



Cambridge IGCSE™

COMBINED SCIENCE

0653/41

Paper 4 Theory (Extended)

May/June 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.

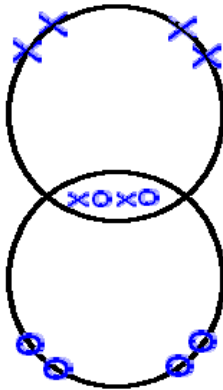
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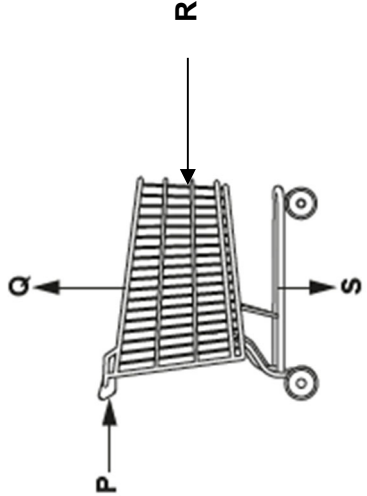
Cambridge International is publishing the mark schemes for the May/June 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **11** printed pages.

Question	Answer	Marks
1(a)(i)	alveoli ;	1
1(a)(ii)	diaphragm ;	1
1(a)(iii)	less oxygen can bind (to haemoglobin) / less oxygen transported (by red blood cells) ; so less (aerobic) respiration ;	2
1(a)(iv)	produce mucus ; mucus traps particles ;	2
1(b)(i)	6 (%) ;	1
1(b)(ii)	<i>Any two from:</i> the percentage of people with COPD increases with age ; more males than females have COPD (in all age groups) ; the difference between males and females increases with age ;	2

Question	Answer	Marks
2(a)	7 / VII / halogens ;	1
2(b)	–2 ; gains (two) electrons to give a full outer shell ;	2

Question	Answer			Marks												
2(c)(i)	<table><tr><th>Formula</th><th>Type of structure</th><th>Element or compound?</th></tr><tr><td>X_2Z</td><td>simple covalent molecules</td><td>compound</td></tr><tr><td>X_2</td><td>simple covalent molecules</td><td>element</td></tr><tr><td>Z_2</td><td>simple covalent molecules</td><td>element</td></tr></table> ;			Formula	Type of structure	Element or compound?	X_2Z	simple covalent molecules	compound	X_2	simple covalent molecules	element	Z_2	simple covalent molecules	element	1
Formula	Type of structure	Element or compound?														
X_2Z	simple covalent molecules	compound														
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Z_2	simple covalent molecules	element														
2(c)(ii)	 <i>fully correct (2)</i> <i>double bond correct (1)</i>			2												
2(c)(iii)	X_2 has a covalent bond ;			1												
2(c)(iv)	hydrogen ;			1												

Question	Answer	Marks
3(a)(i)	 arrow pointing to left with label R ;	1
3(a)(ii)	(S =) 150 (N) ;	1
3(a)(iii)	(Q =) 150 (N) AND no vertical movement, (so forces must be equal and opposite) ;	1
3(b)(i)	reading 0.4 for speed from graph ; $KE = \frac{1}{2} mv^2$ (<i>in any form</i>) / $= \frac{1}{2} \times 15 \times 0.4 \times 0.4$; 1.2 (J) ;	3
3(b)(ii)	acceleration = change in speed $\div$ time / $= (0.8 - 0.4) \div 2$; 0.2 ; m / s² ;	3
3(b)(iii)	work done = $F \times d$ (in any form) ; distance travelled = area under graph between 4 s and 10 s / (0.8×6) ; ($= (0.8 \times 6) \times 25 =$) 120 (J) ;	3

Question	Answer	Marks
4(a)(i)	ovary labelled ;	1
4(a)(ii)	<i>any two from:</i> small petals ; feathery stigma ; pollen / anther / filaments / stamens / stigma outside (flower) ;	2
4(b)(i)	(6) CO ₂ + (6) H ₂ O ; light and (6) O ₂ ;	2
4(b)(ii)	absorbs / traps / uses light energy ; (light energy is) transferred / converted to chemical energy ;	2
4(c)	<i>any three from:</i> (as temperature decreases) transpiration rate decreases ; so less water lost ; correct reference to evaporation from (mesophyll) cells ; correct reference to diffusion (of water vapour) from stomata ;	3
4(d)	carbon dioxide enters leaf through stomata ; carbon dioxide is needed for photosynthesis ;	2

Question	Answer	Marks
5(a)(i)	(dip paper in) and observe the colour ; compare colour to a chart / idea that colour indicates the pH ;	2
5(a)(ii)	gives a value to one decimal place idea / idea of greater precision of measurements ; do not need to use a reference chart / can be reused / avoids the uncertainty of judging colours ;	2
5(b)(i)	$2\text{NH}_3 + \text{H}_2\text{SO}_4$ formula of both correct ; balancing correct dependent on correct formulae ;	2
5(b)(ii)	nitric acid ;	1
5(b)(iii)	leave in warm place / heat ; evaporate water ;	2

Question	Answer	Marks						
6(a)(i)	$3 \times 10^8 \text{ m / s ;}$	1						
6(a)(ii)	speed = distance/time (<i>in any form</i>) ; 8 minutes 20 secs = $(8 \times 60 + 20) = 500 \text{ s}$ OR speed = $3 \times 10^5 \text{ km/s ;}$ distance = $3 \times 10^5 \times 500 = 150 \times 10^6 \text{ (km) / } 1.5 \times 10^8 \text{ km ;}$	3						
6(a)(iii)	<table><tr><td></td><td></td><td>(ultraviolet)</td><td></td><td>infrared ;</td><td>(microwaves)</td></tr></table>			(ultraviolet)		infrared ;	(microwaves)	1
		(ultraviolet)		infrared ;	(microwaves)			
6(b)(i)	change in density (of the medium) / change in speed (of wave) ;	1						

Question	Answer	Marks
6(b)(ii)	radiation / heat / light reflected by shiny / white / absorbed by dull/black ; dull/black absorbs more radiation (than the shiny / white) ;	2

Question	Answer	Marks
7(a)(i)	liver ;	1
7(a)(ii)	insoluble AND soluble ;	1
7(b)	<i>any three from:</i> (similarities) are enzymes / speed up digestion ; breakdown large / insoluble, food molecules ; (differences) amylase breaks down / digests starch / carbohydrates / produces sugars ; lipase breaks down / digests fats / oils / lipids / produces fatty acids / glycerol ;	3
7(c)	plasma ;	1

Question	Answer	Marks
8(a)(i)	(equation) 3 AND carbon monoxide removes oxygen from iron (oxide) ;	1
8(a)(ii)	carbon monoxide AND carbon dioxide ; carbon monoxide, is toxic / restricts oxygen transport in the blood ; carbon dioxide causes, climate change / enhanced greenhouse effect / global warming ;	3
8(a)(iii)	$3+ / \text{Fe}^{3+}$;	1
8(b)(i)	sodium AND because it is the most reactive ;	1

Question	Answer	Marks
8(b)(ii)	Cu heating with carbon AND Mg electrolysis ; Cu because less reactive than iron / carbon ; Mg because more reactive than aluminium / carbon ;	3

Question	Answer	Marks
9(a)(i)	$R = V \div I$ (in any form) / $6.0 \div 0.75$; $8.0 (\Omega)$;	2
9(a)(ii)	$\text{Power} = V \times I$ (in any form) / $= 6.0 \times 0.75$; $4.5 (\text{W})$;	2
9(b)	correct symbols for switch AND voltmeter ; correct symbol for variable resistor ; complete circuit with voltmeter parallel to lamp only and switch correctly positioned;	3