Cambridge IGCSE™

COMBINED SCIENCE **0653/41**

Paper 4 **October/November 2022**

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.

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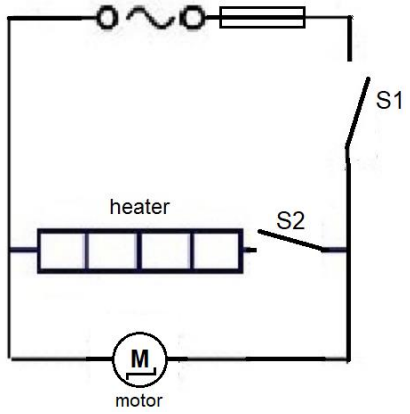
Question	Answer	Marks
1(a)(i)	(right) atrium ;	**1**
1(a)(ii)	vena cava ;	**1**
1(a)(iii)	*any two from:* blood passes through the heart twice (in one circuit of the body) ; the idea that one circulation is to lungs ; the idea that one circulation is to the body (tissues) ;	**2**
1(b)(i)	80 ÷ 97 / 0.824742268 ; 0.82 ;	**2**
1(b)(ii)	(incidence of) coronary heart disease increases with increased waist-to-hip ratio ;	**1**
1(b)(iii)	high fat diet / obesity ; causes blockage of coronary artery ;	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>hydrogen test lighted splint AND positive result pops ;
chlorine test (damp) litmus paper AND positive result bleaches ;</td><td>2</td></tr>
<tr><td>2(b)(i)</td><td>2NaCl (aq) AND $2H_2O$ (l) AND 2NaOH (aq) ;</td><td>1</td></tr>
<tr><td>2(b)(ii)</td><td>sodium hydroxide ;</td><td>1</td></tr>
<tr><td>2(c)</td><td>
<table>
<tr><th>statement</th><th>true</th><th>false</th></tr>
<tr><td>OH^- ions are attracted to the cathode.</td><td></td><td>✓</td></tr>
<tr><td>H^+ ions gain electrons at the negative electrode.</td><td>✓</td><td></td></tr>
<tr><td>H^+ ions come from the water in the solution.</td><td>✓</td><td></td></tr>
<tr><td>Hydrogen gas is made when OH^- ions lose electrons.</td><td></td><td>✓</td></tr>
</table>
two or three correct ;
all four correct ;
</td><td>2</td></tr>
<tr><td>2(d)</td><td>colour red ;
pH answer in range 1–3 ;</td><td>2</td></tr>
</table>

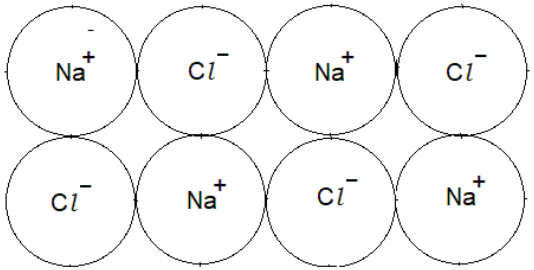
Question	Answer	Marks
3(a)	Q, S ; P, R ;	**2**
3(b)(i)	1 200 000 (N) ;	**1**
3(b)(ii)	evidence of, $p = F \div A$ / 1 200 000 ÷ 0.125 ; 9 600 000 ; Pa OR N / m^2 ;	**3**
3(b)(iii)	evidence of, $W = F d$ / $1.2 \times 10^6 \times 1500$; 1.8×10^9 / 1 800 000 000 (J) ;	**2**
3(b)(iv)	evidence of, $KE = ½ m v^2$ / $½ \times 120\,000 \times 80^2$; $3.8(4) \times 10^8$ / 380 000 000 (J) ;	**2**
3(b)(v)	(work done against) friction / air resistance ;	**1**

Question	Answer	Marks
4(a)(i)	(simple) sugar ;	**1**
4(a)(ii)	starch is broken down more quickly as temperature increases / activity of amylase increases as temperature increases ; increase in kinetic energy (of particles) / (particles) move faster ; increased frequency of collisions / increased number of successful collisions ;	**3**
4(a)(iii)	idea that, amylase is specific (to starch) ; protein molecules will not fit into active site / (shape of) active site not complementary to protein (shape) / (shape of) active site is complementary to starch (shape) ;	**2**
4(b)(i)	*any two from:* combustion ; respiration ; decomposition ; AVP ;	**2**
4(b)(ii)	fossilisation ;	**1**
4(c)	(snake is a) secondary consumer when it eats the insect ; tertiary consumer when it eats the toad ;	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(a)</td><td>C ;</td><td>1</td></tr>
<tr><td>5(b)</td><td>
<table>
<tr><th></th><th>bonds break</th><th>bonds form</th><th>energy is taken in</th><th>energy is given out</th></tr>
<tr><td>arrow A</td><td>✓</td><td></td><td>✓</td><td></td></tr>
<tr><td>arrow B</td><td></td><td>✓</td><td></td><td>✓</td></tr>
</table>
two or three correct ;
all four correct ;
</td><td>2</td></tr>
<tr><td>5(c)(i)</td><td>similarity both produce, water / water vapour ;
difference alkanes / hydrocarbons / diesel, also produce carbon dioxide ;</td><td>2</td></tr>
<tr><td>5(c)(ii)</td><td>(carbon dioxide emissions cause)
an <u>enhanced</u> greenhouse effect / contribute to climate change ;</td><td>1</td></tr>
<tr><td>5(c)(iii)</td><td>hydrogen is a gas AND diesel is a liquid ;
hydrogen, takes up more space / needs to be stored under pressure ;</td><td>2</td></tr>
</table>

Question	Answer	Marks
6(a)(i)	evidence of, power = current × voltage ; fan current = 60 ÷ 240 = 0.25 A / heater current = 2300 ÷ 240 = 9.58 A ; current in fuse = 0.25 + 9.58 = 9.83 A ; OR evidence of, power = current × voltage ; total power drawn = 2300 + 60 / 2360 W ; current in fuse = 2360 ÷ 240 = 9.83 A ;	**3**
6(a)(ii)	comparison of fuse rating with operating current, e.g. rating is, higher than / too close to, operating current ; appropriate matching conclusion, e.g. so fuse, does not blow / may blow, under normal operation ;	**2**
6(b)	 switch S1 in main circuit ; switch S2 in heater branch ;	**2**

Question	Answer	Marks
7(a)(i)	either ovary labelled ;	**1**
7(a)(ii)	toxins ; excretory ;	**2**
7(b)	idea that, fetus needs (some of the) vitamin D ; vitamin D needed, for bone (development) / to prevent rickets ;	**2**
7(c)	*nicotine* addictive ; *tar* prevents cilia working / causes (lung) cancer ;	**2**

Question	Answer	Marks
8(a)	*any two metals from*: sodium, magnesium, aluminium ; *any two non-metals from*: silicon, phosphorus, sulfur, chlorine, argon ;	**2**
8(b)	idea of achieving a full outer shell (for stability) ; sodium atom has one outer electron and chlorine atom has seven ; sodium atom loses one electron and chlorine atom gains one electron ;	**3**
8(c)(i)	 alternating arrangement as shown ;	**1**
8(c)(ii)	*any two from:* ions, have opposite charges / are positive and negative ; strong attraction (between ions) ; so high energy needed to break bonds ;	**2**
8(c)(iii)	potassium / rubidium / caesium / francium ;	**1**
8(c)(iv)	fluorine ;	**1**

Question	Answer	Marks
9(a)(i)	<table><tr><td></td><td>X-rays</td><td>ultraviolet</td><td></td><td></td><td>microwaves ;</td><td></td></tr></table>	**1**
9(a)(ii)	*volume* large(r) <u>amplitude</u> ; *pitch* high(er) <u>frequency</u> ;	**2**
9(b)	transverse / named example ; longitudinal / named example ;	**2**
9(c)(i)	3.0×10^8 / 300 000 000 (m / s) ;	**1**
9(c)(ii)	evidence of, speed = distance ÷ time / 150 000 000 000 ÷ 300 000 000 ; 500 (s) (= 8 min 20 s) ;	**2**
9(c)(iii)	a shiny white surface is a, poor <u>absorber</u> / (good) <u>reflector</u> (of radiation) ;	**1**