



Cambridge IGCSE™

COMBINED SCIENCE

0653/31

Paper 3 Core Theory

October/November 2020

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.

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These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

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GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

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Science-Specific Marking Principles

- 1 Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
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7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Question	Answer	Marks
1(a)(i)	A larynx ; B intercostal muscles ;	2
1(a)(ii)	pump blood (around the body) ;	1
1(b)(i)	4 ;	1
1(b)(ii)	(rate) increases ; (depth) increases ;	2
1(c)	glucose + (oxygen) → carbon dioxide + water LHS ; RHS ;	2

Question	Answer	Marks
2(a)(i)	(copper oxide) + carbon → copper + carbon dioxide LHS ; RHS ;	2
2(a)(ii)	compound ; ions ; atoms ; covalent ;	4
2(a)(iii)	reduction AND (copper) loses oxygen ;	1

Question	Answer	Marks
2(b)(i)	electrolysis ;	1
2(b)(ii)	(electrons) 13 ; (neutrons) 14 ;	2

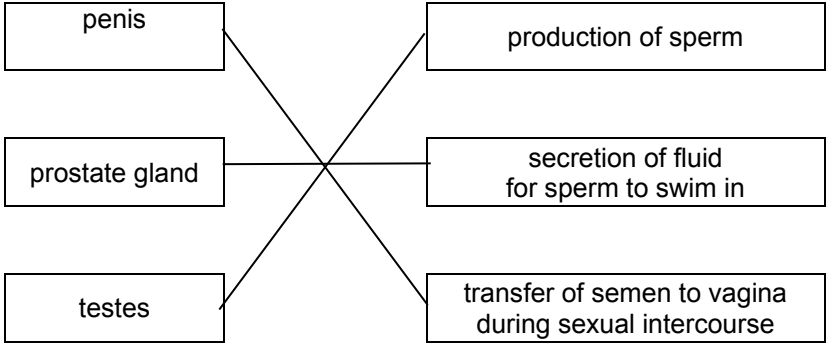
Question	Answer	Marks
3(a)(i)	standing still / not moving / stationary / at rest ;	1
3(a)(ii)	X marked on the graph between 0 s and 5 s (steepest gradient) ;	1
3(a)(iii)	total distance = 20 m / (average) speed = (total) distance÷time <i>in any form</i> / 20÷25 ; 0.8 (m / s) ;	2
3(b)	(mass = weight ÷ <i>g</i> = 800 ÷ 10 =) 80 (kg) ;	1
3(c)(i)	kinetic ; gravitational (potential) ;	2
3(c)(ii)	<i>any two from:</i> (work done against) friction ; (so some) energy, wasted / lost to surroundings / transferred to surroundings ; as, thermal energy / heat ;	2

Question	Answer	Marks
4(a)(i)	cell wall ;	1
4(a)(ii)	<i>any two from:</i> (cell / cytoplasm / vacuole) shrinks ; water moves out / water moves across partially permeable membrane ; by, osmosis / diffusion ;	2

Question	Answer	Marks
4(b)(i)	label line in any xylem cell ;	1
4(b)(ii)	take in, water / mineral ions ;	1
4(b)(iii)	evaporation ; diffusion ;	2
4(c)(i)	chloroplasts ;	1
4(c)(ii)	oxygen ;	1

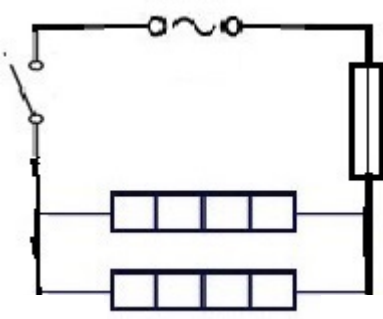
Question	Answer	Marks
5(a)(i)	nitrogen ;	1
5(a)(ii)	oxygen ;	1
5(a)(iii)	(pollutant) carbon monoxide / CO ; (effect) suffocation / less oxygen absorbed/transported ; OR (pollutant) sulfur dioxide / SO ₂ ; (effect) damages buildings / asthma / acid rain ; OR (pollutant) oxides of nitrogen / NO / NO ₂ ; (effect) damages buildings / asthma / acid rain ;	2
5(a)(iv)	CO ₂ ; CH ₄ ;	2
5(b)	one hydrogen oxygen bond correct ; 4 electrons on oxygen outside bonds ; all else correct ;	3
5(c)	(turns to) pink;	1

Question	Answer	Marks
6(a)(i)	(separation) decreases ;	1
6(a)(ii)	(move) faster / speed up ;	1
6(b)(i)	radiation ;	1
6(b)(ii)	<i>any two from:</i> radiation reflected (off sun hat) ; cotton/hat is bad conductor / good insulator ; air (trapped) between hat and head is bad conductor / good insulator ;	2
6(b)(iii)	ultraviolet / UV (radiation) (causes sunburn) ; (sunscreen,) filters out / reduces absorption (of UV) ;	2
6(c)(i)	0.4 (m) ;	1
6(c)(ii)	larger amplitude / description of larger amplitude ;	1

Question	Answer	Marks
7(a)	 1 correct ; 3 correct ;	2

Question	Answer	Marks
7(b)(i)	line labelled F to either oviduct ;	1
7(b)(ii)	<i>any two from:</i> female gamete / ova / egg (cell), develops / matures ; follicle develops ; female gamete / ova / egg (cell), released ; correct reference to time ;	2
7(b)(iii)	ovum ; sperm ; zygote ;	3
7(c)	<i>any two from:</i> idea of protective sexual intercourse ; abstinence ; not sharing needles ;	2

Question	Answer	Marks
8(a)	(it) increases ;	1
8(b)(i)	metal(lic) to non-metal(lic) ;	1
8(b)(ii)	increases ;	1
8(b)(iii)	gas to (liquid to) solid / increasing, melting / boiling point ;	1
8(c)(i)	decolourises / brown disappears / brown to colourless ;	1
8(c)(ii)	(catalytic) cracking ;	1

Question	Answer	Marks
9(a)	 switch symbol correct ; fuse symbol correct ; fuse in main circuit ; switch in main circuit ;	4
9(b)(i)	(parallel connection means there is) still a completed circuit through the working heater ;	1
9(b)(ii)	$R = V \div I$ in any form / $230 \div 2.5$; 92 ; Ω / ohm ;	3
9(c)	13A AND (because,) fuse gives a suitable margin / 5A fuse will blow too readily ;	1

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1(a)(ii)	photosynthesis ;	1
1(a)(iii)	frog / fish / kingfisher ;	1
1(a)(iv)	algae → snail / water beetle → frog → kingfisher ;	1
1(b)	(an organism that) gets its energy from dead or waste organic matter ;	1
1(c)	X respiration ; Y fossilisation ; Z feeding ;	3

Question	Answer	Marks
2(a)(i)	alloy ;	1
2(a)(ii)	unreactive / does not react (with water) ;	1
2(b)(i)	$(65 - 30 =) 35$;	1
2(b)(ii)	30 ;	1
2(b)(iii)	$(30 - 2 =) 28$;	1
2(c)(i)	(zinc) + (dilute) hydrochloric acid → zinc chloride + hydrogen ;	1
2(c)(ii)	ZnCl_2 ;	1

Question	Answer	Marks
3(a)(i)	Q ;	1

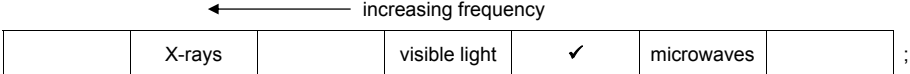
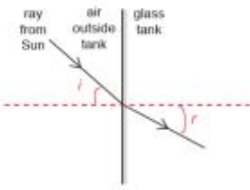
Question	Answer	Marks
3(a)(ii)	S ;	1
3(a)(iii)	Yes AND (because) (movement at) constant speed (so no resultant force) ;	1
3(b)(i)	X at (1.5, 2) or (5, 3) ;	1
3(b)(ii)	Y anywhere between (0, 0) and (1.5, 2) ;	1
3(c)(i)	kinetic ; gravitational ;	2
3(c)(ii)	<i>any two from:</i> friction ; air resistance ; man gets hot ;	2
3(d)	(empty wheelbarrow has) less, mass / weight, so less force (from man) needed ;	1

Question	Answer	Marks
4(a)(i)	C ;	1
4(a)(ii)	phloem ;	1
4(b)	evaporation ; diffusion ;	2
4(c)(i)	phototropism ;	1
4(c)(ii)	to attract insects ;	1

Question	Answer	Marks
4(d)(i)	<i>any two from:</i> in the blood ; in the plasma ; through, the circulatory system / (blood) vessels ;	2
4(d)(ii)	<i>any two from:</i> increased, breathing rate / depth of breathing ; increased, pulse rate / heart rate ; widened pupils ;	2

Question	Answer	Marks
5(a)(i)	electrolysis ;	1
5(a)(ii)	water / H ₂ O ;	1
5(a)(iii)	(negative electrode product) hydrogen / H ₂ ; (positive electrode product) chlorine / Cl ₂ ;	2
5(a)(iv)	(negative electrode) cathode ; (positive electrode) anode ;	2
5(b)(i)	copper ;	1
5(b)(ii)	reduction ;	1

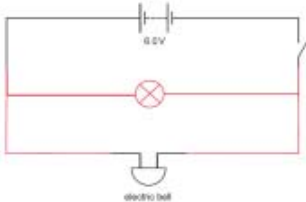
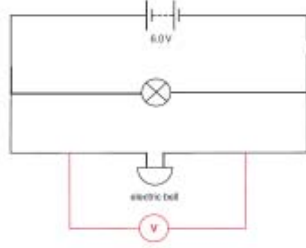
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6(a)(i)	evaporation ;	1
6(a)(ii)	faster / more energetic molecules have enough energy to (break their bonds and) escape ;	1
6(a)(iii)	(temperature) decreases / (sea water) cools down ;	1

Question	Answer	Marks
6(b)	No AND (because) maximum temperature is below boiling point of (sea) water ;	1
6(c)(i)	infrared ;	1
6(c)(ii)		1
6(c)(iii)	the number of complete waves per second / the number of waves that pass a fixed point in unit time ;	1
6(d)	 angle i correctly located ; angle r correctly located ;	2

Question	Answer	Marks
7(a)	P trachea ; Q bronchiole ;	2
7(b)	excretion ;	1
7(c)(i)	pulmonary vein ;	1
7(c)(ii)	white blood cell ;	1

Question	Answer	Marks
7(d)(i)	centre of X on ovary ;	1
7(d)(ii)	oviduct ;	1
7(d)(iii)	<i>any two from:</i> (uterus lining) breaks down ; (uterus lining) is shed ; (uterus) thickness decreases ;	2

Question	Answer	Marks
8(a)(i)	natural gas ;	1
8(a)(ii)	covalent ;	1
8(a)(iii)	one bond shown correctly ; four bonds shown correctly ;	2
8(b)(i)	fractional distillation ;	1
8(b)(ii)	none / no effect / (stays) orange-brown ;	1
8(c)(i)	exothermic ;	1
8(c)(ii)	(nitrogen) no change / no effect / none ; (oxygen) decreases ;	2
8(c)(iii)	(test) limewater ; (result) turns milky ;	2

Question	Answer	Marks
9(a)(i)	 lamp symbol ; parallel connection and complete circuit ;	2
9(a)(ii)	still a complete circuit (through bell branch) ;	1
9(b)	 voltmeter symbol ; connected in parallel to bell (above or below) ;	2
9(c)	$R = V \div I$ in any form / $6.0 \div 0.48$; 12.5 ; Ω / ohm(s) ;	3



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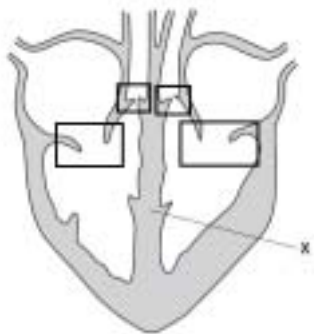
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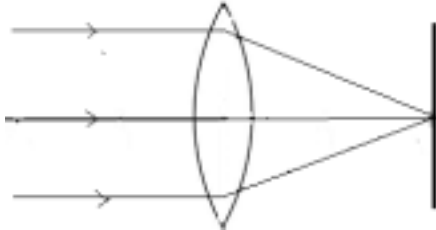
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1(a)(i)	(cell) membrane ; site of different (metabolic) reactions ; nucleus ;	3
1(a)(ii)	movement ;	1
1(a)(iii)	respiration ;	1
1(b)	<i>any two from:</i> red blood cells transport oxygen ; less oxygen, transported / available ; for (aerobic) respiration / less (aerobic) respiration OR oxygen is needed for respiration ;	2
1(c)(i)	septum ;	1
1(c)(ii)	 label line to any valve ;	1

Question	Answer	Marks
2(a)(i)	magnesium + hydrochloric acid → magnesium chloride + (hydrogen) reactants ; magnesium chloride ;	2
2(a)(ii)	(test) lighted splint ; (result) burns with a squeaky 'pop' ;	2
2(b)	(thermal) energy / heat, is, released / given out ;	1
2(c)(i)	rate increases ;	1
2(c)(ii)	rate decreases ;	1
2(d)	(effect) rate, decreases / reduces ; (explanation) zinc is less reactive (than magnesium) ;	2

Question	Answer	Marks
3(a)(i)	640 (N) ;	1
3(a)(ii)	(the) Earth ;	1
3(b)(i)	kinetic ;	1
3(b)(ii)	gravitational (potential energy) ;	1
3(c)(i)	total time = $120 + 60 = 180$ s ; speed = distance ÷ time / $12 \div 180$; 0.067 (m / s) ;	3
3(c)(ii)	the distance moved (and the force / climber's weight) is the same ;	1
3(c)(iii)	(the climber does the same work in a) shorter time taken ;	1

Question	Answer	Marks
4(a)(i)	chloroplast ;	1
4(a)(ii)	(LHS) carbon dioxide + water ; (RHS) (glucose) + oxygen ;	2
4(a)(iii)	carbon AND hydrogen AND oxygen ;	1
4(b)(i)	iodine (solution) ;	1
4(b)(ii)	no starch in white area OR iodine stays brown so no starch / ORA ; no photosynthesis takes place in white area / ORA OR chlorophyll is needed for photosynthesis ;	2
4(c)	anther ;	1

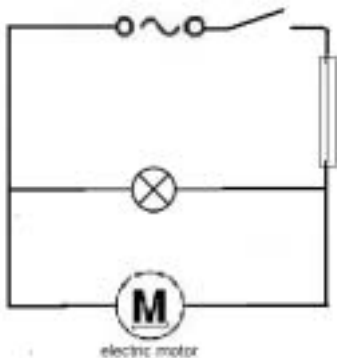
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5(a)(i)	heat / heating ;	1
5(a)(ii)	(in solid copper, atoms are) in fixed position ; regular (arrangement) ;	2
5(a)(iii)	(change) physical AND (explanation) no new substance is made / no chemical reaction ;	
5(b)(i)	high density ; high melting point ;	2
5(b)(ii)	<i>any one from:</i> high boiling point ; malleable ; (good) conductor (of heat / electricity) ;	1
5(c)	metallic to non-metallic ;	1

Question	Answer						Marks	
6(a)	gamma radiation		(ultraviolet)	(visible light)		(microwaves)		1
6(b)(i)	 3 rays continued to converge AND middle ray straight ; meeting at point on screen ;						2	
6(b)(ii)	focal length ;						1	
6(b)(iii)	refraction ;						1	
6(c)(i)	satellite TV / mobile phones / microwave ovens ;						1	
6(c)(ii)	no matter in space / conduction and convection require, a medium / matter;						1	

Question	Answer	Marks
7(a)(i)	leaves → sloth → jaguar correct order ; arrows in right direction ;	2
7(a)(ii)	primary ;	1
7(b)(i)	1995 ;	1

Question	Answer	Marks
7(b)(ii)	<i>any two from:</i> amount of deforestation is decreasing ; less habitat being destroyed ; decrease in (the rate of) loss of leaves / food source ;	2
7(c)(i)	cortex ;	1
7(c)(ii)	arrow drawn going into the root hair ;	1
7(c)(iii)	by, diffusion / osmosis ; through a partially permeable membrane ;	2

Question	Answer	Marks
8(a)(i)	covalent ;	1
8(a)(ii)	(electrons are) shared ;	1
8(a)(iii)	CH ₄ ;	1
8(b)(i)	oxygen / O ₂ ;	1
8(b)(ii)	(gas A) water (vapour) / H ₂ O ; (gas B) carbon dioxide / CO ₂ ;	2
8(c)(i)	petroleum ;	1
8(c)(ii)	fractional distillation ;	1
8(c)(iii)	heating / cooking ;	1

Question	Answer	Marks
9(a)	random arrangement of 6 additional particles, far apart ;	1
9(b)(i)	evaporation ;	1
9(b)(ii)	faster / more-energetic, water molecules escape ; remaining molecules have less energy (so water is cooler) ;	2
9(c)	 correct symbol for lamp ; correct symbol for fuse ; lamp in parallel with motor ; fuse in main circuit ;	4
9(c)	$V = IR$ in any form / 0.080×3000 ; 240 ; V / volts ;	3