



Cambridge IGCSE™

COMBINED SCIENCE

0653/41

Paper 4 Theory (Extended)

May/June 2021

MARK SCHEME

Maximum Mark: 80

Published

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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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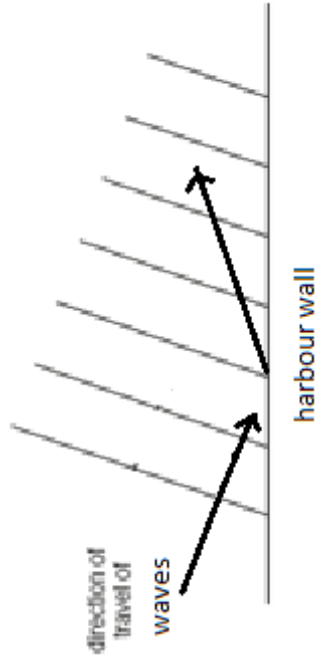
Cambridge International is publishing the mark schemes for the May/June 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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

Question	Answer	Marks
1(a)(i)	contains genetic material ;	1
1(a)(ii)	has a flagellum / presence of enzymes ;	1
1(a)(iii)	testes ;	1
1(b)(i)	guard cell ;	1
1(b)(ii)	chloroplast / cell wall ;	1
1(c)(i)	$(15 + 12 + 14) \div 3$; (=) 14 (bubbles) ;	2
1(c)(ii)	as light intensity increases or distance decreases the rate increases ORA ; the idea that the rate levels off (closer than 20 cm) ;	2
1(d)	<i>any two from:</i> absorbs light (energy) ; (transfers) light to chemical energy ; for the synthesis of carbohydrates ;	2

Question	Answer	Marks
2(a)(i)	(two) electrons are shared ;	1
2(a)(ii)	<i>difference:</i> oxygen has four electrons between atoms / hydrogen has two OR oxygen has a double bond / hydrogen has a single bond ; <i>explanation:</i> each atom shares electrons to, gain a full outer shell / become stable / oxygen atoms need two electrons to fill outer shell but hydrogen needs only one OWTTE ;	2
2(b)(i)	gas: carbon dioxide ; <i>explanation:</i> two elements, bonded / joined ;	2

Question	Answer	Marks
2(b)(ii)	in lamps / lightbulbs / lights ;	1
2(b)(iii)	(they are) unreactive / inert ; (because) full (outer) shell of electrons / has a stable electron arrangement / outer shell contains 8 electrons ;	2
2(b)(iv)	percentages do not add up to 100 ;	1

Question	Answer	Marks
3(a)(i)	$KE = \frac{1}{2} mv^2 / \frac{1}{2} \times 3100 \times 12 \times 12 ;$ $(=) 223\,200 / 223\,000 \text{ (J)} ;$	2
3(a)(ii)	<i>any three from:</i> friction / resistance (force) ; balanced force needed (for constant speed) ; energy required for work done against friction ; the idea that energy (chemical, kinetic) is, transferred / lost as thermal energy (heat) ; energy input from gasoline turned into mechanical work by engine ;	3
3(b)(i)	reflection ;	1
3(b)(ii)	 direction of travel of waves harbour wall arrow shown reflected from wall (example above) ; at approximately the correct angle as seen by eye ;	2

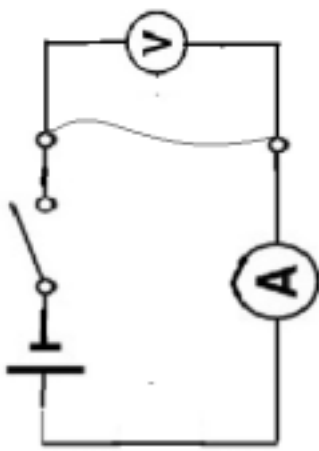
Question	Answer	Marks
4(a)(i)	meat ;	1
4(a)(ii)	9.4 / 9.5(%) ;;; MP1 21.1 ÷ 4 = 5.275 / 5.3 ; MP2 (5.275 ÷ 56) × 100 / = 9.42 OR (5.3 ÷ 56) × 100 / = 9.46 ; MP3 answer given as two significant figures 9.4 or 9.5 % ;	3
4(a)(iii)	higher in protein than, the other vegetable based proteins / beans / lentils OWTTE ;	1
4(b)(i)	<i>any two from:</i> both types break down, food / protein ; the idea that mechanical digestion results in smaller pieces (of food) AND idea that chemical digestion results in smaller molecules ; chemical digestion involves enzymes / mechanical digestion does not use enzymes ; chemical digestion produces soluble molecules / mechanical digestion may not result in soluble molecules ;	2
4(b)(ii)	(provides an acidic pH) for enzymes / for enzymes to work ;	1

Question	Answer	Marks
5(a)	CO ₂ AND H ₂ O given as products ; balanced equation 3CO ₂ + 4H ₂ O ;	2
5(b)(i)	(in both reactions) energy is given out ; energy change is negative / energy of the products is lower than energy of the reactants OWTTE ;	2
5(b)(ii)	propane has a higher activation energy ; propane gives out more energy / gives a more exothermic reaction ;	2
5(c)	toxic / poisonous ;	1

Question	Answer	Marks
6(a)(i)	boiling point raised ; boiling point of pure water is 100 °C ;	2
6(a)(ii)	more work / energy needed (to separate the particles) ;	1
6(b)(i)	425 (dm ³) ;	1
6(b)(ii)	(density =) $m \div V / 1150 \div 425$; = 2.71 (kg/dm ³) ;	2
6(b)(iii)	11500 (N) ;	1
6(b)(iv)	$(P =) F \div A / 11500 \div 1.1$; = $1.05 \times 10^4 / 10455$; N / m ² OR Pa (pascals) ;	3

Question	Answer	Marks
7(a)(i)	muscle / elastic tissue ;	1
7(a)(ii)	<i>any two from:</i> oxygenated blood is kept separate from deoxygenated blood ; blood pressure to body is higher ; blood pressure to lungs is lower ;	2
7(a)(iii)	reference to contraction ; (contraction of) muscles in ventricle (wall) ;	2
7(b)(i)	as the number of cigarettes smoked increases so do the number of deaths ;	1
7(b)(ii)	<i>any two from:</i> the goblet cells, secrete / produce (sticky) mucus ; the mucus traps, particles / microbes / dust ; cilia move (to remove) the mucus (containing particles) ;	2

Question	Answer	Marks																
8(a)(i)	<table><tr><th>element</th><th>formula</th><th>state</th><th>colour</th></tr><tr><td>bromine</td><td>Br₂</td><td>liquid</td><td>red</td></tr><tr><td>chlorine</td><td>Cl₂</td><td>gas</td><td>green</td></tr><tr><td>iodine</td><td>I₂</td><td>solid</td><td>grey</td></tr></table> ..., ,, <i>chlorine:</i> (state) gas ; (colour) green ; <i>iodine:</i> (state) solid ;	element	formula	state	colour	bromine	Br ₂	liquid	red	chlorine	Cl ₂	gas	green	iodine	I ₂	solid	grey	3
element	formula	state	colour															
bromine	Br ₂	liquid	red															
chlorine	Cl ₂	gas	green															
iodine	I ₂	solid	grey															
8(a)(ii)	(diatomic means) only two atoms ; (atoms) joined / combined / bonded together, (in a molecule) ;	2																
8(b)	they have 7 electrons in the outer shell ;	1																
8(c)	<i>order of reactivity:</i> chlorine, bromine, iodine ; <i>explanation:</i> a more reactive element can displace a less reactive element / a more reactive element can react with a salt of a less reactive element ;	2																
8(d)(i)	ionic ;	1																
8(d)(ii)	attraction (between ions) is very strong ;	1																

Question	Answer	Marks
9(a)(i)	 voltmeter symbol in correct place ; ammeter symbol in correct place ; OR ammeter and voltmeter symbols correct ; both meters in correct place ;	2
9(a)(ii)	$3 \times 5.5 / 16.5 / 3 \times 11 ;$ $2 \times 5.5 / 11.0 / 2 \times 16.5 ;$ resistance of new wire = $6 \times 5.5 / 33 (\Omega) ;$	3
9(b)(i)	2 (A) ; correct application of Ohm's Law, e.g. half the resistance means double the current / $V \div 5 = 2 \times V \div 10$ or equivalent ideas ;	2
9(b)(ii)	$R = R_1 \times R_2 \div (R_1 + R_2) = 50 \div 15$ OR equivalent ; $= 3.3 (\Omega) ;$	2