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

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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

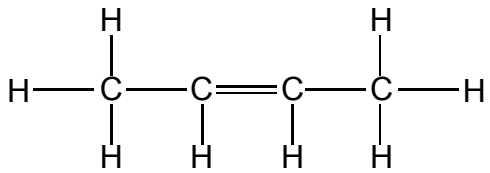
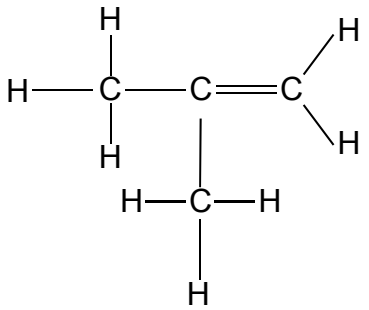
Question	Answer	Marks
3(a)	hematite	**1**
3(b)	(coke reacts with oxygen / air) to produce heat / increase temperature / exothermically	**1**
	coke is reducing agent / produces reducing agent / produces carbon monoxide **OR** **coke reduces** Fe_2O_3 / (iron) ore / hematite (producing iron)	**1**
	$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ **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**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(d)(ii)</td><td>$Fe_2O_3 + 3H_2SO_4 \rightarrow Fe_2(SO_4)_3 + 3H_2O$
M1 formula of $Fe_2(SO_4)_3$
M2 all formulae correct (no additional species)
M3 balanced</td><td>**3**</td></tr>
<tr><td>3(e)</td><td><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></td><td>**4**</td></tr>
</table>

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**