**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]**