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**COMBINED SCIENCE**

**0653/41**

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 **11** printed pages.

**PUBLISHED****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:**

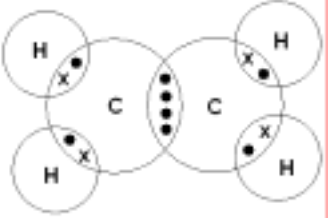
Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

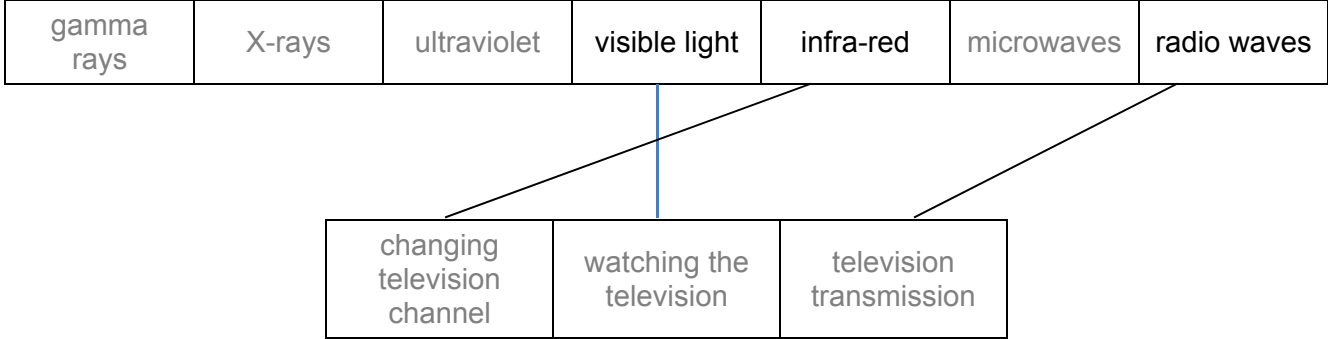
Question	Answer	Marks																														
1(a)	<table border="1" data-bbox="692 220 1583 523"> <thead> <tr> <th data-bbox="692 220 900 320">substance in food</th> <th colspan="4" data-bbox="900 220 1583 268">element</th> </tr> <tr> <td data-bbox="692 320 900 368"></td> <th data-bbox="900 268 1070 320">carbon</th> <th data-bbox="1070 268 1240 320">hydrogen</th> <th data-bbox="1240 268 1411 320">nitrogen</th> <th data-bbox="1411 268 1583 320">oxygen</th> </tr> </thead> <tbody> <tr> <td data-bbox="692 368 900 416">carbohydrate</td> <td data-bbox="900 368 1070 416">✓</td> <td data-bbox="1070 368 1240 416">✓</td> <td data-bbox="1240 368 1411 416"></td> <td data-bbox="1411 368 1583 416">✓</td> </tr> <tr> <td data-bbox="692 416 900 464">fat</td> <td data-bbox="900 416 1070 464">✓</td> <td data-bbox="1070 416 1240 464">✓</td> <td data-bbox="1240 416 1411 464"></td> <td data-bbox="1411 416 1583 464">✓</td> </tr> <tr> <td data-bbox="692 464 900 512">protein</td> <td data-bbox="900 464 1070 512">✓</td> <td data-bbox="1070 464 1240 512">✓</td> <td data-bbox="1240 464 1411 512">✓</td> <td data-bbox="1411 464 1583 512">✓</td> </tr> <tr> <td data-bbox="692 512 900 560">water</td> <td data-bbox="900 512 1070 560"></td> <td data-bbox="1070 512 1240 560">✓</td> <td data-bbox="1240 512 1411 560"></td> <td data-bbox="1411 512 1583 560">✓</td> </tr> </tbody> </table> <p data-bbox="320 560 757 592">one mark for each correct row ;;;;</p>	substance in food	element					carbon	hydrogen	nitrogen	oxygen	carbohydrate	✓	✓		✓	fat	✓	✓		✓	protein	✓	✓	✓	✓	water		✓		✓	<b>4</b>
substance in food	element																															
	carbon	hydrogen	nitrogen	oxygen																												
carbohydrate	✓	✓		✓																												
fat	✓	✓		✓																												
protein	✓	✓	✓	✓																												
water		✓		✓																												
1(b)	include more fibre / roughage / fruit / vegetables ; (fibre) helps to move food through digestive system ;	<b>2</b>																														
1(c)	fatty ; (first space) smoking ; stress ;	<b>3</b>																														
1(d)(i)	(increases blood flow) (because the artery is) wider / the idea of more space (for blood to pass through) ;	<b>1</b>																														
1(d)(ii)	<b>increases</b> supply of glucose / oxygen (reaching the heart muscle) ; for respiration (in heart muscle cells) / to release energy (in muscle cells) / for contraction / action (of heart muscle) ;	<b>2</b>																														

Question	Answer	Marks
2(a)(i)	No reaction expected / will take place / experiment has to compare different metals ;	<b>1</b>
2(a)(ii)	aluminium / Al zinc / Zn tin / Sn lead / Pb ; aluminium and lead correctly located = 1 all correct = 2	<b>2</b>
2(b)(i)	magnesium chloride ;	<b>1</b>
2(b)(ii)	$\text{Mg(s)} + 2\text{HCl(aq)} \rightarrow \text{MgCl}_2\text{(aq)} + \text{H}_2\text{(g)}$  all formulae and balanced (dependent on formulae) ; 3 or 4 correct state symbols (dependent on correct species) ;	<b>2</b>
2(b)(iii)	feasible method of collection ; timing device listed or shown in diagram ;	<b>2</b>
2(c)(i)	(Number of) protons + neutrons (in an atom) ;	<b>1</b>
2(c)(ii)	13 electrons shown ; arranged 2, 8, 3 ;	<b>2</b>

Question	Answer	Marks
3(a)(i)	arrow vertically upwards acting from the load ;	1
3(a)(ii)	(moving at) constant speed ;	1
3(b)(i)	constant acceleration constant speed changing acceleration ;	1
3(b)(ii)	Distance (= area under graph) = $\frac{1}{2} \times 4 \times 25 + 4 \times (65 - 25)$ ; = 210 (m) ;	2
3(c)	volume of cube = $2.0 \times 2.0 \times 2.0 = 8.0 \text{ m}^3$ ; density = mass / volume <b>or</b> $d = m / V$ <b>or</b> $m = V \times d = 8.0 \times 7000$ ; = 56 000 (kg) ;	3

Question	Answer	Marks
4(a)(i)	(leaf <b>P</b> ) it contains most chlorophyll ;	1
4(a)(ii)	converted to chemical energy ; used to make glucose / carbohydrate ;	2
4(b)(i)	$\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$ correct formulae ; correctly balanced depending on correct formulae ;	2
4(b)(ii)	from leaves ; (transport) through the phloem ;	2



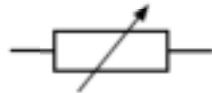
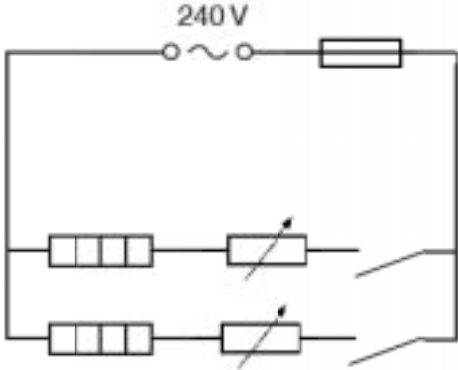
Question	Answer	Marks
5(a)(i)	(compound / substance ) containing hydrogen and carbon (atoms) ; (carbon and hydrogen ) only ;	<b>2</b>
5(a)(ii)	 <p>(circles not essential) four electrons shown between carbon atoms ; four H atoms drawn with single pair of electrons between each and a C atom ;</p>	<b>2</b>
5(a)(iii)	(test) (addition of) bromine ; (ethane) no change owtte <b>and</b> (ethene) decolourises ;	<b>2</b>
5(b)(i)	global warming / any valid effect of global warming ;	<b>1</b>
5(b)(ii)	thermal /heat energy released (by chemical reaction) / (chemical reaction causes) temperature increase ; chemical energy converted (to thermal / heat energy) ;	<b>2</b>

Question	Answer	Marks
6(a)	 <p>3 correctly named parts of the electromagnetic spectrum ;                  these named parts correctly located ;                  2 correct links between action and part of the electromagnetic spectrum ;</p>	<b>3</b>
6(b)(i)	convection ;	<b>1</b>
6(b)(ii)	the density of hot gases is lower (than air in balloon) ; hot gases / lower density gases rise / ora ;	<b>2</b>
6(b)(iii)	molecules move faster / have greater kinetic energy ;  (attractive) forces become weaker / less significant ;  the separation between molecules increases ;	<b>3</b>



Question	Answer	Marks
7(a)(i)	green plants → caterpillars → small birds → hawk or green plants → mice → cats → hawk  correct organisms from the diagram in order ; arrows in correct sense ;	2
7(a)(ii)	cat ; hawk ;	2
7(b)(i)	(the hawk's) energy lost in respiration / heat / movement / growth ; (the hawk's) energy lost in waste <b>products</b> e.g. faeces, urine ; not all of the cat eaten by the hawk ;	max 2
7(b)(ii)	very little energy remains after 4 transfers / the idea that there is insufficient energy to sustain further levels ;	1

Question	Answer	Marks
8(a)(i)	melt / make it molten / convert it into a liquid form ;	1
8(a)(ii)	ions not mobile / the idea that ions need to (be able to) move ;	1
8(b)(i)	<u>blast furnace</u> ;	1
8(b)(ii)	carbon is more reactive than iron ; group II metals / calcium are more reactive than carbon ;	2
8(c)(i)	transition (elements / metals) ;	1
8(c)(ii)	noble (gases) / Group VIII ;	1

Question	Answer	Marks
9(a)(i)	<p>fuse </p> <p>switch </p> <p>variable resistor </p> <p>3 correct for 2 marks                      Any 1 correct for 1 mark</p>	2
9(a)(ii)	parallel ;	1
9(a)(iii)	 <p>two hotplates connected in parallel ;                      each hotplate branch contains a variable resistor in series ;                      each hotplate branch contains a switch in series ;                      fuse in main circuit ;</p>	4

Question	Answer	Marks
9(b)	$P = V \times I$ ; EITHER larger hotplate: $I = 1500 / 240 = 6.25 \text{ A}$ smaller hotplate: $I = 1000 / 240 = 4.17 \text{ A}$ ; total current = 10(.4 A), (safely less than 13 A ) ;  <b>or</b>  total power = 1.5 (kW) + 1.0 (kW) = 2.5 (kW) ; $P = V \times I$ or $I = P / V$ or total current = 2500 / 240 ; = 10(.4 A) (safely less than 13 A) ;	<b>3</b>