



Cambridge IGCSE™

COMBINED SCIENCE**0653/42**

Paper 4 Theory (Extended)

February/March 2022**MARK SCHEME**Maximum Mark: 80

Published

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

Question	Answer	Marks												
1(a)(i)	banana tree → macaw → python ;; <i>one mark for correct order</i> <i>one mark for arrows in correct direction</i>	2												
1(a)(ii)	banana eaten by monkey and/or parrot ; monkey and/or parrot eaten by jaguar ;	2												
1(b)	<table border="1"> <thead> <tr> <th>part of leaf</th><th>feature</th><th>function</th></tr> </thead> <tbody> <tr> <td>palisade mesophyll layer</td><td>(many) chloroplasts</td><td>(photosynthesis)</td></tr> <tr> <td>spongy mesophyll layer</td><td>(air spaces)</td><td>gas exchange</td></tr> <tr> <td>xylem tissue</td><td>(hollow)</td><td>transport of water / support</td></tr> </tbody> </table>	part of leaf	feature	function	palisade mesophyll layer	(many) chloroplasts	(photosynthesis)	spongy mesophyll layer	(air spaces)	gas exchange	xylem tissue	(hollow)	transport of water / support	3
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palisade mesophyll layer	(many) chloroplasts	(photosynthesis)												
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xylem tissue	(hollow)	transport of water / support												
1(c)	as light intensity increases the rate of photosynthesis increases ; then levels off / owtte ;	2												

Question	Answer	Marks
2(a)	Z and has 7 electrons in its outer shell / 7 valence electrons ;	1

Question	Answer	Marks															
2(b)(i)	X in Group 2 (no mark) X atoms have two outer electrons; X is a metal ;	2															
2(b)(ii)	(X is metallic and) Y is non-metallic because it is a gas / exists as single atoms / X is a metal and Y is a noble gas / X atoms bond together and Y atoms not (normally) bonded / owtte ;	1															
2(b)(iii)	helium ;	1															
2(b)(iv)	<table border="1"> <thead> <tr> <th>Statement</th><th>True</th><th>False</th></tr> </thead> <tbody> <tr> <td>The bond between two atoms in Z₂ is a double bond.</td><td></td><td>✓</td></tr> <tr> <td>The bonding in Z₂ is covalent.</td><td>✓</td><td></td></tr> <tr> <td>Z₂ molecules are diatomic.</td><td>✓</td><td></td></tr> <tr> <td>Z₂ is non-metallic.</td><td>✓</td><td></td></tr> </tbody> </table> All correct (2) 2 / 3 correct (1)	Statement	True	False	The bond between two atoms in Z ₂ is a double bond.		✓	The bonding in Z ₂ is covalent.	✓		Z ₂ molecules are diatomic.	✓		Z ₂ is non-metallic.	✓		2
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2(b)(v)	X ion positive and Z ion negative ; X ion is +2 and Z ion is –1; (subsumes first point) X loses (2) electrons and Z gains (1) electron ;	3															

Question	Answer	Marks
3(a)(i)	friction ;	1
3(a)(ii)	25 (N) ;	1

Question	Answer	Marks
3(b)	$KE = \frac{1}{2}mv^2$ (in any form) / $\frac{1}{2} \times 20 \times 0.7 \times 0.7$; 4.9 (J) ;	2
3(c)(i)	use of area under curve ; calculation of one area e.g., distance = $(\frac{1}{2} \times 1 \times 0.7 = 0.35) / (3 \times 0.7 = 2.1)$; (= 0.35 + 2.1 =) 2.45 (m) ;	3
3(c)(ii)	acceleration = change in speed $\div$ time (in any form) / $0.7 \div 1$; 0.7 ; m / s ² ;	3

Question	Answer	Marks
4(a)(i)	X – oesophagus ; Y – pancreas ;	2
4(a)(ii)	produce / secrete, <u>amylase</u> ; digest <u>starch</u> ; to produce, simpler sugars / glucose ;	3
4(b)	prevents constipation ;	1
4(c)	water moves from higher to lower water potential ; through a partially permeable membrane ; (by the process of) osmosis ;	3
4(d)	thin <u>wall</u> / <u>wall</u> one cell thick ; allow (efficient) exchange of substances ;	2

Question	Answer	Marks
5(a)	hydrogen: lighted splint and pops / gives a squeaky pop ; oxygen: glowing splint and relights ;	2
5(b)(i)	$2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$ $4\text{OH}^-(\text{aq}) \rightarrow \text{O}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l}) + 4\text{e}^-$ (g) shown for hydrogen and oxygen ; (aq) for H^+ and OH^- and (l) for water ;	2
5(b)(ii)	(at the negative electrode / cathode) hydrogen ions gain electrons (to form hydrogen atoms / hydrogen molecules) ; (at the positive electrode / anode) hydroxide ions lose electrons (to form water molecules and oxygen molecules) ;	2
5(c)	universal indicator / (blue) litmus AND turns red ;	1

Question	Answer	Marks
6(a)	<u>focal length</u> ;	1
6(b)(i)	X located between A and lens ;	1
6(b)(ii)	density = mass $\div$ volume (<i>in any form</i>) / $m = V \times \rho = 50.0 \times 0.85$; 42.5 (g) ;	2
6(c)(i)	kinetic energy of molecules increases ; distance between molecules increases / molecules further apart ;	2
6(c)(ii)	(decreases – no mark) higher volume but same mass / the idea that $m \div V$ decreases ;	1

Question	Answer	Marks
7(a)(i)	300 – 280 ; 20 ;	2
7(a)(ii)	tar ; oxygen ; nicotine ;	3
7(b)	(damaged alveoli) less surface (area) ; so less diffusion / lower rate of diffusion (of gases) ;	2

Question	Answer	Marks																				
8(a)(i)	cracking ;	1																				
8(a)(ii)	high temperature ; catalyst / high pressure ;	2																				
8(b)	<table><tr><td></td><td>C₇H₁₆</td><td>C₂H₄</td><td>C₅H₁₂</td></tr><tr><td>It has molecules which contain 23 atoms.</td><td>✓</td><td></td><td></td></tr><tr><td>It is unsaturated.</td><td></td><td>✓</td><td></td></tr><tr><td>It is an alkane.</td><td>✓</td><td></td><td>✓</td></tr><tr><td>It produces carbon dioxide and water when it burns.</td><td>✓</td><td>✓</td><td>✓</td></tr></table> All correct (3 marks) 3 rows correct (2 marks) 2 rows correct (1 mark)		C ₇ H ₁₆	C ₂ H ₄	C ₅ H ₁₂	It has molecules which contain 23 atoms.	✓			It is unsaturated.		✓		It is an alkane.	✓		✓	It produces carbon dioxide and water when it burns.	✓	✓	✓	3
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It is an alkane.	✓		✓																			
It produces carbon dioxide and water when it burns.	✓	✓	✓																			
8(c)	from orange to colourless ;	1																				

Question	Answer	Marks
8(d)	(same) general formula ; similar chemical properties ;	2

Question	Answer	Marks							
9(a)	variable resistor ; controls current / the idea that it controls the brightness of the lamps ;	2							
9(b)	resistance of each lamp = $V \div I \div 220 \div 5 \div 44 \text{ (}\Omega\text{)}$; combined resistance = $(R_1 \times R_2) \div (R_1 + R_2)$ (in any form) / $44 \times 44 \div 88$; 22 (Ω) ;	3							
9(c)(i)	the current (through lamps) exceeded 10 A; because the current fluctuates / fuse needs to allow for fluctuations / fuse rating needs to be a little higher than expected current / owtte ;	2							
9(c)(ii)	the idea that a 13 A fuse allows normal operation / takes 10 A without blowing ; a rating greater than 13 A risks damaging the circuit / lamps / owtte ;	2							
9(d)	← increasing frequency <table><tr><td>(gamma radiation)</td><td>(X-rays)</td><td>ultraviolet (radiation)</td><td>visible (light)</td><td>infrared (radiation)</td><td>(microwaves)</td><td>(radio waves)</td></tr></table>	(gamma radiation)	(X-rays)	ultraviolet (radiation)	visible (light)	infrared (radiation)	(microwaves)	(radio waves)	1
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