Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/31**

Paper 3 Theory (Core) **May/June 2018**

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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks
1(a)(i)	ammonia / NH_3	**1**
1(a)(ii)	sulfur dioxide / SO_2	**1**
1(a)(iii)	methane / CH_4	**1**
1(a)(iv)	carbon dioxide / CO_2	**1**
1(a)(v)	argon / Ar	**1**
1(b)(i)	helium is inert / it is inert / helium is unreactive / hydrogen is flammable	**1**
1(b)(ii)	(old) light bulbs / welding / to protect reactive metals from oxidation / lasers	**1**
1(c)	(substance containing) two (or more) types of atom bonded / two (or more) types of atom joined / two (or more) types of atoms chemically combined	**1**
1(d)	pair of bonding electrons between **each** N and H	**1**
	two unpaired electrons on N **AND** no extra electrons on the H	**1**

Question	Answer	Marks
2(a)(i)	15.5(%)	**1**
2(a)(ii)	hydrogen / H_2	**1**
2(a)(iii)	nitrogen **AND** oxygen	**1**
2(a)(iv)	NO_2	**1**
2(a)(v)	the air / the atmosphere	**1**

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Question	Answer	Marks
2(b)(i)	compound of carbon and hydrogen only / compound of hydrogen and carbon with no other elements **IF** 2 marks not scored: 1 mark for it contains carbon and hydrogen only / **compound** of hydrogen and carbon / molecules containing carbon and hydrogen	**2**
2(b)(ii)	poisonous / toxic	**1**
2(b)(iii)	5 (CO_2)	**1**
	6 (H_2O)	**1**

Question	Answer	Marks
3(a)(i)	One mark each for any 3 of: • (limonene) particles go from liquid to vapour • diffusion • random movement of particles / particles move anywhere / particles move in all directions • spreading out of particles / intermingling of particles / mixing of particles / particles collide / particles bounce off each other / particles go all over • (bulk) movement of particles from higher to lower concentration / movement of particles **down** concentration gradient	**3**
3(a)(ii)	solid	**1**
	– 80 ºC is below the melting point / it is below the melting point / it has not yet reached its melting point / melts above – 80 ºC	**1**
3(b)(i)	(substance which) speeds up a reaction / substance which increases the rate of reaction	**1**
3(b)(ii)	addition of oxygen (to a substance) / loss of electrons / increase in oxidation number	**1**

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Question	Answer	Marks
3(c)(i)	C=C bond	**1**
3(c)(ii)	orange / red-brown / brown	**1**
	to colourless	**1**

Question	Answer	Marks
4(a)	nickel<iron<chromium<magnesium **IF** 2 marks not scored: 1 mark if all reversed / one consecutive pair reversed	**2**
4(b)	One mark each for any 3 of: • iron has high melting point / boiling point / ORA for K • iron has high density / ORA for K • iron has catalytic activity / ORA for K • iron forms coloured <u>compounds</u> / ORA for K • iron <u>compounds</u> have variable oxidation states / form ions with different charges / ORA for K • iron is hard / potassium is soft / iron is strong / potassium is weak • one suitable difference in chemical properties e.g. iron is less reactive than potassium ORA / potassium reacts with cold water / iron does not react with cold water / iron rusts / potassium does not rust • iron is magnetic / ORA for K	**3**

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Question	Answer	Marks
4(c)	3 (Fe)	**1**
	2 (O_2)	**1**
4(d)	it loses oxygen / oxygen is removed from the iron oxide / hydrogen gains the oxygen from the iron oxide	**1**
4(e)(i)	add (aqueous) sodium hydroxide / (aqueous) ammonia AND green precipitate (2) **IF** 2 marks not scored: 1 mark for add (aqueous) sodium hydroxide / (aqueous) ammonia	**2**
4(e)(ii)	Fe_2Cl_6	**1**
4(f)	**B** / boiled water **AND** because no air / no oxygen	**1**
	C / with calcium chloride **AND** because no water	**1**

Question	Answer	Marks
5(a)	breakdown	**1**
	compound	**1**
	molten	**1**
	electricity	**1**
5(b)	+ electrode labelled anode **and** – electrode labelled cathode	**1**
	liquid labelled electrolyte	**1**

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Question	Answer	Marks
5(c)	graphite / it conducts electricity	**1**
5(d)	negative electrode: zinc / Zn	**1**
	positive electrode: iodine / I_2	**1**
5(e)	iodine	**1**
	chlorine is more reactive than iodine ORA	**1**

Question	Answer	Marks
6(a)	One mark each for any 5 of: • protons in the nucleus / centre (of the atom) • neutrons in the nucleus / centre (of the atom) • electrons outside the nucleus / electrons surrounding the nucleus / electrons orbiting the nucleus • 9 protons • 9 electrons • 10 neutrons	**5**
6(b)	element	**1**
	atomic	**1**
	nucleons	**1**
6(c)	any suitable e.g. treating cancer / checking thyroid function / tracer (in the body)	**1**

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Question	Answer	Marks
6(d)	$^{235}_{92}U$	**1**

Question	Answer	Marks
7(a)(i)	atomic radius of Rb: any value between 228 and 264 (inclusive of these values)	**1**
	relative thermal conductivity of K: any value between 3.8 and 1.7 (inclusive of these values)	**1**
7(a)(ii)	decreases down (the Group) / increases up (the Group) / decreases from sodium to caesium ORA	**1**
7(a)(iii)	bursts into flame / extremely rapid bubbling / explodes	**1**
7(b)	second box down ticked (a sodium atom loses an electron)	**1**
7(c)	basic oxide because metallic oxides are basic	**1**
7(d)	76 **IF** 2 marks not scored: 1 mark for (C =) 12, (H =) 1 (Na =) 23	**2**
7(e)	sodium sulfate	**1**
	water	**1**

Question	Answer	Marks
8(a)	the reaction is complete / the reaction has finished	**1**
8(b)	any value between and including 37 (cm^3) to 38 (cm^3)	**1**

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Question	Answer	Marks
8(c)	line starts from 0 cm^3 **AND** initial gradient less steep	**1**
	final volume levels off between 24–30 cm^3 **OR** line below 27 cm^3 **AND** gradient becoming less steep at a later point	**1**
8(d)	zinc chloride	**1**
8(e)	pH 1	**1**

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