CO-ORDINATED SCIENCES **0654/41**

Paper 4 Theory (Extended) **October/November 2018**

MARK SCHEME

Maximum Mark: 120

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.

Cambridge International is publishing the mark schemes for the October/November 2018 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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.

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.

Question	Answer	Marks
1(a)(i)	decomposers ;	1
1(a)(ii)	(carbon dioxide is released by) respiration ; (carbon is lost by) excretion ;	2
1(a)(iii)	feeding / nutrition ;	1
1(b)(i)	combustion ;	1
1(b)(ii)	global warming ; carbon dioxide is a greenhouse gas / causes (enhanced) greenhouse effect ;	2
1(c)	reforestation / plant more trees ; correct ref to photosynthesis ;	2

Question	Answer	Marks
2(a)(i)	effervescence / bubbles ;	1
2(a)(ii)	(calcium carbonate + hydrochloric acid →) calcium chloride ; carbon dioxide and water ;	2
2(b)	limestone has decomposed / broken down / released carbon dioxide / a gas ; (silicon (IV) oxide) is stable / does not react / does not decompose ;	2
2(c)(i)	giant (covalent) / macromolecule ;	1
2(c)(ii)	ratio of Si atoms to O atoms is 1:2 ;	1
2(c)(iii)	the idea that (thermal) energy is required to break bonds ; bonds are strong / a large number of bonds (have to be broken) ;	2
2(c)(iv)	cutting tools / other correct ;	1

Question	Answer	Marks
3(a)(i)	two lamps in parallel ; each switch operates one lamp only ; all symbols and everything else correct ;	**3**
3(a)(ii)	voltage = current × resistance or 0.5×12 ; = 6 (V) ;	**2**
3(a)(iii)	charge = current × time or 0.5×120 ; = 60 (C) ;	**2**
3(b)(i)	ray reflects ; at approximately correct angle ;	**2**
3(b)(ii)	angle *i* correctly labelled ;	**1**
3(b)(iii)	45° AND angle of incidence = angle of reflection ;	**1**

Question	Answer	Marks
4(a)(i)	(rapid) decrease and increase (in first 6 months) ; <u>decrease</u> after 0.5 years / 6 months / AVP ;	**2**
4(a)(ii)	HIV virus kills / destroys white blood cells ;	**1**
4(b)	antibodies / wbc, destroy, pathogens / bacteria / microorganisms ; (white blood cells) <u>produce</u> / <u>release</u> <u>antibodies</u> ; (white blood cells) responsible for <u>phagocytosis</u> ; AVP ;	**max 3**
4(c)	*platelets* – blood clotting ; *red blood cells* – transport of oxygen ;	**2**

Question	Answer	Marks
5(a)	gas to liquid ; liquid to solid ;	**2**
5(b)	7 ; outer electron number = group number ;	**2**
5(c)(i)	in the atom, number of protons = number of electrons / positive and negative charge is balanced ; in the ion, electrons exceed protons by one / owtte ;	**2**
5(c)(ii)	$(Cl_2 +) \ 2(I^-) \rightarrow 2Cl^- + I_2$ $2I^-$ and I_2 ; $2Cl^-$;	**2**
5(d)(i)	hydrogen ;	**1**
5(d)(ii)	one electron moves from ion (to anode / positive electrode) ; (iodide) ions attracted / move to anode OR (iodide) ions become iodine atoms OR (iodine) atoms form (iodine) molecules ;	**2**

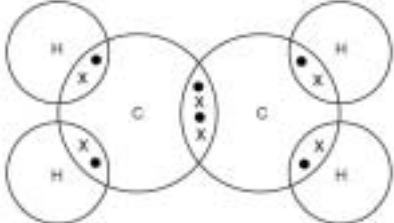| Question	Answer	Marks
6(a)(i)	Yes, because human normally hears up to 20 000 Hz ;	1
6(a)(ii)	frequency = speed / wavelength or $\dfrac{330}{9 \times 10^{-3}}$ or $\dfrac{330}{0.009}$; 37 000 (Hz) ;	2
6(a)(iii)	compression region of high pressure / where the particles are close together or rarefaction region of low pressure / where particles are further apart ;	1
6(a)(iv)	distance between two (consecutive) compressions ;	1
6(b)(i)	300 000 000 m / s ;	1
6(b)(ii)	box to the left of visible light ;	1
6(b)(iii)	left hand side / gamma ;	1
6(c)(i)	$\text{time} = \dfrac{\text{distance}}{\text{speed}}$ or $\dfrac{200}{9}$; = 22 (s) ;	2
6(c)(ii)	$KE = \dfrac{1}{2}mv^2$ or $\dfrac{1}{2} \times 0.2 \times 9 \times 9$; 8.1 (J) ;	2

Question	Answer	Marks
7(a)(i)	nitrate ;	1
7(a)(ii)	(nitrates) needed for protein synthesis ;	1
7(b)(i)	(plants on surface) grow more due to increased nitrates / fertiliser ;	1
7(b)(ii)	(plants on surface) block sunlight underwater plants can't <u>photosynthesise</u> (so die) ;	1
7(b)(iii)	(bacteria) feed on / decompose <u>dead</u> plants and reproduce / increase in number ;	1
7(b)(iv)	oxygen content decreases due to bacteria <u>respiring</u> ;	1
7(c)	(glucose converted to) sucrose ; (named) sugar travels through phloem / translocation ;	2

Question	Answer	Marks
8(a)	transition (metals) ;	**1**
8(b)(i)	Haber ;	**1**
8(b)(ii)	nitrogen, hydrogen ;	**1**
8(b)(iii)	(material) that increases reaction rate ;	**1**
8(c)(i)	>7 to 14 AND (potassium oxide reacts to produce an) alkaline solution / potassium hydroxide ;	**1**
8(c)(ii)	7 ;	**1**
8(d)(i)	sulfur dioxide ;	**1**
8(d)(ii)	Low concentration of acid / low temperature / small surface area ; so collision **frequency** / chance of collision (between reactants) is low ;	**2**

Question	Answer	Marks
9(a)(i)	$^{239}_{94}Pu \longrightarrow\ ^{235}_{92}U + ^{4}_{2}He$ U nuclide ; He nuclide ;	**2**
9(a)(ii)	unable to penetrate skin / closer to body cells when inside the body ;	**1**
9(b)	fission is splitting of nuclei ; fusion is joining of nuclei ;	**2**
9(c)(i)	(each side of) coil cuts magnetic field lines / coil experiences changing magnetic field ;	**1**
9(c)(ii)	(each side of) coil moves upwards and then downwards / changes direction ;	**1**
9(c)(iii)	sinusoidal wave with constant time period ; equal amplitudes ;	**2**

Question	Answer	Marks
10(a)(i)	arrow drawn from alveolus to inside the <u>red blood cell</u> labelled X ;	**1**
10(a)(ii)	arrow drawn from the blood <u>plasma</u> to inside the alveolus labelled Y ;	**1**
10(a)(iii)	thin <u>wall</u> ; (good) blood supply ; large surface area ;	**max 2**
10(b)	nutrient ; living ; energy ;	**3**

Question	Answer	Marks
11(a)	refinery gas / gasoline / diesel / gas oil for <u>fuel</u> ;	1
11(b)	methane propane butane 2 correct ; 3 correct ;	2
11(c)(i)	(catalytic / thermal) cracking ;	1
11(c)(ii)	step 1 calculate M_r $(12 \times 15) + (1 \times 32)$ OR 212 ; moles = $42.4 \div 212$ $(= 0.2)$ / 0.2×212 $(= 42.4)$; step 2 0.2×2 OR 0.4 ; step 3 $0.4 \times 28 = 1.2$ (g) ;	4
11(d)	 two shared pairs between carbons ; four shared pairs between carbon and hydrogens ;	2

Question	Answer	Marks
12(a)	regular irregular stronger all 4 correct ; 2 or 3 correct ;	2
12(b)	latent heat of fusion is the energy needed ; to overcome forces of attraction between molecules ;	2
12(c)	ref to convection ; cold air sinks and warm air rises ;	2
12(d)	Energy = $m \times c \times \Delta T$ or $0.25 \times 1.01 \times 15$; = 3.8 (J) ;	2

Question	Answer	Marks
13(a)	<table><tr><td></td><td>nervous control</td><td>hormonal control</td></tr><tr><td>how is the information carried</td><td>(electrical) <u>impulses</u>, in neurones / nerves</td><td>hormones in the blood</td></tr><tr><td>speed of transmission of information</td><td>fast</td><td>slow</td></tr><tr><td>duration of response</td><td>short</td><td>long</td></tr></table> 1 row correct ; 2 rows correct ; 3 rows correct ;	3
13(b)(i)	heart ;	1
13(b)(ii)	increasing blood glucose concentration ;	1
13(b)(iii)	liver ;	1
13(c)	insulin ; glucagon ;	2