COMBINED SCIENCE   **0653/41**

Paper 4 Extended Theory   **October/November 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.

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.

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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.

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.

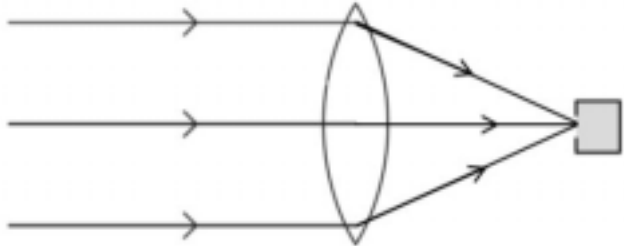| Question	Answer	Marks
1(a)(i)	arrow drawn from the <u>plasma</u> of the blood to the air sac of alveolus ;	1
1(a)(ii)	there is a concentration / diffusion gradient / greater oxygen concentration in alveolus than the blood ;	1
1(a)(iii)	thin wall / flattened cells ; large surface area ; good blood supply ; **Max 2**	2
1(b)	through <u>placenta</u> ; and then one of by diffusion ; via (umbilical) cord ; **Max 2**	2
1(c)(i)	carbon dioxide / CO_2 / produced / present (in smoke) ;	1
1(c)(ii)	causes cancer ; stimulates mucus production ; **Max 1**	1
1(c)(iii)	mucus cannot be swept out of the lungs ; pathogens / particles (in mucus) more likely to enter lungs ;	2
1(c)(iv)	combines with the haemoglobin / red blood cells ; CO replaces oxygen (on haemoglobin) ; reduces the transport of oxygen by blood / less oxygen available (for cells) ; **Max 2**	2

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Question	Answer	Marks
2(a)(i)	covalent ;	1
2(a)(ii)	shared (pairs of) electrons ;	1
2(a)(iii)	two bond pairs ; two non-bond pairs on O atom ;	2
2(b)(i)	(electrode **X**) cathode ; (electrode **Y**) anode ;	2
2(b)(ii)	(to electrode **X**) copper **ions** / Cu^{2+} ; (to electrode **Y**) chloride (ions) / Cl^- ;	2
2(c)	(negative) lead ; (positive) oxygen ;	2

Question	Answer	Marks
3(a)(i)	weight / gravitational (force) ;	1
3(a)(ii)	yes *(no mark)* constant speed / no acceleration, (so forces must balance) ;	1

Question	Answer	Marks
3(b)(i)	distance = speed × time and / or work done = force × distance **or** d = s × t and / or w = F × d **or** 200 000 × 25 × (500 – 200) ; = 1 500 000 000 ; J / joules ;	**3**
3(b)(ii)	(negative) acceleration / deceleration ; not constant (deceleration) / increasing deceleration (becoming constant deceleration) ;	**2**
3(b)(iii)	evidence of area under graph calculated up to 200 s / $\frac{1}{2}$ × 200 × 25 ; 2.5 km ;	**2**
3(b)(iv)	total distance = 2.5 + (500–200) × 0.025 + 2.8 = 12.8 km ;	**1**

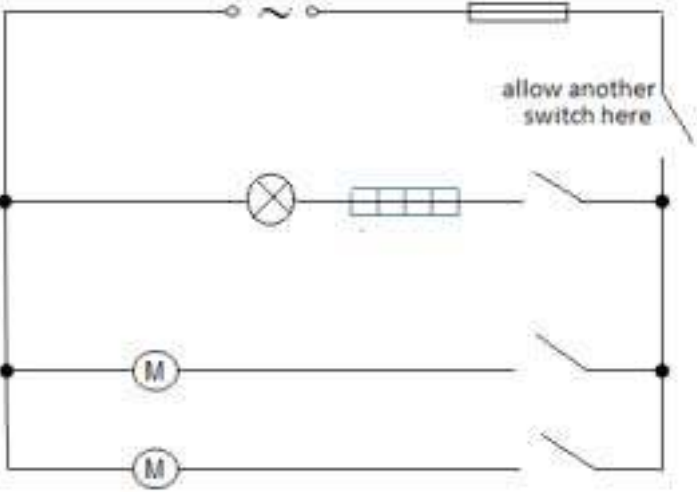| Question	Answer	Marks
4(a)(i)	seaweed → shellfish → crab → octopus → sea lion → killer → whale ;;	**2**
4(a)(ii)	consists of more than 4 trophic levels ;	**1**
4(b)	protein synthesis / building up molecules ; cell division ; growth ; **Max 2**	**2**
4(c)	not all eaten ; not all digested / absorbed / egestion / lost in faeces ; excretion / lost in urine ; **Max 2**	**2**

Question	Answer	Marks
5(a)(i)	sulfuric_acid / H_2SO_4 ; calcium oxide / CaO / calcium hydroxide / $Ca(OH)_2$ calcium carbonate / $CaCO_3$;	2
5(a)(ii)	(technique) filter / filtering / filtration ; (explanation) solid (particles) cannot pass through / remain on filter paper / liquid (particles) can pass through filter paper ;	2
5(b)(i)	(electrical conductor) good (melting point) high ; (both required)	1
5(b)(ii)	2, 8, 8, 2 ;	1
5(c)(i)	more / very rapid / explosive ;	1
5(c)(ii)	any stated value > 25 °C and < 63 °C ;	1
5(d)	(reaction) no (visible) reaction (explanation) copper is less reactive than potassium ; (both required)	1

Question	Answer	Marks
6(a)	(thermal) expansion / expansion on heating / owtte ;	1
6(b)(i)	only ethanol is a liquid at both these temperatures / both fixed points of ammonia / all others are solid at mpt of ammonia / at 78 °C ;	1
6(b)(ii)	typical room temperature / 21 °C is below 30 °C / m.pt. of gallium ; gallium would be a solid at that temperature / (kept above 30) so it does not freeze / owtte ;	2
6(c)(i)	(frequency will) increase ; use of $f = v / \lambda$ to explain increase / as λ decreases frequency increases ;	2
6(c)(ii)	 all three rays extended to meet at the same point at the detector ; (arrows on refracted rays not essential)	1

Question	Answer	Marks
7(a)	$6H_2O + 6(CO_2) \rightarrow C_6H_{12}O + 6(O_2)$ 1 mark for correct formulae ; 1 mark for balanced (dependent on formulae) ;	2
7(b)	oxygen / gas produced (by the plant and displaces water) ;	1
7(c)(i)	line (meniscus) drawn on Fig.7.1 at a lower position than in Fig. 7.2 ;	1
7(c)(ii)	reference to increased (rate of) photosynthesis ;	1

Question	Answer	Marks
7(d)(i)	due to denaturation of enzymes / damage to leaves / increased soil toxicity ;	1
7(d)(ii)	use cleaner / alternative energy sources / reduce usage of fossil fuels ; remove <u>sulfur dioxide</u> from factory emissions ; catalytic converters ; avp ; **Max 2**	2

Question	Answer	Marks
8(a)	(size of molecules) **P** smaller than **Q** / ora ; (intermolecular forces) **P** smaller than **Q** / ora ;	2
8(b)	$C_3H_8 + \mathbf{5}O_2 \rightarrow \mathbf{3}CO_2 + \mathbf{4}H_2O$ species ; balancing ;	2
8(c)(i)	alkenes have (one) (carbon-carbon) double bond / C=C ; **or** alkanes have only (carbon-carbon) single bonds / C-C ;	1
8(c)(ii)	(test) (add) bromine (water) / Br_2 ; (propane) no (visible) change **and** (propene) decolourises ;	2

Question	Answer	Marks
9(a)(i)	parallel ;	1
9(a)(ii)	 correct lamp symbol ; heater in one branch, a motor in at least one other branch ; switch in series with the component in each branch ; lamp in series with heater only and no short circuits ;	4
9(b)(i)	power = voltage x current / P = V x I / I = P / V = 2400 / 240 ; = 10 (A) ;	2
9(b)(ii)	total current = 10 + 1.2 + 1.2 = 12.4 (A) **or** 12 (A) ;	1
9(b)(iii)	any value from 13 A to 20 A ; fuse value needs to be above max working current of machine, but not too large to put machine components at risk ;	2