

Mark schemes

Q1.

- | | |
|---------------------------------------------------------------------------------------------------------------------------|---|
| (a) disposal at the end of useful life | 1 |
| (b) heating in a furnace | 1 |
| shaping wet clay | 1 |
| (c) polymers | 1 |
| propene | |
| <i>allow (a) monomer</i> | 1 |
| (d) cracking | 1 |
| fractional distillation | 1 |
| (e) covalent | 1 |
| (f) thermosetting | 1 |
| (g) polymer A has crosslinks (between polymer molecules)
or
polymer B has no crosslinks (between polymer molecules) | 1 |

[10]

Q2.

- (a) any two from:
- energy used in:
- extraction of raw materials
 - processing raw materials
- allow energy used to make food plate materials*
- manufacturing
 - transportation
 - cleaning non-disposable plates
 - disposal
 - recycling

2

- (b) Level 2: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given. 3-4

Level 1: Some logically linked reasons are given. There may also be a simple judgement. 1-2

No relevant content 0

Indicative content

Raw materials

- Trees are renewable
- Crude oil and clay are finite

Manufacturing and packaging

- Paper plates use the least packaging so conserve raw materials
- Paper plates need less transportation overall as more plates in a 10 dm³ cardboard box

Use and operation

- Paper plates are single use so must be replaced most often
- Ceramic plates last longer than polymer plates so must be replaced less often

Disposal

- Polymer / ceramic plates take up landfill which is running out
- Paper / polymer plates can be used to make new products
- Recycling conserves raw materials

Reasoned judgement

- (c) (wet) clay is shaped 1

(and) heated in a furnace

allow (and) heated in a kiln / oven
allow (and) fired

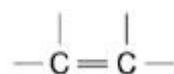
1

[8]

Q3.

- (a) covalent 1

(b)



1

- (c) composite 1

- (d) limestone 1
- sand 1
- either order*
- (e) *ignore corrosion / erosion / rotting / rusting*
- any two from:
(makes the board)
- strong
 - hard
 - tough
 - waterproof
 - durable
 - *allow long lasting*
 - aesthetic reasons
 - rigid
 - less friction
 - *allow streamlined / smooth*
 - protection
 - *allow prevents damage*
- 2
- (f) (advantages of addition polymers)
- low(er) cost 1
- allow cheap(er)*
- low(er) density 1
- allow light(er)*
- (disadvantages of addition polymers)
- weak(er) 1
- allow (more) likely to break*
- hard(er) to dispose of 1
- ignore references to recycling or use as a fuel*
- (g) *an answer of 0.035 (m³) scores 3 marks.*
- allow 2 marks for an answer of 0.105 (m³) (addition polymer)*
- $150 = \frac{5.25}{\text{volume}}$ 1

$$(\text{volume} =) \frac{5.25}{150}$$

1

$$(\text{volume} =) 0.035 \text{ (m}^3\text{)}$$

1

[14]

Q4.

(a) bar to 0.3 g

1

bar labelled copper
allow Cu

1

(b) (£) 57

allow (£) 57.00

1

(c) $\frac{22}{9} \times 1.9$

1

= 4.6 (g)

allow an answer of 4.6(4444) (g)

1

an answer of 4.6(4444) (g) scores 2 marks

(d) (9 carat gold is)

any two from:

- harder

allow stronger or more durable or less malleable

- less expensive

allow cheaper

- aesthetic reasons

allow references to colour

allow converse arguments about 24 carat or pure gold

ignore references to finite resources

2

(e) any three from:

- copper ores will run out

allow copper ores scarce

- landfill sites running out

allow reduces waste

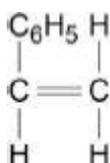
- less energy used
allow produces less carbon dioxide or an implication e.g. global warming
- mining causes pollution
allow a specific pollution resulting from mining, e.g. noise, eyesore, damage to environment
- copper from copper ore more expensive
allow recycled copper is cheaper

3

[10]

Q5.

(a)



1

(b) polymerisation

1

(c) monomers

1

many

1

polymers

1

must be in this order

(d) Level 2: Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.

3-4

Level 1: Relevant features are identified and differences noted.

1-2

Level 1: Relevant features are identified and differences noted.

1-2

No relevant content

0

Indicative content

for coated paper cups – accept converse for poly(styrene) advantages

- produced from a renewable resource
- biodegradable so breaks down

disadvantages

- higher energy costs
- greater use of fossil fuels and consequent pollution
- not recyclable so uses landfill

[9]

Q6.

- (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]

Q7.

(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]

Q8.

(a) all points correct

±1 small square

allow 1 mark for 6 or 7 plots

2

Year	Percentage (%) of bottles made from other materials
1975	5
1980	10
1985	22
1990	42
1995	70
2000	72
2005	90
2010	95

1

- (b) Level 3 (5–6 marks):
 A detailed and coherent argument is provided which considers a range of issues and comes to a conclusion consistent with the reasoning.
- Level 2 (3–4 marks):
 An attempt to describe the advantages and disadvantages of the production and uses is made, which comes to a conclusion. The logic may be inconsistent at times but builds towards a coherent argument.
- Level 1 (1–2 marks):
 Simple statements made. The logic may be unclear and the conclusion, if present, may not be consistent with the reasoning.
- 0 marks:

No relevant content.

Indicative content

- glass – 2 stages in production of soda-lime glass
- glass – second stage, heating sand, limestone and sodium carbonate
- HDPE – 3 stages in production
- HDPE – second stage, cracking of naphtha to obtain ethene
- HDPE – third stage, polymerisation of ethene
- fewer stages in glass production, may be quicker
- higher temperature in glass manufacture, therefore maybe higher energy requirement
- glass bottle can be reused
- consideration of collection / cleaning costs to reuse glass bottles
- other glass products can be made from recycled glass
- plastic has greater range of sizes both produced from limited raw materials
- higher percentage recycled materials in glass conserves raw materials
-

This indicative content is not exhaustive, other creditworthy responses should be awarded marks as appropriate.

6

[9]

Q9.

- (a) because it is a good conductor of electricity. 1
- (b) (i) 2.1 (%) 1
- (ii) correct bar for calcium at 3.6 % 1
allow error of +/- 0.05%
- correct bar for iron at 5.0 % 1
allow error of +/- 0.05%

- (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]

Q10.

- (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 2Fe₂ 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]