AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



MARK SCHEME

4.10.1 USING THE EARTH'S RESOURCES AND OBTAINING POTABLE WATER (PACK 1)

SCORE	PERCENTAGE
/200	%

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Q1.

(a) watch glass

1

(b) identify 0.29 as anomaly

1

$\frac{0.12 + 0.14 + 0.15}{3}$

or

$\frac{0.41}{3}$

allow $\frac{0.12 + 0.29 + 0.14 + 0.15}{4}$

or

$\frac{0.70}{4}$

1

(=) 0.14 (g)

allow 0.18 (g) if first marking point not awarded

1

*an answer of 0.14 (g) scores **3** marks*

(c) evaporating
or
vaporisation

allow from liquid to vapour / gas
*do **not** accept boiling*

1

(d) pure
or
no salt

allow converse answers relating to seawater
allow not a mixture
allow desalinated
*do **not** accept less salt*
*do **not** accept filtered*

1

(e) uses (a lot of) energy

allow needs heating
allow needs electricity
*allow needs fuel **or** any suitable fuel*
ignore references to equipment
ignore references to time

1

(f) filtering removes particles

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*allow solids **or** suitable named solids*

1

sterilising kills bacteria / microbes

allow destroys viruses
allow kills viruses

1

[9]

Q2.

(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 / H_2O
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) $\frac{2.2}{100} \times 6.50$

1

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(=) 0.143 (g)

1

an answer of 0.143 (g)
***or** 0.14 (g) scores **2** marks*

[9]

Q3.

(a) (water that is) safe to drink

allow suitable to drink
ignore filtered / purified / pure / clean

1

(b) to filter the water
or
to remove solid objects

allow to remove bacteria from the water
allow example of solids

1

(c) 29 × 6 × 2

*allow **1** mark for 174(p)*
***or** (£)1.74*

1

(£)3.48

1

(d) have to wait longer before you can use the water

allow have to wait 2 weeks before you can use the water

1

not portable (if concrete used)

1

(e) any **two** from:

- filters a lot of water per hour **or** high filtration rate

  allow produces more clean water (in a given time)

- (concrete) heavy so cannot be knocked over / stolen
- higher reduction in pathogens (that cause diarrhoea)

  allow 47% reduction instead of 31% reduction

- low maintenance
- faster (than SODIS) **or** don't have to wait 8 hours
- not weather dependent (like SODIS)
- needs replacing less frequently

2

(f) ozone
or
chlorine

allow boiling the water
allow distillation
allow sterilising tablets

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allow gamma rays
ignore filtration / sunlight / heat

1

[9]

Q4.

(a) (number of deaths =) 91 **and**
(number of cases =) 3.4×10^3

allow readings in range 90 to 92
allow readings in range 3.3×10^3 to 3.5×10^3

1

$$\frac{91}{3.4 \times 10^3} (\times 100)$$

allow correct substitution of incorrect readings from 2004

1

(=) 2.68

allow correct calculation using incorrect readings from 2004

1

2.7 (%)

1

*an answer of 2.7 (%) scores **4** marks*

(b) the number of deaths peaked (to 120 in 2008)
the percentage deaths peaked (to 3.2%)

1

(but) the number of reported cases fell / did not rise

1

ignore numbers

(c) we don't know what the data was before 2002

1

(d) any **two** from:

- poor sanitation
  or idea of poor toilet hygiene
  ignore overcrowding
- drinking contaminated water
- eating contaminated food
  or using contaminated water to grow crops

2

(e) air / water under the sheet is warmed by the Sun

1

(so) water evaporates (from the ground / contaminated water)

1

(then water) condenses on (the underside of) the plastic sheet

1

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the weight causes a drip point in the centre of the plastic sheet

1

(so clean) water drips into the can (continuously ready for drinking through the plastic tubing)

1

(f) UV (light)

ignore ionising radiation

1

causes mutations in the DNA

causes breakage(s) in the DNA

1

(so) bacteria cannot replicate (and so die out)

(so) cellular processes stop

1

[17]

Q5.

(a) bioleaching

1

bacteria

dependent on bioleaching being given

1

phytomining

1

plants

dependent on phytomining being given

1

(b) any **three** from:

- copper ores are becoming scarce
- can extract from low grade ores

  allow extraction of copper from contaminated land

- mining not required

  allow consequences of less mining

- moving / disposing of large amounts of rock not required

  allow less energy required

  *allow fewer emissions of greenhouse gases **or** less carbon dioxide released*

  allow reduces global warming

  ignore references to cost

3

(c) iron is more reactive than copper

1

(so) iron displaces copper (from copper sulfate)

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allow (so) iron reduces copper ions

1

(d) correct formulae and symbols

equation must be correctly balanced

1

correct state symbols

1

*allow for **2** marks*

$Fe(s) + CuSO_4(aq) \longrightarrow Cu(s) + FeSO_4(aq)$

(e) $(\text{moles copper ions}) = \frac{3.175}{63.5}$

1

= 0.05 (moles)

1

(number of copper ions =
moles × Avogadro constant)
= $0.05 \times 6.02 \times 10^{23}$

allow incorrectly calculated value for number of moles from step 2

1

= 3.01×10^{22} (ions)

1

*an answer of 3.01×10^{22} (ions) scores **4** marks*

*answer not given in standard form **max 3** marks*

[15]

Q6.

(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	

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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) $CuSO_4 + Fe$

1

$\rightarrow Cu + FeSO_4$

1

(d) electron transfer

1

(e) delocalised electrons

1

carry charge through the metal

1

(f) turns from white

1

to blue

1

[13]

Q7.

(a) 1 600 000 × 5

1

(=) 8×10^6

*an answer of 8 × 10^6 scores **2** marks*
allow 8 000 000

1

(b) experiment 3

1

(c) (148 + 151 + 151) / 3

1

= 150 (g)

*an answer of 150 (g) scores **2** marks*

1

(d) answer in range 530–550 (g)

1

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(e) mean mass of water absorbed in grams ∝ mass of hydrogel in grams

1

(f)

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 **advantages of fabric nappies** • disposable nappies contain non-biodegradable materials • disposable nappies will remain in landfill for long periods • fabric nappies can be reused **disadvantages of fabric nappies** • fabric nappies have slightly higher carbon dioxide emissions • (so) bigger impact on global warming • fabric nappies use more water than disposable nappies to make each nappy • fabric nappies use more water than disposable nappies when used (because of washing).	

4

[11]

Q8.

(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

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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 cm^3 contains 4 g $CuSO_4$

1

M_r $CuSO_4$ = 159.5

1

4 g $CuSO_4$ reacts with $\frac{4}{159.5}$ × 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]

Q9.

(a) Flask

1

(b) Fractional distillation

1

(c) **A** – boiling
in this order

1

B – condensing

1

(d) Octane

1

(e) Formulation

1

(f) the fuel is a pure compound

1

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and crude oil is a mixture

or

the fuel is made up of four hydrocarbons

allow crude oil contains a large number of compounds and the fuel contains four

and crude oil could have many more

1

(g) (35 + 37 + 37 / 3) = 36.33

1

36

1

*allow (35 + 48 + 37 + 37 / 4 =) 39(.25) for **1** mark*

[10]

Q10.

(a) Desalination

1

Sterilising

1

(b) Chloride ion

1

(c) correct bar for NO_3^-

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) $\frac{1.5}{4.0} \times 100$

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]

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Q11.

(a) 4 (C_2H_4)

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 CO_2
- CO_2 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]

Q12.

(a) Safe to drink

1

(b) To remove undissolved solids

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1

(c) the gas is chlorine / Cl_2

1

which sterilises water

1

(d) as distance between steel increases strength of concrete decreases

1

change above and change below 1.0 cm separation is compared and described

must refer to graph values for this mark

1

[6]

Q13.

(a) **Level 2 (3–4 marks):**
A detailed and coherent explanation of how the water molecules transfer through the water cycle from one form / area to another. Logical links are made between the general details of the water cycle to the context of the iceberg.

Level 1 (1–2 marks):
Simple relevant facts stated about the water cycle. Details may be missing and any links made with the context of the iceberg may be inconsistent or vague.

0 marks:
No relevant content.

Indicative content

- water in the iceberg is in its solid state
- when the iceberg melts water is in its liquid form
- and the water molecules go into the sea
- water evaporates from the surface of the sea
- so the water molecules go into the air as vapour
- as the air rises it cools
- so water vapour condenses into droplets in clouds
- clouds can be moved around the world by winds
- droplets then fall as rain / snow / hail / precipitation
- into a lake

4

(b) solid materials

1

removed by filtration **or** by passing through filter beds

1

microbes

1

are killed by sterilisation

1

allow killed by chlorine / ozone / ultraviolet light

[8]

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Q29.

(a) (i) *(advantages of titanium)*

ignore references to figures

less dense

allow lighter

1

stronger

ignore references to corrosion

1

(disadvantage of titanium)

more expensive

1

(ii) high resistance to corrosion

1

(b)

Metal	Method of extraction
Gold	Mined as the pure metal from the ground
Iron	Reduction of metal oxide with carbon
	Electrolysis of molten compound

extra line from any metal negates mark

1
1

(c) silver

ignore chemical symbols

1

(d) (i) mixture

1

(ii) 12 (%)

1

(iii) plants

1

[10]

Q30.

(a) transition (elements / metals)

accept d block (elements / metals)

1

(b) any **three** from:

ignore references to cost

- (good) conductor (of heat)

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ignore references to electricity

- can be bent / shaped
  accept malleable
  ignore moulded
- does not react with water
  allow does not rust
  allow not very reactive
- strong
  allow durable
  ignore tough
- hard enough to make pipes or tanks
- high melting point
  allow ductile

3

(c) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should apply a 'best fit' approach to the marking.

0 marks
No relevant information

(1 – 2 marks)
At least one advantage **or** disadvantage of **either** method is given.

(3 – 4 marks)
At least one advantage **and** one disadvantage is given.
or
At least one advantage of **both** methods is given
or
At least one disadvantage of **both** methods is given.

(5 – 6 marks)
Advantages and disadvantages of **both** methods are given.
For 6 marks a reasonable attempt at a conclusion is made.

examples of the points made in the response
ignore references to cost unless qualified.
ignore jobs / transport

Advantages of smelting:

- quicker
- extracts more copper
- more economically viable
  allow involves fewer stages

Disadvantages of smelting:

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- supply of copper rich ores is limited
- (mining causes) dust / noise pollution
  ignore pollution unqualified
- destruction of landscape or visual pollution
- destruction of habitats
- smelting uses non-renewable fuel
- smelting uses more energy / electricity
- large amounts of waste rock
- (mining / smelting) releases (more) carbon dioxide / causes global warming
  allow (more) greenhouse gases
- (smelting) releases sulfur dioxide / causes acid rain

Advantages of phytomining:

- extracts copper from low grade ores
- conserves copper rich ores
- does not destroy landscape or less visual pollution
  allow does not destroy habitats
  allow carbon neutral

Disadvantages of phytomining:

- produces smaller amount of copper (per unit mass)
- takes up a lot of space
- takes a long time (to grow plants)
- produces carbon dioxide when plants burnt
- land cannot be used to grow food crops

Electrolysis

- Used in <u>both</u> methods (so neither an advantage or disadvantage)

Conclusion supported by comparisons made

6

[10]

Q31.

(a) (i) carbon is more reactive than iron / higher in reactivity series
accept carbon displaces / replaces iron
'it' = carbon

1

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therefore can reduce (iron oxide) / reduction reaction occurs

accept therefore removes oxygen from iron (oxide)

ignore carbon displaces oxygen
ignore carbon reacts with oxygen

*do **not** accept iron reacts with carbon*

1

(ii) left hand side correct: **2**Fe_2O_3 + **3**C

1

right hand side correct: **4**Fe + **3**CO_2

accept as correct if all numbers multiplied by same number eg

4Fe_2O_3 + ***6***C → ***8***Fe + ***6***CO_2

1

(b) (phytomining)
any **two** from:

- less atmospheric pollution / named pollutant eg sulfur dioxide

  allow harmful gases / fumes / smoke / metal particles

  ignore less waste
  ignore no pollution
  ignore carbon dioxide for this marking point

- phytomining (more) carbon neutral / less global warming

  *allow phytomining produces <u>less</u> carbon dioxide / greenhouse gases **or** smelting produces large amounts of carbon dioxide / greenhouse gases*

- phytomining helps clean polluted sites

- plants are a renewable (resource)

- uses less energy / fuel

2

[6]

Q32.

(a) **economic**

any **one** from:
- increases jobs
- more money in local economy
- increase in local trade
- more shops / businesses
- better transport links

1

environmental

any **one** from:
- future development of quarry eg to lake / reservoir
- future development to recreational area
- provides different habitat

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1

(b) calcium oxide and carbon dioxide

both products required for mark
allow CaO for calcium oxide
allow CO_2 for carbon dioxide
allow quicklime for calcium oxide

1

(thermal) decomposition

1

(c) (i) $CaO + H_2O \rightarrow Ca(OH)_2$

correct formulae
*3 correct for **2** marks*
*2 correct for **1** mark*
ignore attempts to balance equation

2

(ii) carbon dioxide

1

solution goes cloudy (then clear again)

accept milky / forms a white precipitate

1

[8]

Q33.

(a) protons = 79

allow proton number is 79
ignore atomic number

1

electrons = 79

1

neutrons = 118

1

protons **and** neutrons in nucleus and electrons in shells / energy levels / orbits around nucleus

*allow for **1** mark, protons, neutrons and electrons if no other mark obtained*

1

(b) (i) supply of copper(-rich) ores is limited

allow can extract copper from low grade ores

or
to limit the environmental impact (of traditional mining)

ignore environmentally friendly unqualified

or
more economical than other methods

ignore it is cheaper unless qualified

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1

(ii) plants (grown on land containing copper)

1

(plants) absorb copper compounds / ions

allow minerals

ignore copper / metal

1

(plants) burned to produce ash / metal compounds

1

[8]

Q34.

to obtain all four marks, at least one argument for biodiesel and one argument against biodiesel must be given

if no fuel named assume it refers to biodiesel

any **four** from:

arguments for biodiesel:

- burning biodiesel produces low amounts of particulates so less global dimming

  accept unburnt hydrocarbons / soot as alternatives to particulates

- absorbs carbon dioxide when plants are growing so carbon dioxide released when burnt equals carbon dioxide taken in

  accept carbon neutral

- removes need to dispose of cooking oil

- using a renewable resource so conserving crude oil / non-renewable resources

4

arguments against biodiesel:

- burning biodiesel produces high amounts of nitrogen oxides so more acid rain formed
- deforestation leads to a reduction in absorption of carbon dioxide so increased global warming
- production of biodiesel leads to increased carbon dioxide output so overall is not carbon neutral
- production of fuel crops rather than food crops could lead to food shortages / food price increases

conclusion supported by the argument presented

Compensation marks

- *apply if 0 or 1 mark scored:*
- ***three / four** comparisons **from table = 2** marks*
- ***two** comparisons **from table = 1** mark*

*compensation marks added to previous marks scored but restricted to maximum of **2** marks for question total*

1

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[5]

Q35.

(a) because the traditional method of extraction produces large amounts of solid waste

1

because the traditional method of extraction would cause atmospheric pollution due to the release of carbon dioxide / sulphur dioxide

1

(b) (i) because iron is cheap

accept because iron is much more abundant than copper

1

(ii) iron is more reactive than copper

1

therefore iron displaces copper from solutions of its salts / copper sulfate solution

1

[5]

Q36.

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response.

No relevant content.

0 marks

There is a brief description of a positive and a negative environmental impact involved with one or more methods used to reduce the amount of plastic bags sent to landfill.

Level 1 (1–2 marks)

There is some description of both positive and negative environmental impacts involved with at least 2 methods used to reduce the amount of plastic bags sent to landfill.

Level 2 (3–4 marks)

There is a clear, balanced and detailed description of both a positive and a negative environmental impact of using each of the 3 methods used to reduce the amount of plastic bags sent to landfill.

Level 3 (5–6 marks)

examples of the points made in the response

Reuse:
Reuse means less bags used so:

Positive environmental impact

- Saves raw materials/crude oil

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- Saves energy
- Cuts down on CO_2 emissions
- Less global warming

Negative environmental impact

- Could cause litter
- Could still be sent to landfill

Recycle:
Bags can be recycled so:

Positive environmental impact

- Used to make new plastic bags / objects
- Saves raw materials / crude oil
- Saves energy compared to producing plastic bags from crude oil
- Cuts down on CO_2 emissions
- Less global warming

Negative environmental impact

- Collection point sites cause an eyesore / litter problem
- Transportation to recycling plant releases carbon dioxide / causes global warming

Burn:
Bags can be burned so:

Positive environmental impact

- Could provide energy for heating buildings
- Could provide energy for generating electricity

Negative environmental impact

- Increases CO_2 emissions
- Increases global warming
- Could release toxic gases
- Does not conserve raw materials / crude oil

[6]

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Q1.

(a) 44% of students correctly selected ‘watch glass’. However, almost an equal number of students selected ‘condenser’, suggesting unfamiliarity with this required practical.

(b) 24% of students achieved all three marks, and 30% achieved two marks. Most students understood the basic concept of finding a mean, although there were a variety of errors. The most commonly seen error was to include the anomaly, 0.29 in the calculation. These students achieved a maximum of two marks for a correctly calculated answer from this.

Other students did not give the answer to two significant figures, either giving the wrong number of significant figures or rounding incorrectly. They also achieved a maximum of two marks if the rest of the calculation was correct.

There was evidence of incorrect addition and division, suggesting that some students did not have, or were not able to correctly use, a calculator.

(c) Evaporation as a change of state was well known, and frequently given, along with the description, turning form a liquid to a gas. 41% of students were achieved this mark.

Commonly seen incorrect responses were ‘condensation’, ‘boiling’ and ‘bubbling’. Some confusion between evaporation and condensation was evident. Answers such as ‘heating’ or ‘change in temperature’ indicated that the concept of change of state was not recognised by these students.

(d) 51% of students gained credit, mostly for stating that the water in the test-tube contains no salt. A smaller proportion stated that it is pure.

Many of the incorrect responses indicated a weak understanding of distillation, often referring to the water being filtered, or made clean, or the salt evaporating. Other students described part of the distillation process, but did not suggest in what way the water in the test-tube was different. Answers suggesting that there was less salt in the test-tube water were not credited as there would be no salt.

(e) 27% of students recognised that energy costs are the greatest contributor to the expense of distillation. Commonly seen incorrect responses often referred to the cost of equipment, of the workforce, of the scale of the process or of the time taken for the process. Some students are confusing distillation with filtration, suggesting that the cost of filtering is the main expense.

(f) 47% of students achieved one mark, and 165 achieved both marks. Students gaining credit often gave clear, precise responses with correct terminology. Responses which were less precise did not gain credit, for example filtering or sterilising makes the water clean, or sterilising is to remove bacteria.

Some students did not understand the concept of filtration, suggesting that it would remove salt or bacteria from the water. With sterilisation, bacteria are killed or destroyed, not removed. Less precise responses such as removal of germs or diseases were not credited.

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Q2.

(a) 76% of students correctly calculated the mass as 16. Some students incorrectly calculated the mass to be 14.

(b) 56% of students achieved at least one mark; 16% achieved both. Incorrect responses describing the length of time 'for the solids to dissolve' were regularly seen. Marks were awarded more often for students who correctly gave a disadvantage of using a larger volume of water than those who attempted to give an advantaged by creating a list of reasons, for example reliable, accurate and precise.

(c) 27% of students correctly described the difference between pure water and potable water. 'Dissolved' was omitted from the majority of descriptions about potable water having chemicals, minerals or even vitamins and nutrients 'in it'. A number of students answered in terms of the pH of the two waters.

(d) 70% of students achieved at least one on this question. 25% gave responses that gained either all three marks or two marks. Students failed to separate out their answers highlighting the differences in the treatment methods to produce potable water from ground water and seawater. 'The water' was filtered, sterilised and distilled to produce potable water was a common response. The higher-attaining students gave clear, succinct responses using the correct terminology.

(e) 56% of students achieved full marks on this question. The most common mistake was not converting 2.2 into a percentage (0.022 or 2.2 ÷ 100) when multiplying by 6.50 to calculate the mass of dissolved solids.

Q3.

(a) 42% of students knew that potable water was safe to drink. Of those who did not gain the mark, responses were almost equally split between those who thought that it was portable water easily carried about and those who thought it was water which had been treated in some way.

(b) 48% of students achieved credit, often for 'removing the bacteria'.

(c) 65% of students achieved one mark for calculating that 6 bottles at 29p would cost £1.74. However, they then missed the next mark as they multiplied it by 365, rather than 2, not seeming to realise that new bottles were only needed twice in a year rather than every day.

(d) Many students repeated the question text rather than going on to explain or making answers comparative. As a result, 30% of students achieved any credit.

(e) 17% of students were able to score two marks here, but as in part **(d)** some students missed out on marks as they made no comparison.

(f) Boiling was the most common correct answer given by 43% of students.

Q4.

(a) 23% of students achieved all four marks in this calculation, while 50% of students did not receive any credit. Common errors included:

- calculating cases ÷ deaths
- reading the wrong scale

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- not using 103 correctly
- not giving the answer correct to two significant figures
- not rounding correctly.

(b) An epidemic is characterised by a sudden increase rising to a peak. A high number of deaths is not necessarily a peak and a low number of cases is not necessarily a fall. 42% of students gained no marks while 22% achieved both marks.

(c) 60% of students achieved this mark for identifying the lack of data before 2002.

(d) Cholera is identified in the specification as an area of study, but 67% of students were unable to give a creditworthy answer. The essential point is that cholera must be ingested in drinking water or on contaminated food and therefore 'through water' was insufficient. Many students thought that cholera is contagious or spread by a vector.

(e) A significant number of students described filtration systems using the parts in the diagram instead of describing the ideas of distillation in this context. Many students suggested that the plastic was to collect rainwater. 27% of students achieved three or more marks. 16% of students did not attempt this question and 37% gave responses that were awarded zero marks.

(f) The stem of the question was designed to point the students in the right direction by stating 'the steriliser emits light'. However, a significant number of students suggested that a chemical was released. Very few of those who gave UV light were able to gain the other two marks. 17% of students achieved any marks in this high demand question (most of which were rewarded one mark).

Q5.

(a) The question asked for the name of the method, so this had to be given to access the organism mark. A common incorrect organism for bioleaching was 'leaches'.

Many students though had no knowledge of the processes with a variety of chemical methods being given which included fracking, distillation, electrolysis and smelting, usually without an organism being named. 21% of students achieved full or partial credit.

(b) Answers were often vague and did not address the situation of copper mining. Examples included 'more environmentally friendly', 'cheaper' or 'safer.' Less energy used was the most common correct response whilst the specification statement of moving large amounts of rock was rarely seen. 5% of students achieved two or three marks.

(c) 38% of students realised that iron was more reactive than copper but a much smaller number were able to explain that this was due to a displacement reaction. Some who realised that it was a displacement reaction then described iron displacing oxygen or sulfur.

(d) 21% of students achieved full marks. Many did not know that this was a displacement reaction and were therefore unable to give the correct products of the reaction.

The clarity of the chemical symbols varied, with Fe often being written with a lower case curly f and Cu with many u's looking same size as the C.

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The state symbols were not well known. Cu was often written next to the (aq) and $CuSO_4$ was described as liquid.

(e) Being able to calculate the number of moles of copper ions present, using the Avogadro constant and expressing an answer in standard form was achieved by 21% of students. 14% of students gained two marks when the working was clearly set out and an incorrect calculation for the number of moles could then be credited when used correctly in steps three and four.

Q29.

(a) (i) This question was well answered with over half the students gaining all 3 marks. When students lost marks it was generally for just quoting figures from the table without adding value, or for not writing comparative statements. Saying titanium 'is strong' or 'has a low density' was insufficient.

(ii) Most students gained the mark for identifying that titanium has a high resistance to corrosion.

(b) Most students gained the mark for gold being mined as the pure metal from the ground.

(c) Almost all students named the metal as silver, having been able to locate Ag in the periodic table.

(d) (i) Most students knew that an alloy is a mixture, although some thought it is a compound.

(ii) Most students correctly subtracted 88 from 100 to calculate the percentage of tin in the alloy.

(iii) Most students thought that fossils were used in phytomining. Only a third of them correctly selected plants.

Q30.

(a) Few students knew that the elements in the central block of the periodic table are called transition metals.

(b) Some students did not understand the term property. The most common responses were that copper does not rust or react with water, many students had both of these written down but could only gain credit for this idea once. Another common answer was that copper can be bent or shaped. There was some confusion between strength and hardness, which are two different properties; only strong was creditworthy. Many students said copper was an insulator rather than a conductor. Many referred to cost, which is not a property, and was ignored.

(c) Most students were able to make a reasonable attempt at answering this question. Most Level 1 responses referred to the comparative time of each process. Beyond Level 1 comparative pollution levels were often seen as a second scientific idea, eg visual, noise and dust pollution, however these were often very poorly expressed. Many students only referred to pollution, without qualifying the statement, which was not creditworthy.

A large number of students were able to describe the disadvantages of both methods very clearly; however they struggled to identify advantages of the processes. Advantages could be inferred from statements about disadvantages

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which were comparative slower or more noise pollution.

To gain full marks students had to follow the instructions given in the question and give advantages and disadvantages of both methods, plus a conclusion. The advantages and disadvantages also had to relate to at least three different ideas to attain Level 3. Many students made good scientific points but did not attempt a conclusion, so only gained 5 marks.

Q31.

(a) (i) The mechanism of the process was poorly understood by most students. However, many students did state that carbon was more reactive than iron. Often there was just a straightforward description of the reaction rather than an explanation. Many students lost marks through incorrect chemistry or confusion about what was reacting eg stating that carbon reacted with iron.

(ii) Students found this question difficult with only a tenth of students gaining full credit.

(b) Again, students found this question difficult with about a quarter of students able to pick up at least one mark.

Q32.

(a) Some students answered the question in terms of advantages and disadvantages of quarries, rather than economic and environmental reasons. They did not realise that the company would want to present advantages for both reasons and gave a variety of arguments against the opening of a new quarry. Many students gained a mark for the economic reason of providing more jobs. A lot of students incorrectly thought that the quarry would be a tourist attraction.

(b) Both products were required to gain one mark. Students often named either carbon dioxide or calcium oxide only, or one of the products was named incorrectly. Common incorrect products were limewater or slaked lime. Incorrect processes named were combustion, melting, cracking and distillation. Students would benefit from learning definitions and examples of all these processes.

(c) (i) A third of students answered this question correctly. A symbol equation was asked for, but many students wrote a word equation so gained no marks. The most common errors were incorrect formulae. Calcium oxide was represented incorrectly as CaO_2 or Ca. Calcium hydroxide was usually written correctly, as it was given in the question. A surprising number did not know the formula of water. Students could not gain the marks if formulae were written with lower case letters or superscripts.

(ii) Compared to the January 2012 exams more students knew the test for carbon dioxide. However, a variety of other gases and chemicals were named. Similarly, a variety of colour changes were given. Students mixed up tests for hydrogen, oxygen and carbon dioxide. The tests for carbon dioxide and for unsaturation are the only two that students need to learn for Unit 2 C1. Almost a fifth of students did not make any attempt at answering this question.

Q33.

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(a) Many students did not understand the question and described what gold looks like or its properties, particularly its position in the reactivity series, rather than its structure. Most students said that gold had 79 protons, but often mixed up the numbers of electrons and neutrons. Some thought the total number of particles added up to 197. A few students gained the last marking point for a description of the positions of the three particles in the atom. A few tried to work out the electron arrangement and ran into problems, but this did not affect their marks.

(b) (i) Responses stating that copper rich ores are in limited supply were rarely seen and most statements about environmental impact or economic reasons were generally too vague. Environmental impact had to relate to scars on the landscape due to traditional mining. Most responses about cost were not qualified, 'it's cheaper' was not enough to gain the mark. Many students mentioned that it was cheaper or more environmentally friendly than electrolysis, not realising that the final stage in phytomining to extract the copper is by electrolysis. Just over a tenth of students answered this question correctly.

(ii) This question was not answered well and over a third of students did not attempt to answer it. Phytomining is a new topic to the specification and perhaps is not familiar enough to students. Students rarely gave the three stages of phytomining. When an attempt to answer the question was made, many students gained one mark for saying it involved the use of plants. If they went on to talk about plants absorbing something, they usually incorrectly stated copper rather than copper ions, compounds or minerals. Some students mentioned that the plants were burned, but did not explain that copper was extracted from the ashes. Although this was a high demand question, students at standard demand should be able to explain the stages of phytomining.

Q34.

The vast majority of marks awarded were for comparisons of emissions given in the table. Students rarely explained the consequences of these emissions. Many students attempted to give a conclusion but found it difficult to support, making vague comments about biodiesel being more environmentally friendly. A very small proportion of students were able to be credited with three or more marks.

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