Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

COMBINED SCIENCE **0653/42**

Paper 4 Extended Theory **March 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.

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Question	Answer	Marks
1(a)(i)	1 ovulation ; 2 fertilisation ;	2
1(a)(ii)	amnion / amniotic membrane ; contains (amniotic) fluid ;	2
1(b)(i)	carbon dioxide ;	1
1(b)(ii)	(waste product of / produced by) **respiration** ;	1
1(b)(iii)	through umbilical cord ;	1
1(c)	reduces oxygen available (to fetus) ; any consequence e.g. reduced respiration / growth ;	2

Question	Answer	Marks
2(a)(i)	chemical AND the idea that new substance(s) made ;	1
2(a)(ii)	copper(II) / Cu^{2+} AND chloride / Cl^- ; (copper(II) / Cu^{2+}) gains (2) electrons ; (chloride / Cl^-) loses (1) electron ;	3
2(b)(i)	reduction / redox ;	1
2(b)(ii)	$C + 2CuO \rightarrow CO_2 + 2Cu$ all formulae correct ; correctly balanced ;	2
2(c)	act as catalysts / form (compounds which act as) catalysts / other valid answers ;	1

Question	Answer	Marks
3(a)	weight ;	**1**
3(b)	speed = distance / time (or rearranged) ; distance (= speed × time) = 28 000 × 90 / 60 = 42 000 (km) ;	**2**
3(c)(i)	density = mass / volume (or rearranged) ; mass (= volume × density) = $1.08 \times 10^{21} \times 5530 = 5.97 \times 10^{24}$ (kg) ;	**2**
3(c)(ii)	(average) density of mantle and core is higher (than 2700 kg / m^3) ; in order to give an average density higher than the density of the crust / owtte ;	**2**
3(c)(iii)	atoms in outer core randomly arranged / inner core regular arrangement / owtte ; atoms in outer core able to move freely / inner core fixed positions / orderly pattern / owtte ;	**2**
3(d)	electrical ; chemical (potential) ;	**2**

Question	Answer	Marks
4(a)	line drawn from **R** to any nucleus ; line drawn from **S** to any xylem tube cross section ;	**2**
4(b)(i)	**P** is nearer to the surface / top so it captures more light ;	**1**
4(b)(ii)	**P** has more chloroplasts than **Q** ; chloroplast is the site of photosynthesis ; reference to increased light absorption / increased amounts of chlorophyll ;	**max 2**
4(c)	traps **light energy** ; converts it to chemical energy / for formation of carbohydrates ;	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(a)(i)</td><td>(electrons) 35
(neutrons) 44
(protons) 35 ;;
all three correct (2)
one or two correct (1)</td><td>2</td></tr>
<tr><td>5(a)(ii)</td><td><table><tr><th>(particle)</th><th>(relative charges)</th><th>(approximate relative masses)</th></tr><tr><td>(electrons)</td><td>–1 / negative / –ve</td><td>negligible / 1 / 2000</td></tr><tr><td>(neutrons)</td><td>0 / none / neutral</td><td>1</td></tr><tr><td>(protons)</td><td>+1 / positive / +ve</td><td>1</td></tr></table>each column correct ;;</td><td>2</td></tr>
<tr><td>5(b)</td><td>(sodium) ionic / electrovalent and (hydrogen) covalent ;
(ionic) idea of gain / loss / transfer of electrons ;
(covalent) electrons are shared ;</td><td>3</td></tr>
<tr><td>5(c)</td><td>iodine / astatine ;</td><td>1</td></tr>
<tr><td>5(d)(i)</td><td>2, 8, 8 ;</td><td>1</td></tr>
<tr><td>5(d)(ii)</td><td>lamps / inert atmosphere / other valid answers ;</td><td>1</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6(a)</td><td>the idea that current is flow of (electrical) charge ;

identifies the charge carriers as <u>electrons</u> ;</td><td>2</td></tr>
<tr><td>6(b)(i)</td><td>between mouth and handset / handset and ear ;
sound waves ;</td><td>2</td></tr>
</table>

Question	Answer	Marks
6(b)(ii)	between handset and base station / satellite dish and satellite ; microwaves *or* radio waves ;	**2**
6(c)	the idea that waves (of any kind) have an associated speed of travel ; the idea that **waves / signals** will take time to cover distance ; reference to great distance / high speed of emr :	**max 2**

Question	Answer	Marks
7(a)(i)	making of / contained in haemoglobin ;	**1**
7(a)(ii)	feel tired / dizzy / other correct symptoms ;	**1**
7(b)(i)	1 to pasteurise the milk / kill unwanted microbes ; 2 so that the microorganisms in the (added) yoghurt do not get killed ;	**2**
7(b)(ii)	microorganisms will multiply in the milk ;	**1**
7(b)(iii)	yes –no mark (student's yoghurt) contains live organisms ;	**1**
7(c)	the acid denatures / destroys the proteins in the milk ; the proteins lose their (3D) shape / owtte ;	**2**
7(d)(i)	prevents constipation;	**1**
7(d)(ii)	adding fruit ;	**1**

Question	Answer	Marks
8(a)	(fraction **P**) lower boiling point ; smaller molecules ; weaker intermolecular (attractive) forces ; greater flammability ; lower viscosity ;	**max2**
8(b)	(catalytic or thermal) cracking ;	**1**
8(c)(i)	increases surface area ;	**1**
8(c)(ii)	particles move faster / have greater **kinetic** energy ; particles collide (with the catalyst) more often ;	**2**
8(d)	(**A**) alkene / unsaturated and (**B**) alkane / saturated ;	**1**
8(e)(i)	CO_2 ;	**1**
8(e)(ii)	reference to global warming / excessive (runaway / enhanced) greenhouse effect / negative effects such as climate change / polar melting / rising sea levels / ocean acidification ;	**1**

Question	Answer	Marks
9(a)	total current of 14 A needs higher value fuse / reference to the safety margin / owtte ;	**1**
9(b)	(R =) V / I ; (R =) 240 / 14 = 17.1 (Ω) ; OR 1 / R = 1 / R_1 + 1 / R_2 ; R_1 = 240 /4 = 60 Ω and R_2 = 240 / 10 = 24 Ω and so 1/R = 1/60 + 1/24 = 7/120, so R = 17.1 Ω ;	**2**

Question	Answer	Marks
9(c)	E = IVt ; = 10 × 240 × 8 × 60 ×60 = 69 120 000 (J) ;	**2**
9(d)	reference to convection ; the idea that water at higher temperature rises / has a lower density ; the idea that the convection current from heater **1** does not affect the water in the lower part of the tank / water below heater **1** has greater density and so does not mix with heated water / owtte ;	**3**