

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

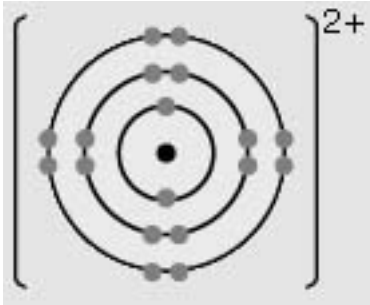
Question Number	Correct Answer	Mark
13	D	1

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)	$1s^22s^22p^63s^23p^6$ Allow electron number as sub script Allow orbitals as capital letters Allow TE from (a) (i) if Ca atom or Ca^+ ion		1

Question Number	Acceptable Answers	Reject	Mark
15 (a)(iii)	<p>Smaller 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)	Any two from: Strong (electrostatic) forces / attractions / bonds (between ions) (1) (ions) held in giant lattice / many (ionic) attractions / forces / bonds (1) So large amount of energy needed (to break apart ions) (1)	Any mention of covalent or metallic bonds or atoms or molecules scores zero High temperature	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)	The cations / barium and calcium (ions) are different sizes Ignore any discussion of reasons (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)	Atoms are different sizes	1

Question Number	Acceptable Answers	Reject	Mark
15 (b)(iii)	<p>Mass of calcium ions in 1 kg = 0.100×40 (= 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 = $(4.0/1000) \times 1000000$ = 4000 (ppm) (1)</p> <p>OR</p> <p>Mass of calcium ions in 1 kg = 0.100×40.1 (= 4.01) (g) (1)</p> <p>Hence 4.01 g per 1000 g of solution So ppm = $(4.01/1000) \times 1000000$ = 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

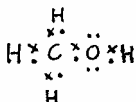
Question Number	Acceptable Answers	Reject	Mark
16 (b)(i)	(Electric field) accelerates ions		1

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 = $(135 \times 9.01 + 136 \times 10.81 + 137 \times 12.32 + 138 \times 67.86) / 100$ (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 Br_2^+ ions) (1)</p> <p>because ions $(^{79}\text{Br}-^{79}\text{Br})^{(+)}$ and $(^{81}\text{Br}-^{79}\text{Br})^{(+)}$ / $(^{79}\text{Br}-^{81}\text{Br})^{(+)}$ and $(^{81}\text{Br}-^{81}\text{Br})^{(+)}$ (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 M_r 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) + 2H₂(g) + 2O₂(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 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

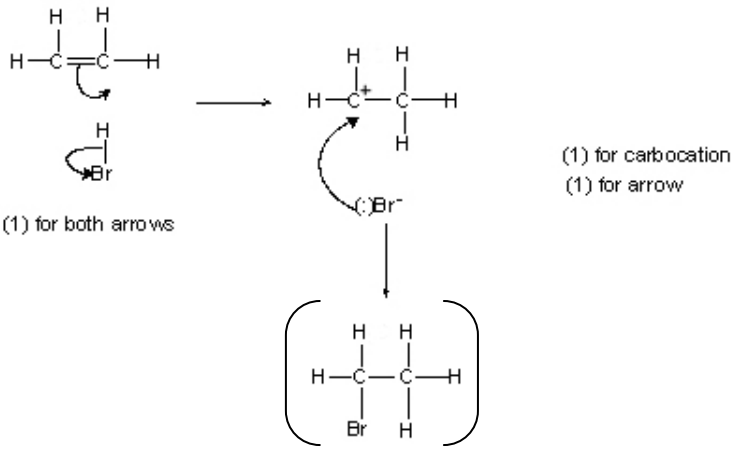
Question Number	Acceptable Answers	Reject	Mark
18 (a)(ii)	<p>use of high temperatures / heat (in the absence of air) / thermal decomposition / catalysts (1)</p> <p>Either</p> <p>to break large molecules / to form smaller molecules / to break bonds in large molecules / to break carbon-carbon bonds (1)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

Question Number	Acceptable Answers	Reject	Mark										
18 (a)(iii)	<p>Risks (2) Amendments (2)</p> <table><tr><th>Risk</th><th>Amendment</th></tr><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></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	<p>Dangerous</p> <p>collect in syringe</p>	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)	<p>Reagent - Hydrogen/H₂ (1) Catalyst - Nickel/Ni/palladium/Pd/platinum/Pt (1)</p> <p>Mark independently</p>		2

Question Number	Acceptable Answers	Reject	Mark
18 (b)(ii)	<p>1,2 - dibromoethane (1)</p> <p>ignore punctuation</p> <pre> H H H — C — C — H Br Br (1) </pre> <p>Mark independently Allow CH₂BrCH₂Br</p>	<p>1,2 - bromoethane dibromoethane</p> <p>Skeletal formula</p> <p>C₂H₄Br₂</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 Br₂ 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 data-bbox="363 302 734 481" data-label="Chemical-Block"> $\begin{array}{cccc} \text{H} & \text{C}_6\text{H}_5 & \text{H} & \text{C}_6\text{H}_5 \\ & & & \\ -\text{C} & -\text{C} & -\text{C} & -\text{C}- \\ & & & \\ \text{H} & \text{H} & \text{H} & \text{H} \end{array}$ </div> <p data-bbox="355 533 967 600">position of hydrogen atoms and phenyl groups (1)</p> <p data-bbox="355 633 954 701">Allow phenyl groups on 2nd and 3rd carbon OR 1st and 4th OR 1st and 3rd</p> <p data-bbox="355 734 951 801">carbon carbon single bonds and continuation bonds (1)</p> <p data-bbox="355 835 874 902">second mark not awarded for incorrect monomer</p> <div data-bbox="355 969 667 1317" data-label="Chemical-Block"> </div> <p data-bbox="355 1346 975 1413">(1) max with or without square brackets and n or numbers</p> <p data-bbox="355 1447 987 1514">Do not penalise H from phenyl groups attaching to carbon chains</p> <p data-bbox="355 1547 970 1615">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 CO₂ 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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