



Cambridge IGCSE™

COMBINED SCIENCE**0653/41**

Paper 4 Theory (Extended)

May/June 2023**MARK SCHEME**Maximum Mark: 80

Published

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This document consists of **12** printed pages.

Question	Answer	Marks
1(a)(i)	artery ;	1
1(a)(ii)	<i>any one from:</i> frog has only 3 chambers / frog has one ventricle ; humans have four chambers / humans have two ventricles ; no septum in frog / AW ;	1
1(a)(iii)	oxygenated and deoxygenated blood kept separate ; high blood pressure around body / low blood pressure to lungs ;	2
1(b)(i)	(lack of) physical activity ;	1
1(b)(ii)	$(54 \times 350) \div 100$; 189 ;	2
1(b)(iii)	age / genetics / inheritance ;	1
1(c)	scurvy – (fruit and vegetables) are a source of Vit C / Vit C prevents scurvy ; constipation – (vegetables) are a source of fibre / fibre needed for bulk ;	2

Question	Answer	Marks
2(a)(i)	H ⁺ ; hydroxide and water ; Na ⁺ and sodium chloride ;	3
2(a)(ii)	decreases , because used up / forms chlorine ;	1

Question	Answer	Marks
2(b)	(test) lighted splint AND (observation) pops ;	1
2(c)(i)	shows an acid (produced) ;	1
2(c)(ii)	(red to) colourless ; (because litmus is) bleached by chlorine (formed) ;	2

Question	Answer	Mark
3(a)	<u>radiation</u> ;	1
3(b)	reference to molecules moving faster ; reference to expansion of air or gases / gases or air occupy greater volume / molecules move further apart ; the idea that lower density (air) rises / hot air displaced by heavier or denser cool air ;	3
3(c)(i)	vibrating (string) ;	1
3(c)(ii)	speed = frequency $\times$ wavelength / $v = f \lambda$ (<i>in any form</i>) / $\lambda = 330 \div 256$; 1.29 (m) ;	2
3(c)(iii)	compression means, particles or molecules are close together / (air) density is greater / air pressure is greater / ORA for rarefaction ; succession refers to the idea that compressions and rarefactions form a repeating, pattern / (longitudinal) wave ;	2

Question	Answer	Marks																								
4(a)(i)	<table><tr><th>organism</th><th>producer</th><th>herbivore</th><th>secondary consumer</th></tr><tr><td>flying squirrel</td><td></td><td>✓</td><td></td></tr><tr><td>owl</td><td></td><td></td><td>✓</td></tr><tr><td>cougar</td><td></td><td></td><td>✓</td></tr><tr><td>beaver</td><td></td><td>✓</td><td></td></tr><tr><td>fruit</td><td>(✓)</td><td></td><td></td></tr></table> one mark for each correct column	organism	producer	herbivore	secondary consumer	flying squirrel		✓		owl			✓	cougar			✓	beaver		✓		fruit	(✓)			2
organism	producer	herbivore	secondary consumer																							
flying squirrel		✓																								
owl			✓																							
cougar			✓																							
beaver		✓																								
fruit	(✓)																									
4(a)(ii)	cougar is in a higher trophic level / beaver is in lower trophic level ; energy lost (between levels) ; example of energy loss, e.g. respiration / heat / waste / incomplete digestion ;	3																								
4(b)	any two from : large / heavy (compared to wind pollinated) ; has spikes ; sticky ;	2																								

Question	Answer	Marks
5(a)	C_nH_{2n} ;	1
5(b)	C_2H_6 ; C_8H_{16} ;	2
5(c)(i)	(unsaturated because) they contain a (carbon-carbon) double bond ; (hydrocarbons) contain hydrogen and carbon only ;	2
5(c)(ii)	(the idea that methane would contain) only one carbon atom / an alkene needs (at least) two carbon atoms ; the idea that a (C = C) double bond cannot form ;	2
5(d)(i)	bottled gas / heating / cooking ;	1
5(d)(ii)	similar boiling point ;	1

Question	Answer	Marks
6(a)(i)	weight ;	1
6(a)(ii)	force arrow parallel to belt in contact with box pointing up the belt ;	1
6(b)	time = distance $\div$ speed (<i>stated or evidence of use</i>) / (time =) $5 \div 0.2$; 25 (s) ;	2
6(c)(i)	(gain in GPE =) $mg\Delta h$ (<i>stated or evidence of use</i>) / $45 \times 10 \times 2$; 900 (J) ;	2

6(c)(ii)	pressure = force ÷ area (<i>in any form</i>) ; = 450 ÷ 3000 OR 450 ÷ 0.3 ; (pressure =) 0.15 (N/cm²) OR 1500 (N/m² or Pa) ; N/cm² OR N/m² OR Pa (<i>to match numerical answer</i>) ;	4
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Question	Answer	Marks
7(a)(i)	chlorophyll ; chemical ; carbohydrates ;	3
7(a)(ii)	<i>any three from:</i> responds to gravity / gravitropism ; auxin is produced at the shoot tip ; increased (concentration of) auxin on underside (of stem) ; auxin causes cell elongation ;	3
7(b)	large surface area ; increased absorption of, water / mineral (ions) ;	2
7(c)	decomposers feed on / break down, (aquatic) plants ; (aerobic) respiration of decomposers (uses oxygen) ;	2

Question	Answer	Marks
8(a)(i)	3 and 2 ;	1
8(a)(ii)	Fe^{3+} ;	1
8(b)(i)	excludes, oxygen / air ; excludes water ;	2
8(b)(ii)	paint / grease / oil / other suitable coating ;	1
8(c)	4 ; it has a double bond with two electrons in each bond / two pairs of electrons are shared ;	2
8(d)	oxygen, is covalent / has a simple (molecular) structure and <u>iron</u> oxide, is ionic / has a giant structure ; forces between particles / ions, in iron oxide, are stronger than in oxygen (particles / molecules) ;	2

Question	Answer	Marks
9(a)	angle of incidence = angle of reflection AND angles measured to the normal ;	1
9(b)(i)	resistance = voltage $\div$ current (<i>stated or evidence of use</i>) / $5 \div 0.020$; $250 (\Omega)$;	2
9(b)(ii)	$P = I \times V$ (<i>stated or evidence of use</i>) / ($P = $) 0.020×5.0 ; $0.1 (0) (W)$;	2
9(b)(iii)	LEDs in parallel, using LED symbol provided ; circuit symbol for resistor and switch ; resistor and switch in main circuit, circuit completed with no additional components or extra wiring causing a short circuit ;	3