**Chemistry Chapter 12 Question Booklet**

**Monday 27th March & Tuesday 28th March Booklet Part 1: Questions 1 - 4**

Mark schemes

**Q1.**

(a)  any **two** from:

•   high temperature

*ignore heat / hot*

*allow a temperature between 400 °C and 900 °C*

•   catalyst

*allow aluminium oxide, alumina, porous pot, zeolites*

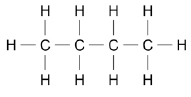
•   steam

•   high pressure

•   low oxygen atmosphere

**2**

(b)



*all bonds and atoms must be present*

**1**

(c)  carbon dioxide

*allow CO2*

**1**

water

*allow H2O*

**1**

(d)  bromine (water)

*do* ***not*** *accept bromide*

**1**

turns (from orange / brown / yellow to) colourless

*MP2 is dependent on MP1*

*allow decolourises*

*ignore clear*

**1**

(e)  sustainable development

**1**

**[8]**

**Q2.**

(a)     4 (C2H4)

**1**

(b)     cracking involves a catalyst

**1**

distillation does not

**or**

distillation does not involve a chemical change

but cracking does

**1**

(c)     Decomposition

**1**

(d)     **Level 3 (5–6 marks):**

A logically structured evaluation with links involving several comparisons. Nearly all points made are relevant and correct.

**Level 2 (3–4 marks):**

Some valid comparisons made between the two types of bag. There may be some  
incorrect or irrelevant points.

**Level 1 (1–2 marks):**

A vague response with few correct and relevant points and with no direct comparisons.

**0 marks:**

No relevant content

**Indicative content**

Accept converse in terms of plastic bags for all statements

•        Paper bags are made from a renewable resource

•        Plastic bags are made from a finite resource

•        Paper bags require more energy to manufacture

•        Paper bags produce more waste

•        Paper bags are biodegradable

•        Paper bags create more CO2

•        CO2 created by paper bags offset by photosynthesis in growing wood

•        Paper bag requires much more fresh water

•        Paper bags cannot be recycled

•        Agree because non-renewability less important than other factors **or** disagree because of converse **or** can’t say because data inconclusive / incomplete

**6**

**[10]**

**Q3.**

(a)  condenses

**1**

(b)  the fractions have different boiling points

**1**

(c)  propane

*do* ***not*** *accept propene*

**1**

(d)  CnH2n+2

**1**

(e)  CH4 + **2** O2 ⟶ CO2 + **2** H2O

*allow multiples*

**1**

(f)  bromine water

**1**

(g)  to assess the environmental impact (of the stages in the life of a product)

*allow to see the effect / harm / damage on the Earth / environment / planet*

*ignore references to energy, pollution, carbon footprint, carbon dioxide, sustainability*

**1**

(h)  **Level 2:** Scientifically relevant features are identified; the ways in which they are similar / different is made clear and the magnitude of the similarity / difference noted.

**3−4**

**Level 1:** Relevant features are identified and differences noted.

**1−2**

**No relevant content**

**0**

**Indicative content**

•   burning 10 000 bags produces 10 kg more of carbon dioxide than landfill

•   putting 10 000 bags in landfill produces 0.02 kg more of solid residue than burning

•   putting 10 000 bags in landfill produces 50% more sulfur dioxide than burning

•   burning 10 000 bags produces 25 kg of carbon dioxide, but landfill only produces 15 kg

•   putting 10 000 bags in landfill produces 0.07 kg of solid residue but burning only produces 0.05 kg

•   landfill produces less carbon dioxide than burning

•   landfill produces more solid residue than burning

•   burning produces less sulfur dioxide than landfill

**[11]**

**Q4.**

(a)  at high temperatures (in the engine)

**1**

nitrogen

**1**

reacts with oxygen (to produce nitrogen dioxide)

**1**

(b)  (**X** =)

(33 × 7) – [(37 × 3) + 35 + 34 + 29]

*allow*

*33 x 7 = (37 x 3)+ 35 + 34 + 29 +****X***

**1**

= 22 (micrograms per m3)

**1**

(c)  countryside data has smallest values

**1**

(so) 2 is a higher proportion / percentage of the value

*allow (so) countryside is ± 2 out of a value between 6 to 8*

**1**

(d)  2 NO2 → N2 + 2 O2

*allow multiples or halves*

*allow 1 mark for N2* ***and*** *O2*

**2**

(e)  a resource which will run out

*allow a non-sustainable resource*

**1**

(f)  (because carbon dioxide is emitted in) extracting / processing raw materials

**1**

(and) manufacturing

**1**

(and) disposal at the end of its useful life

**1**

**[13]**

**Monday 3rd April Booklet Part 2: Questions 5 - 9**

12.2 Potable Water & 12.3 Waste Water

Name: ………………………….. Mark: ………/54 Grade: ………

**Q5.**

(a)     Desalination

**1**

Sterilising

**1**

(b)     Chloride ion

**1**

(c)     correct bar for NO3-

**1**

(d)     **D**

**1**

(e)     any **two** from:

•        people have the right to choose (opinion)

•        ethical / moral question

•        cannot be tested by experiment

**2**

(f)



**1**

(g)     the percentage tooth decay increases with age

**1**

by 4 % for each increasing age group

**1**

(h)     reduces tooth decay (for all age groups)

**1**

greater reduction in older people

**1**

**[12]**

**Q6.**

(a)  balance

**1**

(b)  mass was greater / more than expected

**1**

(c)  dry the bottom of the evaporating basin

**or**

use an electric heater

**1**

(d)  heat until the mass of the evaporating basin and contents is constant.

**1**

(e)  evaporation

*ignore boiling*

**1**

(f)  **C**

**1**

(g)

**or**



**1**

= 0.22 (g)

**1**

(h)  mass of dissolved solids

**1**

(i)



**1**

= 0.6 (g)

**1**

**[11]**

**Q7.**

(a)  16(.0)

**1**

(b)  advantage: more accurate result

*do* ***not*** *accept reliable*

**1**

disadvantage: takes a long(er) time, more energy needed (to heat more water)

*ignore expensive*

**1**

(c)  pure: no dissolved solids / impurities

**or** no (dissolved) chlorine

*allow only water / H2O*

*ignore safe to drink*

**and**

potable: has dissolved solids / impurities

**or** has (dissolved) chlorine

*ignore safe to drink*

**1**

*a clear comparative statement referring to solutes gains the mark*

(d)  groundwater:

•   filtered

*allow acceptable method of filtration*

**1**

•   sterilised

*allow acceptable method of sterilisation*

**1**

groundwater:

•   distilled **or** reverse osmosis

*allow desalination*

*ignore salt removed*

*ignore boiling alone*

*ignore filtering*

*do* ***not*** *accept fractional distillation*

**1**

(e)



**1**

(=) 0.143 (g)

**1**

*an answer of 0.143 (g)*

***or*** *0.14 (g) scores* ***2*** *marks*

**[9]**

**Q8.**

(a)  potable

**1**

(b)  boil (water)

*ignore heat*

*do* ***not*** *accept filter*

*do* ***not*** *accept incorrect test*

**1**

(boils) at 100°C

***alternative approach*** *freeze (water) (1)*

*(freezes) at 0°C (1)*

*if no other mark awarded, allow 1 mark for evaporate or distil water* ***and*** *no solid left*

**1**

*allow boils at 100°C for* ***2*** *marks*

(c)  **Level 2:** The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.

**3−4**

**Level 1:** The design/plan would not necessarily lead to a valid outcome. Some steps are identified, but the plan may not be logically sequenced.

**1−2**

**No relevant content**

**0**

**Indicative content**

•   weigh container.

•   measure volume (100 cm3) of water into container.

•   evaporate / heat until dry.

•   weigh container and remaining solids.

•   determine mass of dissolved solids

to access Level 2 there should be an indication of using a known volume of water, heating until dry and determining the mass of solid.

(d)

*an answer of 0.031 (g) scores* ***4*** *marks*

(conversion of cm3 to dm3)

(250 cm3 =) or 0.25 (dm3)



**1**

(conversion of mg to g)

(125 mg =) or 0.125 (g)



**1**

(0.25 × 0.125) = 0.03125

*allow correct calculation from incorrect attempt(s) at conversion*

**1**

=0.031 (g)

*allow an answer correctly rounded to 2 significant figures from an incorrect calculation that uses the values in the question*

**1**

(e)   × 100



**1**

= 8.8 (%)

*allow 9 (%)*

**1**

*an answer of 8.8 (%) or 9 (%) scores* ***2*** *marks*

**[13]**

**Q9.**

(a)  microbes

*allow bacteria / pathogens*

**1**

chemicals

**1**

(b)  anaerobic digestion

**1**

(c)  (decrease =)

6.7 (billion)

**1**

(% decrease =)

× 100



*allow correct use of an incorrect value for decrease in plastic bag use*

**1**

= 84 (%)

*allow 83.75 / 83.8 (%)*

**1**

**alternative approach:**

(% now used =)

× 100 (1)



= 16.25 (1)

(% decrease =)

84 (%) (1)

*allow 83.75 / 83.8 (%)*

(d)  respiratory problems

*allow named respiratory conditions eg asthma allow breathing problems*

**or**

acid rain

*allow consequences of acid rain eg kills aquatic life*

***or***

*damages limestone buildings*

*allow smog*

**1**

(e)  (increased)

more traffic

*allow more cars*

**1**

(decreased)

improved efficiency of car engines

*allow use of catalytic converters*

*allow more electric / hybrid cars*

*allow lower temperature of car engines*

*allow more use of public transport*

*allow more people walk / cycle*

*ignore better designed engines*

**1**

**[9]**

**Tuesday 4th April Booklet Part 3: Questions 10 - 13**

12.4 Extracting Metals from Ores (Copper)

Name: ………………………….. Mark: ………/47 Grade: ………

**Q10.**

(a)  (copper ore)

(70 × 100 =) 7000

**1**

(recycled copper)

(27×100 =) 2700

**1**

(7000 – 2700 =) 4300 (MJ)

*allow correct use of incorrectly determined values for MP1 (copper ore) and/or MP2 (recycled copper)*

**1**

(b)  any **one** from:

•   reduces acid rain

*allow sulfur dioxide causes acid rain*

•   reduces respiratory problems (in humans)

*allow sulfur dioxide causes respiratory problems (in humans)*

**1**

(c)

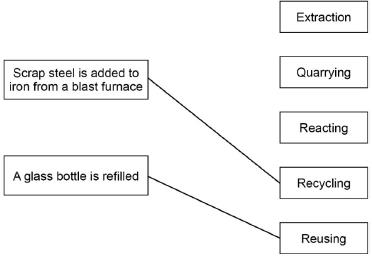


**1**

= 6 (g)

**1**

(d)



do **not** accept more than one line from a box on the left

**1**

**1**

(e)  **B**, **C**, **D**, **A**

**1**

**[9]**

**Q11.**

(a)     electrodes connected to d.c. power supply by wires

*for this diagram ignore the material used for the electrodes as long as they are made from carbon or metals that are inert*

**1**

electrodes labelled anode (+) and cathode (−)

**1**

(b)     copper ions cause the blue colour

*answer must be in terms on copper ions*

**1**

copper ions are reduced / converted to copper ions

**1**

so the concentration of copper ions decreased

**1**

*if no other mark awarded allow* ***1*** *mark for copper ions are used up during electrolysis*

(c)     copper ions are positive

**1**

so are attracted to the inert cathode **or** inert negative electrode

**1**

copper ions gain electrons at the inert cathode **or** inert negative electrode

**1**

so they are reduced to form copper atoms

**1**

(d)     50 cm3 contains 4 g CuSO4

**1**

*M*r CuSO4 = 159.5

**1**

4 g CuSO4 reacts with   × 56 g Fe



= 1.40(43877)

**1**

= 1.4 (g)

**1**

*accept 1.4(g) with no working shown for* ***4*** *marks*

*allow 1.40(43887) without working shown for* ***3*** *marks*

**[13]**

**Q12.**

(a)

|  |  |
| --- | --- |
| **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 |
| No relevant content | 0 |
| **Indicative content**  •   bioleaching is very slow, but although slow, phytomining can be made more efficient by growing quick growing plants  •   bioleaching extracts copper from quarrying waste, but phytomining extracts copper from contaminated ground  •   phytomining decontaminates polluted ground, but bioleaching can produce toxic run off which may go into rivers  •   phytomining takes a long time to stop  •   bioleaching is a very slow process  •   plants are burned in phytomining |  |

**4**

(b)     (plants burned to produce) ash

**1**

copper compounds in ash dissolved in sulfuric acid

**1**

(c)     CuSO4 + Fe

**1**

→ Cu + FeSO4

**1**

(d)     electron transfer

**1**

(e)     delocalised electrons

**1**

carry charge through the metal

**1**

(f)      turns from white

**1**

to blue

**1**

**[13]**

**Q13.**

(a)  production of copper is increasing

**1**

at an increasing rate

**1**

(b)  increase in population / demand

*allow more uses for copper*

**1**

(c)  any **one** from:

•   more use of recycling

•   copper is a finite resource and may run out

•   alternative metals may be used in future

*ignore only an estimate*

**1**

(d)  **B**, **D**, **C**, **A**, **E**

**1**

(e)  any **two** from:

•   (phytomining is) slower to produce copper

*ignore reference to cost*

*ignore references to carbon dioxide*

*ignore references to global warming*

*allow plants grow slowly*

•   large area of land required

•   insufficient yield to meet demand

**2**

(f)  (energy use through recycling =

27.2 × 8.89 × 109 × )



= 9.914 × 1010

**1**

(energy use through extraction =

70.4 × 8.89 × 109 × )



= 3.693 × 1011

**1**

(total consumption today =

9.914 × 1010 + 3.693 × 1011)

= 4.6844 × 1011

*allow correct use of an incorrect energy use determined in MP1 and/or MP2*

**1**

(energy use if only recycling used = 27.2 × 8.89 × 109)

= 2.418 × 1011

**1**

(energy saving =

4.6844 × 1011 – 2.418 × 1011)

= 2.27 × 1011 (MJ)

*allow an answer correctly calculated to 3 significant figures which uses the values in the question*

**1**

**[12]**