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

allow (a) monomer

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 dm^3 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

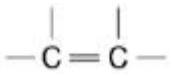
[8]

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
allow cheap(er)

1

low(er) density
allow light(er)

1

(disadvantages of addition polymers)
weak(er)
allow (more) likely to break

1

hard(er) to dispose of
ignore references to recycling or use as a fuel

1

(g)

*an answer of 0.035 (m^3) scores **3** marks.*
*allow **2** marks for an answer of 0.105 (m^3) (addition polymer)*

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

1

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

1

(volume =) 0.035 (m^3)

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

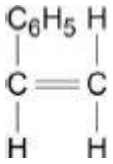
  allow recycled copper is cheaper

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

1

= 6.63×10^4 (kJ)

allow 6.6265060240963 × 10^4 (kJ) correctly rounded

*allow 66265.060240963 (kJ) correctly rounded for **1** mark*

1

*an answer of 6.63 × 10^4 (kJ) scores **2** marks*

(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 $2Fe_2$ 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]