Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/43**

Paper 4 Extended Theory **October/November 2017**

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Question	Answer	Marks
1(a)	mixture	**1**
1(b)	element	**1**
1(c)	compound	**1**
1(d)	mixture	**1**

Question	Answer	Marks
2(a)(i)	(two or more) **atoms**	**1**
	combined / joined / sharing electrons (by a covalent bond) / bonded	**1**
2(a)(ii)	substance that cannot be split up / broken down / decomposed (into anything simpler) **OR** (substance) made of **atoms** with the same atomic number / number of protons / proton number	**1**
2(b)(i)	10	**1**
2(b)(ii)	22	**1**
2(b)(iii)	A **AND** B	**1**
2(b)(iv)	A **AND** B	**1**
2(b)(v)	C **AND** D	**1**
2(c)		**3**

	number of protons	number of electrons
Na	11	11
S^{2-}	16	18
Cl_2	34	34

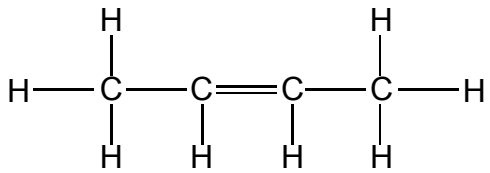
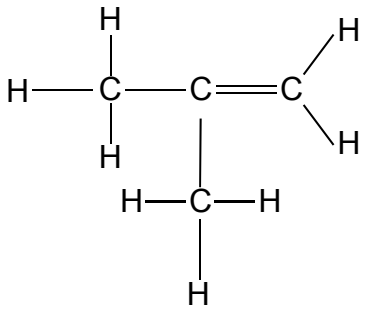
Question	Answer	Marks
3(a)	hematite	**1**
3(b)	(coke reacts with oxygen / air) to produce heat / increase temperature / exothermically	**1**
	coke is reducing agent / produces reducing agent / produces carbon monoxide **OR** **coke reduces** Fe_2O_3 / (iron) ore / hematite (producing iron)	**1**
	$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ **OR** $Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$ **OR** $2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$ **M1** species correct **M2** balanced	**2**
	limestone (decomposes to calcium oxide which) reacts with / removes **acidic impurities** / SiO_2 / sand / silica / silicon(IV) oxide / silicon dioxide	**1**
	limestone / calcium oxide / lime is involved in the production of slag / calcium silicate	**1**
3(c)(i)	positive ions / cations	**1**
	sea of electrons / mobile electrons / delocalised electrons / moving electrons / flowing electrons	**1**
	attraction between positive ions and electrons	**1**
3(c)(ii)	layers / rows / sheets of ions	**1**
	slide / slip / shift (over each other or past each other)	**1**
3(c)(iii)	particles have different sizes / radii	**1**
	layers cannot slide / slip / shift	**1**
3(d)(i)	$Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$	**1**

Question	Answer	Marks
3(d)(ii)	$Fe_2O_3 + 3H_2SO_4 \rightarrow Fe_2(SO_4)_3 + 3H_2O$ **M1** formula of $Fe_2(SO_4)_3$ **M2** all formulae correct (no additional species) **M3** balanced	**3**
3(e)	<table><tr><th></th><th>observation with aqueous iron(II) sulfate</th><th>observation with aqueous iron(III) sulfate</th></tr><tr><td>aqueous sodium hydroxide</td><td></td><td>**M3** brown precipitate</td></tr><tr><td>aqueous potassium iodide</td><td>**M1** no change</td><td>**M4** brown solution / black solid</td></tr><tr><td>aqueous acidified potassium manganate(VII)</td><td>**M2** (pink / purple to) colourless / decolourised</td><td></td></tr></table>	**4**

Question	Answer	Marks
4(a)	fractional distillation	**1**
4(b)(i)	oxidation	**1**
4(b)(ii)	acid(ic)	**1**
4(c)	$2H_2 + O_2 \rightarrow 2H_2O$	**1**
4(d)(i)	no carbon dioxide produced / more efficient	**1**
4(d)(ii)	storage of hydrogen is difficult / takes more space to store (hydrogen) / high likelihood of (hydrogen) leaks / lack of availability of hydrogen	**1**
4(e)(i)	$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ **M1** species correct **M2** balanced	**2**
4(e)(ii)	climate change / greenhouse effect / consequence of climate change	**1**

Question	Answer	Marks
4(e)(iii)	fermentation	**1**
4(f)	electrolysis	**1**

Question	Answer	Marks
5(a)(i)	oxygen / O_2	**1**
	sodium nitrite / sodium nitrate(III) / $NaNO_2$	**1**
5(a)(ii)	$2Cu(NO_3)_2 \rightarrow 2CuO + O_2 + 4NO_2$ **M1** CuO **M2** rest of equation fully correct	**2**
5(b)(i)	reversible reaction in which the **rate** of the forward reaction **equals** the **rate** of the backward reaction	**1**
	concentration of all reactants and products becomes constant / does not change	**1**
5(b)(ii)	forward reaction is endothermic	**1**
	(increased temperature) causes equilibrium to shift to the right / to shift in the endothermic direction / to form more nitrogen dioxide / to form more product(s)	**1**
5(b)(iii)	less brown / light**er** / paler / colour fades	**1**
	more molecules / moles / volume on the right **ORA** **OR** equilibrium shifts in the direction of **fewer** molecules / moles / lower volume	**1**

Question	Answer	Marks
6(a)(i)	compounds containing carbon and hydrogen **only**	**1**
6(a)(ii)	*alkanes:* C_nH_{2n+2}	**1**
	alkenes: C_nH_{2n}	**1**
6(a)(iii)	any 2 from: same or similar chemical properties (consecutive members) differ by CH_2 same functional group common (allow similar) methods of preparation physical properties vary in predictable manner / show trends / gradually change **OR** example of a physical property variation	**2**
6(a)(iv)	 **OR** 	**1**
6(a)(v)	structural isomers	**1**

Question	Answer	Marks
6(b)(i)	**more than** enough oxygen to react with **all** of the hydrocarbon	**1**
6(b)(ii)	125 (cm^3)	**1**
6(b)(iii)	1:5:3	**1**
6(b)(iv)	C_3H_8 If full credit is not awarded, allow 1 mark for $C_xH_y(g)$ + **5**$O_2(g)$ → **3**$CO_2(g)$ + **4**$H_2O(l)$	**2**

Question	Answer	Marks
7(a)(i)	diffusion	**1**
7(a)(ii)	silicon(IV) oxide is a solid, whereas carbon dioxide is a gas	**1**
7(a)(iii)	photosynthesis	**1**
	chlorophyll / chloroplasts	**1**
	M2 sunlight / UV (light)	**1**
	$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ **M1** species correct **M2** balanced	**2**
7(b)(i)	condensation	**1**
7(b)(ii)	hydrolysis	**1**
7(b)(ii)	HO–□–OH **OR** H–O–□–O–H	**1**