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**COMBINED SCIENCE**

**0653/42**

Paper 4 Extended Theory

**May/June 2018**

MARK SCHEME

Maximum Mark: 80

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**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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This document consists of **10** printed pages.

**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:**

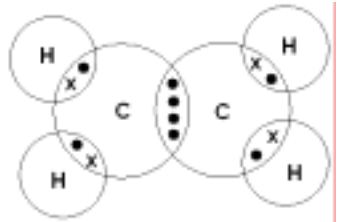
Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

**GENERIC MARKING PRINCIPLE 6:**

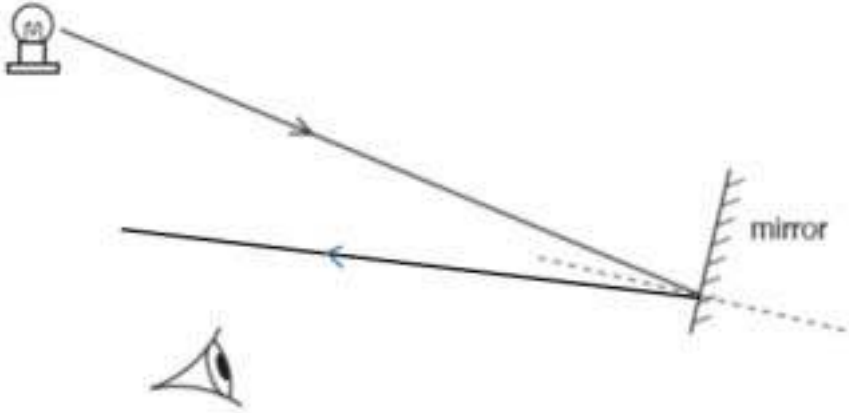
Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Question	Answer	Marks
1(a)(i)	geotropism ;	1
1(a)(ii)	auxin moves to lower surface ; causes <b>more</b> elongation / growth ;	2
1(a)(iii)	causes retardation of elongation / growth (on lower surface) ;	1
1(b)(i)	has large projection / is long / large surface area ; the idea of increased rate of water uptake / of diffusion ;	2
1(b)(ii)	higher concentration of water / water potential in soil / ora / there is a concentration gradient between the soil water and the cell water ; water moves from high to low concentration (of water) / down the concentration gradient ;	2
1(c)	xylem ;	1

Question	Answer	Marks
2(a)(i)	anhydrous / blue cobalt chloride ; turns (blue to ) pink ; OR anhydrous / white copper sulfate ; turns (white to ) blue ;	2
2(a)(ii)	$\text{Ca(OH)}_2(\text{aq}) + \text{CO}_2(\text{g}) \rightarrow \text{CaCO}_3(\text{s}) + \text{H}_2\text{O}(\text{l})$ correct species both sides ; 3 or 4 correct states ;	2

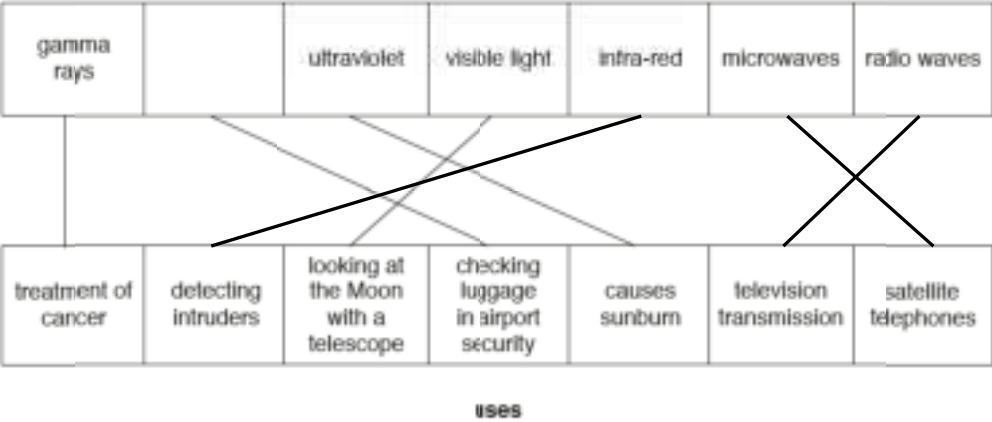
Question	Answer	Marks
2(b)(i)	 <p>(circles not essential) 4 electrons between two C atoms ; 2 electrons between each of 4 pairs of C and H atoms ;</p>	2
2(b)(ii)	covalent ;	1
2(c)	2, 4 ;	1

Question	Answer	Marks
3(a)	fuse ; (the idea that 240 V could produce a) high current ; one from (a high current could) cause damage / overheating ; (fuse) protects circuit / breaks circuit / melts ;	3
3(b)(i)	$(R = V / I) = 3 / 0.2 ;$ $= 15 (\Omega) ;$	2
3(b)(ii)	total power supply required = $100 + 20 = 120 \text{ W} ;$ $P = I \times V$ or total current = $120 / 240 ;$ $= 0.5 \text{ A} ;$	3

Question	Answer	Marks
3(c)	 <p>reflected ray shown at approx. correct angle missing the eye ;</p>	1

Question	Answer	Marks
4(a)	trachea, bronchus, bronchiole ;	1
4(b)	<p><i>effect on mucus</i> mucus production increases ;</p> <p><i>effect on cilia</i> cilia become paralysed / damaged ; cannot remove mucus from airway / away from lungs ;</p>	3
4(c)	(rate of gas exchange reduced) reduced area (for gas exchange in alveoli) ;	1
4(d)(i)	narrowing / blockage of <u>coronary arteries</u> ; due to fatty deposits / plaque ;	2
4(d)(ii)	high fat diet ; stress ;	2

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
5(a)(i)	(decrease) gas produced / released (by the reaction) ; to the surroundings / substance leaves the flask / apparatus ;	<b>2</b>
5(a)(ii)	(increase) particles move faster / gain (kinetic) energy ; particles collide more often ; the idea that more of the collisions are successful ;	<b>max 2</b>
5(a)(iii)	increase ; calcium is more reactive (than magnesium) ;	<b>2</b>
5(b)(i)	cathode ;	<b>1</b>
5(b)(ii)	(each ion) loses (one) electron ;	<b>1</b>
5(b)(iii)	$\text{MgCl}_2$ ;	<b>1</b>
5(b)(iv)	reduction ;	<b>1</b>

Question	Answer	Marks
6(a)(i)	X-rays ;	<b>1</b>
6(a)(ii)	<p style="text-align: center;"><b>electromagnetic spectrum</b></p>  <p style="text-align: center;"><b>uses</b></p> <p>all three correct ;</p>	<b>1</b>
6(b)	electromagnetic / infra-red waves can travel through a vacuum / do not need a medium to travel through ;	<b>1</b>
6(c)(i)	glass is a bad / poor conductor (of thermal energy) ;	<b>1</b>
6(c)(ii)	air / gas expands / volume increases ; molecules move faster / gain kinetic energy ; separation / distance between molecules increases ;	<b>3</b>



Question	Answer	Marks
7(a)(i)	the Sun ;	1
7(a)(ii)	death / egestion / excretion ;	1
7(a)(iii)	1, 2, 4	1
7(b)(i)	photosynthesis ;	1
7(b)(ii)	(concentration increases) less CO <sub>2</sub> removed ; <b>because</b> photosynthesis reduced ; (CO <sub>2</sub> continues to be) added to atmosphere by respiration / combustion ;	max 2
7(c)	dissolves in rainwater / owtte ; forms acid rain ; consequence of pollution by acid rain ; (e.g. harm to plants / animals / water courses damage to building materials)	3

Question	Answer	Marks
8(a)(i)	the idea that the number of outer electrons is the same as the group number ;	1
8(a)(ii)	more (outer-shell) electrons more non-metallic ; metallic elements have fewer (outer-shell) electrons ;	1
8(b)(i)	temperature in range 21–62 (°C) ;	1
8(b)(ii)	rubidium is <b>more</b> reactive ;	1
8(c)	kill / destroy bacteria / microbes / microorganisms ;	1
8(d)(i)	thermal / heat energy released (by chemical reaction) / (chemical reaction causes) temperature increase ; chemical energy converted (to thermal / heat energy) ;	2
8(d)(ii)	sodium hydroxide / NaOH / sodium carbonate / Na <sub>2</sub> CO <sub>3</sub> / sodium hydrogen carbonate / sodium bicarbonate / NaHCO <sub>3</sub> ;	1

Question	Answer	Marks
9(a)(i)	two opposite vertical force arrows ; both arrows from the load ;	2
9(a)(ii)	weight / gravitational force ;	1
9(b)(i)	constant acceleration constant speed changing acceleration (in this order) ;	1
9(b)(ii)	selection of area under graph as method ; calculation of area: $\frac{1}{2} \times 50 \times 1 + (125 - 50) \times 1 = 100 \text{ m}$ ;	2
9(b)(iii)	$(P =) E/t$ or $W/t$ or $(P =) 2\,000\,000 \div 150$ ; $= 13\,300 \text{ (W)} / 13\,000 \text{ (W)}$ ;	2
9(c)	density = mass / volume ; unit change noted: $5000 \text{ dm}^3 = 5 \text{ m}^3$ ; mass (= volume x density) = $5 \times 1025 = 5125 \text{ (kg)}$ ;	3