

# Mark Scheme (Results)

## June 2010

GCE

### GCE Chemistry (6CH01/01)

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Section A (multiple choice)

Question Number	Correct Answer	Mark
1 (a)	B	1

Question Number	Correct Answer	Mark
1 (b)	D	1

Question Number	Correct Answer	Mark
2	D	1

Question Number	Correct Answer	Mark
3	A	1

Question Number	Correct Answer	Mark
4 (a)	B	1

Question Number	Correct Answer	Mark
4(b)	D	1

Question Number	Correct Answer	Mark
4 (c)	C	1

Question Number	Correct Answer	Mark
4 (d)	A	1

Question Number	Correct Answer	Mark
5	B	1

Question Number	Correct Answer	Mark
6	A	1

Question Number	Correct Answer	Mark
7	C	1

Question Number	Correct Answer	Mark
8	D	1

Question Number	Correct Answer	Mark
9	C	1

Question Number	Correct Answer	Mark
10	C	1

Question Number	Correct Answer	Mark
11	D	1

Question Number	Correct Answer	Mark
12	B	1

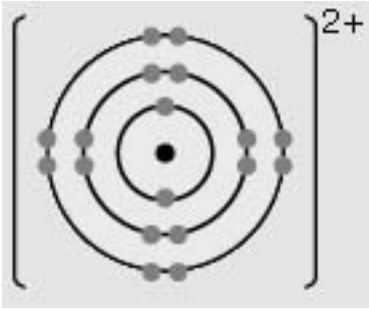
Question Number	Correct Answer	Mark
13	D	1

Question Number	Correct Answer	Mark
14 (a)	B	1

Question Number	Correct Answer	Mark
14 (b)	A	1

Question Number	Correct Answer	Mark
14 (c)	C	1

Section B

Question Number	Acceptable Answers	Reject	Mark
15 (a)(i)	 <p>electrons (1) charge (1) square brackets not essential</p> <p>Mark independently</p> <p>Ignore (labelling of) nucleus unless incorrect</p>		2

Question Number	Acceptable Answers	Reject	Mark
15 (a)(ii)	$1s^22s^22p^63s^23p^6$ <p>Allow electron number as sub script</p> <p>Allow orbitals as capital letters</p> <p>Allow TE from (a) (i) if Ca atom or Ca<sup>+</sup> ion</p>		1

Question Number	Acceptable Answers	Reject	Mark
15 (a)(iii)	<p>Smaller</p> <p>Because it has one less (sub) shell of electrons / orbital / energy level / less shielding (1)</p> <p>And the ratio of protons : electrons has increased / more protons than electrons / greater net force on remaining electrons (so remainder of electrons held more closely) / greater effective nuclear charge (1)</p>	<p>bigger scores zero</p> <p>greater nuclear charge / positive charge</p>	2

Question Number	Acceptable Answers	Reject	Mark
15 (a)(iv)	<p>Any two from:            Strong (electrostatic) forces / attractions / bonds (between ions) (1)</p> <p>(ions) held in giant lattice / many (ionic) attractions / forces / bonds (1)</p> <p>So large amount of energy needed (to break apart ions) (1)</p>	<p>Any mention of covalent or metallic bonds or atoms or molecules scores zero</p> <p>High temperature</p>	2

Question Number	Acceptable Answers	Reject	Mark
15 (b)(i)	Because the ions are free to move (when a potential difference is applied)	Electrons / particles are free to move	1

Question Number	Acceptable Answers	Reject	Mark
15 (b)(ii)	<p>The cations / barium and calcium (ions) are different sizes</p> <p>Ignore any discussion of reasons</p> <p>(could select either the calcium ion because it has more water molecules associated with it OR the barium ion because it has more shells of electrons and so larger)</p>	Atoms are different sizes	1

Question Number	Acceptable Answers	Reject	Mark
15 (b)(iii)	<p>Mass of calcium ions in 1 kg = <math>0.100 \times 40</math> (= 4.0) (g) (1)</p> <p>If mass quoted must be correct to score first mark</p> <p>Hence 4.0 g per 1000 g of solution So ppm = <math>(4.0/1000) \times 1000000</math> = 4000 (ppm) (1)</p> <p>OR</p> <p>Mass of calcium ions in 1 kg = <math>0.100 \times 40.1</math> (= 4.01) (g) (1)</p> <p>Hence 4.01 g per 1000 g of solution So ppm = <math>(4.01/1000) \times 1000000</math> = 4010 (ppm) (1)</p> <p>Correct answer alone = 2 marks</p> <p>Allow TE for second mark from incorrect mass</p>		2

Question Number	Acceptable Answers	Reject	Mark
15 (c)	<p>(Sulfur / nitrogen oxides) form when (fossil) fuels are burnt / when petrol or diesel burn in vehicle engines / emissions from vehicle (engines) / volcanoes / lightning (1)</p> <p>They (react with water to) form sulfuric / sulfurous acid / nitric acid / acid rain / gases are acidic (1)</p> <p>Which reacts with limestone (to form soluble compounds) / limestone and acid take part in neutralisation / dissolves building / corrodes building (1)</p> <p>Allow correct equation for third mark but ignore equations if mark already awarded. Ignore comments regarding erosion</p>	from factories alone	3

Question Number	Acceptable Answers	Reject	Mark
15 (d)	Either Yes, as the values match closely (so little deviation from ionic model) Or no, as the values are (slightly) different so a degree of covalency / not fully ionic	100% ionic  covalent	1



Question Number	Acceptable Answers	Reject	Mark
16 (a)	<p>Atoms (of an element) with the same number of protons (1)</p> <p>But with different number of neutrons (1)</p> <p>Same atomic number but different mass number only = (1)</p> <p>Element(s) with same number of protons but different number of neutrons = (1) max</p> <p>Ignore comments on electrons unless incorrect in which case award max 1</p>		2

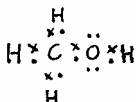
Question Number	Acceptable Answers	Reject	Mark
16 (b)(i)	(Electric field) accelerates ions		1

Question Number	Acceptable Answers	Reject	Mark
16 (b) (ii)	<p>(Magnetic field) deflects / changes direction of / bends the beam of ions</p> <p>if the term 'ions' is missing or an incorrect term is used e.g. 'atoms', penalise only once in parts b (i) and b (ii)</p>	just bends ions	1

Question Number	Acceptable Answers	Reject	Mark
16 (c)	<p>% abundance = <math>(135 \times 9.01 + 136 \times 10.81 + 137 \times 12.32 + 138 \times 67.86) / 100</math> (1)</p> <p>= 137.4 (1)</p> <p>ignore units</p> <p>Allow TE for one slip in transfer of data from question</p> <p>Correct answer scores (2)</p>	<p>Just 137 as final answer</p> <p>137.39</p> <p>137.3903</p> <p>137.390</p>	2

Question Number	Acceptable Answers	Reject	Mark
16 (d)	<p>three peaks (caused by <math>\text{Br}_2^+</math> ions) (1)</p> <p>because ions <math>(^{79}\text{Br}-^{79}\text{Br})^{(+)}</math>  and <math>(^{81}\text{Br}-^{79}\text{Br})^{(+)}</math> / <math>(^{79}\text{Br}-^{81}\text{Br})^{(+)}</math>  and <math>(^{81}\text{Br}-^{81}\text{Br})^{(+)}</math> (1)</p> <p>Mark independently</p>		2

Question Number	Acceptable Answers	Reject	Mark
16 (e)	<p>Any one</p> <p>analysis of material from space  / drug testing in sport  / identify breakdown products from drugs in body  / quality control in pharmaceutical industry  / identify molecules from sample with potential biological activity  / radioactive dating with context e.g determine age of fossils / human remains</p> <p>The uses above must have a context</p> <p>/ determining <math>M_r</math> of a molecule  / evidence for structure from fragmentation pattern</p>		1

Question Number	Acceptable Answers	Reject	Mark
17 (a)	 <p>(1) for around carbon and its hydrogens (1) for around oxygen and its hydrogen</p> <p>Allow all dots or all crosses Ignore circles around atoms</p>		2

Question Number	Acceptable Answers	Reject	Mark
17 (b)(i)	<p>C(s) / (graphite) + 2H<sub>2</sub>(g) + 2O<sub>2</sub>(g) Correct species (1)</p> <p>Allow oxygen above arrows rather than in box</p> <p>Balancing and state symbols (1)</p> <p>Second mark dependent on correct species except as below with either hydrogen or oxygen or both as atoms e.g C(s) / (graphite) + 4H(g) + 4O(g)</p> <p>Scores second mark</p>		2

Question Number	Acceptable Answers	Reject	Mark
17 (b)(ii)	<p>Enthalpy / energy / heat(energy) change when one mole of a substance (1)</p> <p>Is formed from its elements (in their most stable / standard states) (1)</p> <p>Under standard conditions of 298K/ 25 °C / any stated temperature AND 1 atm pressure / 101 kPa / 100 kPa (1)</p> <p>Definitions based on lattice enthalpies may score third mark only</p>	heat required / heat given out / heat taken in	3

Question Number	Acceptable Answers	Reject	Mark
17 (b)(iii)	$\Delta H_c^\ominus = -\Delta H_1^\ominus + \Delta H_2^\ominus$ (1) $= (2 \times -285.8 + -393.5) - (-239.1)$ $= -726$ (1) Ignore units Correct answer alone = 2 marks $+726 = 1$ $-440.2 = 1$ if omit multiply by 2		2

Question Number	Acceptable Answers	Reject	Mark
17 (c)(i)	$20.7 \times 200 \times 4.18 = 17305(.2)$ (J) ignore sf except 1 sf i.e. 20000 OR $20.7 \times 200 \times 0.00418 = 17.305(2)$ kJ ignore sf except 1 sf i.e. 20 ignore signs ignore $\text{mol}^{-1}$		1

Question Number	Acceptable Answers	Reject	Mark
17 (c) (ii)	$0.848/32 = 0.0265$ (mol) ignore sf except 1 sf i.e. 0.03		1

Question Number	Acceptable Answers	Reject	Mark
17 (c)(iii)	$17305.2/0.0265 = -653000 \text{ (J mol}^{-1}\text{) (3sf)}$ OR $-653 \text{ (kJ mol}^{-1}\text{) (3sf)}$ Ignore missing units but penalise incorrect units Allow TE from (c)(i) & (ii)		1

Question Number	Acceptable Answers	Reject	Mark
17 (c)(iv)	Any two from As heat/energy absorbed by apparatus / heat/energy 'lost' to surroundings (1) methanol not completely burnt / incomplete combustion (1) methanol 'lost' by evaporation (1) cannot ensure all products are at standard conditions at end of reaction / water is produced as a gas / reaction not carried out in the standard conditions (1)	just heat/energy loss just incomplete reaction	2

Question Number	Acceptable Answers	Reject	Mark
18 (a)(i)	Crude oil / petroleum / coal	Oil on its own / Natural gas / fossil fuels / any named fraction of crude oil	1

Question Number	Acceptable Answers	Reject	Mark
18 (a)(ii)	<p>use of high temperatures / heat (in the absence of air) / thermal decomposition / catalysts (1)</p> <p>Either</p> <p>to break large molecules / to form smaller molecules / to break bonds in large molecules / to break carbon-carbon bonds (1)</p> <p>OR</p> <p>producing alkenes / producing carbon-carbon double bonds (1)</p>		2

Question Number	Acceptable Answers	Reject	Mark										
18 (a)(iii)	Risks (2) Amendments (2) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Risk</th> <th style="width: 50%;">Amendment</th> </tr> </thead> <tbody> <tr> <td>exposure to harmful / toxic fumes</td> <td>Set up in fume cupboard</td> </tr> <tr> <td>Escape of flammable / harmful / toxic reactants or products from ill fitting bung</td> <td>Correct fitting of bung</td> </tr> <tr> <td>Escape of flammable / harmful / toxic reactants or products from poorly positioned delivery tube</td> <td>Placement of delivery tube below mouth of test tube / use a longer delivery tube</td> </tr> <tr> <td>suck back</td> <td>Attach Bunsen valve / remove delivery tube from water before stopping heating etc</td> </tr> </tbody> </table> <p>Mark all 4 points independently            If escaping gases linked to 2 amendments but no risk mentioned then allow 1 for risk</p>	Risk	Amendment	exposure to harmful / toxic fumes	Set up in fume cupboard	Escape of flammable / harmful / toxic reactants or products from ill fitting bung	Correct fitting of bung	Escape of flammable / harmful / toxic reactants or products from poorly positioned delivery tube	Placement of delivery tube below mouth of test tube / use a longer delivery tube	suck back	Attach Bunsen valve / remove delivery tube from water before stopping heating etc	Dangerous  collect in syringe	4
Risk	Amendment												
exposure to harmful / toxic fumes	Set up in fume cupboard												
Escape of flammable / harmful / toxic reactants or products from ill fitting bung	Correct fitting of bung												
Escape of flammable / harmful / toxic reactants or products from poorly positioned delivery tube	Placement of delivery tube below mouth of test tube / use a longer delivery tube												
suck back	Attach Bunsen valve / remove delivery tube from water before stopping heating etc												

Question Number	Acceptable Answers	Reject	Mark
18 (b)(i)	Reagent - Hydrogen/H <sub>2</sub> (1) Catalyst - Nickel/Ni/palladium/Pd/platinum/Pt (1) <p>Mark independently</p>		2

Question Number	Acceptable Answers	Reject	Mark
18 (b)(ii)	1,2 - dibromoethane (1) <p>ignore punctuation</p> $  \begin{array}{c}  \text{H} \quad \text{H} \\    \quad   \\  \text{H}-\text{C}-\text{C}-\text{H} \\    \quad   \\  \text{Br} \quad \text{Br}  \end{array}  $ (1) <p>Mark independently            Allow CH<sub>2</sub>BrCH<sub>2</sub>Br</p>	1,2 - bromoethane dibromoethane <p>Skeletal formula</p> <p>C<sub>2</sub>H<sub>4</sub>Br<sub>2</sub></p>	2

Question Number	Acceptable Answers	Reject	Mark
18 (b)(iii)	From purple / pink → colourless	clear	1

Question Number	Acceptable Answers	Reject	Mark
18 (c)(i)	<p>(1) for both arrows</p> <p>(1) for carbocation (1) for arrow</p> <p>arrow from bromide ion can start from any part of the bromide ion and can go towards the C or the + sign on the intermediate</p> <p>bromide ion must show negative charge</p> <p>allow 2 max for addition of Br<sub>2</sub> and any other electrophilic additions</p> <p>half headed arrows used throughout penalise only once</p>	<p>δ- on bromide ion for third mark</p>	3

Question Number	Acceptable Answers	Reject	Mark
18 (c)(ii)	<p>Bromine / bromide / hydrogen could add to either carbon (in the double bond) / bromide / bromine could add to either primary or secondary carbocation / (propene is unsymmetrical) so could form 1-bromopropane and / or 2-bromopropane.</p> <p>Allow correct structural or displayed formulae.</p>	bromine could add to any of the three carbons	1



Question Number	Acceptable Answers	Reject	Mark
18 (d)	<div style="text-align: center;"> <math display="block">  \begin{array}{cccc}  \text{H} &amp; \text{C}_6\text{H}_5 &amp; \text{H} &amp; \text{C}_6\text{H}_5 \\    &amp;   &amp;   &amp;   \\  -\text{C} &amp; -\text{C} &amp; -\text{C} &amp; -\text{C}- \\    &amp;   &amp;   &amp;   \\  \text{H} &amp; \text{H} &amp; \text{H} &amp; \text{H}  \end{array}  </math> </div> <p>position of hydrogen atoms and phenyl groups (1)</p> <p>Allow phenyl groups on 2<sup>nd</sup> and 3<sup>rd</sup> carbon OR 1<sup>st</sup> and 4<sup>th</sup> OR 1<sup>st</sup> and 3<sup>rd</sup></p> <p>carbon carbon single bonds and continuation bonds (1)</p> <p>second mark not awarded for incorrect monomer</p> <div style="text-align: center;"> </div> <p>(1) max with or without square brackets and n or numbers</p> <p>Do not penalise H from phenyl groups attaching to carbon chains</p> <p>Ignore extra square brackets, numbers and 'n' provided 2 monomer units shown</p>		2

Question Number	Acceptable Answers	Reject	Mark
18 (e)(i)	<p>Any two</p> <p>(raw material for) paper cup requires cutting down trees (1)</p> <p>polystyrene cup uses less energy (280 kWh rather than 980 kWh) to produce so less CO<sub>2</sub> released / less fossil fuels (1)</p> <p>polystyrene cup releases less sulfur based compounds into air so less chance of forming acid rain / less chance of damaging buildings / acidifying lakes (produces 3.5 kg rather than 11 kg) (1)</p> <p>polystyrene cup releases no chlorine compounds which damages ozone layer / poisonous (produce 0 kg rather than 0.4 kg) (1)</p> <p>2 pieces of data chosen with no explanation allow 1 mark</p> <p>Ignore comments regarding water</p>		2

Question Number	Acceptable Answers	Reject	Mark
18 (e)(ii)	<p>2 additional factors</p> <p>e.g ease of recyclability  whether cup is easy to reuse  space taken up in landfill  type and amount of gases formed if incinerated  useful heat obtained if incinerated  biodegradability / how long they take to decompose  management of gases produced during decomposition  durability / how long the cup lasts  method of disposal</p> <p>Ignore comments regarding atom economy</p> <p>Ignore comments regarding acid rain / ozone layer / greenhouse gases unless linked to gases produced during disposal</p>		2

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