versa*

(c) (i) make it economical (to extract the metal/iron)

*allow make it worth extracting*

*allow so they can make money/profit*

1

- (ii) Fe 1
- balanced correctly (2,3,4,3)
- not ecf*
- allow correct balanced equation but with 2Fe<sub>2</sub> on right for one mark*
- 1
- (iii) **iron** from the blast furnace is brittle 1
- steel** produced is strong / flexible
- allow steel has more/specific uses*
- allow steel is rust-resistant*
- 1
- "it" = iron*
- (iv) (recycling) is used to conserve iron (ore) **or** energy **or** resources **or** minimise pollution **or** reduce the need to quarry
- allow reverse arguments.*
- 1
- (not reuse) because of damage, paint removal, rusting/corrosion, metal fatigue/weaker
- 1
- (not landfill) because sites have limited space **or** loss of habitats
- allow to reduce the use of landfill*
- 1
- [15]**
- 3.** (a) because it is a good conductor of electricity. 1
- (b) (i) 2.1 (%) 1
- (ii) correct bar for calcium at 3.6 %
- allow error of +/- 0.05%*
- correct bar for iron at 5.0 %
- allow error of +/- 0.05%*
- 1
- (c) (i) decomposition 1
- (ii) carbon dioxide 1
- (iii) carbon = 1
- allow one*
- 1
- oxygen = 3
- allow three*
- 1

(iv) 44 (g)

*allow forty four*

1

(d) (i) to make alloys for specific uses.

1

(ii) any **three** from:

- to conserve resources of iron or iron ore  
*allow steel instead of iron or iron ore*  
*allow limited resource or non-renewable*
- to avoid the need for quarrying/mining
- to conserve energy resources or fossil fuels
- to limit the amount of carbon dioxide produced or to reduce global warming
- to reduce the amount of landfill

*"it" = steel*

*ignore cost and reuse and time and waste*

3

[13]

4.

(a) **Level 2 (3-4 marks):**

A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

**Level 1 (1-2 marks):**

Relevant points are made. These are not logically linked.

**Level 0**

No relevant content.

### Indicative content

#### raw material

- wood will not run out
- aluminium (ore) will run out
- more expensive to process aluminium from its raw material

#### mass of frame

- wooden frame more expensive to transport
- wooden frame uses more fuel to transport
- wooden frame more difficult to handle / erect

#### useful lifetime

- wooden greenhouse would need replacing more often
- fewer aluminium greenhouses needed over time

#### end of useful life

- both materials can be put to further use
- aluminium can be recycled repeatedly

4

(b)  $\frac{12000}{80}$

1

= 150

1

*an answer of 150 scores 2 marks*

(c) any **two** from:

- conserves finite ores  
*allow ores will last longer*
- uses less energy
- lower energy costs
- reduces landfill  
*allow less waste*

2

(d) (polymer windows are) lighter

1

[9]