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**CO-ORDINATED SCIENCES**

**0654/31**

Paper 3 Theory (Core)

**October/November 2019**

MARK SCHEME

Maximum Mark: 120

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**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.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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This document consists of **16** printed pages.

**PUBLISHED****Generic Marking Principles**

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:**

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

**GENERIC MARKING PRINCIPLE 2:**

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

**GENERIC MARKING PRINCIPLE 3:**

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

**GENERIC MARKING PRINCIPLE 4:**

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

**GENERIC MARKING PRINCIPLE 5:**

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

**GENERIC MARKING PRINCIPLE 6:**

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Question	Answer	Marks												
1(a)(i)	layer of muscle and elastic tissue labelled ; lumen labelled ;	<b>2</b>												
1(a)(ii)	valve ;	<b>1</b>												
1(b)	narrower (lumen) ; thin wall / wall only one cell thick ; does not contain muscular tissue / valves ;  <b>max 2</b>	<b>2</b>												
1(c)	<table border="1"> <thead> <tr> <th>organ</th> <th>blood vessel bringing blood to the organ</th> <th>blood vessel taking blood away from the organ</th> </tr> </thead> <tbody> <tr> <td>heart</td> <td>vena cava</td> <td>aorta / pulmonary artery ;</td> </tr> <tr> <td>kidney</td> <td>renal artery</td> <td>renal vein ;</td> </tr> <tr> <td>lungs</td> <td>pulmonary artery ;</td> <td>pulmonary vein</td> </tr> </tbody> </table>	organ	blood vessel bringing blood to the organ	blood vessel taking blood away from the organ	heart	vena cava	aorta / pulmonary artery ;	kidney	renal artery	renal vein ;	lungs	pulmonary artery ;	pulmonary vein	<b>3</b>
organ	blood vessel bringing blood to the organ	blood vessel taking blood away from the organ												
heart	vena cava	aorta / pulmonary artery ;												
kidney	renal artery	renal vein ;												
lungs	pulmonary artery ;	pulmonary vein												

Question	Answer	Marks
2(a)	number of protons in an atom (of the element) ;	1
2(b)(i)	hydrogen / H <sub>2</sub> ;	1
2(b)(ii)	(X) X reacts most vigorously with water ; reactivity increases down Group 1 / with increasing proton number ;	2
2(b)(iii)	Z (highest) Y X (lowest) ;  the idea that melting point decreases down Group 1 / as reactivity increases / owtte ;	2
2(c)(i)	relights <b>glowing</b> splint ;	1
2(c)(ii)	catalyst ; speeds up reaction rate ;	2
2(c)(iii)	$2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$ ;	1

Question	Answer	Marks
3(a)(i)	gravitational potential ;	<b>1</b>
3(a)(ii)	kinetic ;	<b>1</b>
3(a)(iii)	force x distance or $10 \cdot 10$ ; 100 ; Nm ;	<b>3</b>
3(b)(i)	visible in centre ;	<b>1</b>
3(b)(ii)	IR to heat sensing camera radio waves to TV transmission X-rays to airport security  1 correct for 1 mark ; all 3 correct for 2 marks ;  <b>max 2</b>	<b>2</b>
3(b)(iii)	radio waves ;	<b>1</b>
3(c)	speed = distance/time or $s = d/t$ or $8000/900$ ; $8000 / 900$ (conversions to m/s) ; 9 (m/s) ;	<b>3</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
4(a)(i)	grass / dandelion (plants) ;	<b>1</b>
4(a)(ii)	rabbit / mouse ;	<b>1</b>
4(a)(iii)	grass / dandelion plants → mouse → snake → hawk ;;	<b>2</b>
4(b)	rabbits / mice / primary consumers ; snakes / secondary consumers ;	<b>2</b>
4(c)	as there is less food for snakes ; increased predation of snakes ;	<b>2</b>
4(d)	Sun ;	<b>1</b>

Question	Answer	Marks
5(a)	ionic / electrovalent ; covalent ;	<b>2</b>
5(b)(i)	graphite ;	<b>1</b>
5(b)(ii)	( <b>A</b> , <b>B</b> and <b>C</b> are elements because) they contain only one type of atom ; ( <b>D</b> is compound because) it shows <u>different</u> types of atom bonded together ;	<b>2</b>
5(b)(iii)	C <sub>2</sub> H <sub>6</sub> O symbols correct ; subscripts correct ;	<b>2</b>
5(c)(i)	<b>E</b> – cathode ; <b>F</b> – anode ;	<b>2</b>
5(c)(ii)	<u>bromine</u> ;	<b>1</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
6(a)(i)	electrical; thermal;	<b>2</b>
6(a)(ii)	wind/geothermal/biomass;	<b>1</b>
6(a)(iii)	increase the number of turns on the coil <b>or</b> increase the current;	<b>1</b>
6(b)(i)	to protect the circuit/ to prevent fire/to prevent electrocution/to prevent overheating;	<b>1</b>
6(b)(ii)	13 amp; the fuse will stay intact in normal use and blow with a small increase of current <b>or</b> a 30 amp fuse will allow too much abnormal current to flow and the circuits could be damaged;	<b>2</b>

Question	Answer	Marks
7(a)(i)	iodine ;	<b>1</b>
7(a)(ii)	<i>part A</i> blue-black ; <i>part B</i> orange / yellow / brown ;	<b>2</b>
7(b)	carbohydrates ; light ;	<b>2</b>
7(c)	(net) movement of particles ; from a region of their higher concentration to a region of their lower concentration/down a concentration gradient ; as a result of their random movement ;	<b>3</b>

Question	Answer	Marks
8(a)(i)	I J K ;;	2
8(a)(ii)	(I) copper sulfate produced which is blue / a compound of a transition metal is produced which is coloured ;	1
8(b)	add sodium hydroxide solution and warm ; ammonia released / gas turning (damp) red litmus to blue released ;	2
8(c)(i)	pH decreases ; description of shape / use of data;	2
8(c)(ii)	25 (cm <sup>3</sup> ) ; this volume produces mixture with pH 7 / working shown on graph ;	2
8(c)(iii)	sodium chloride and water ;	1

Question	Answer	Marks
9(a)(i)	normal drawn from ice and ray intercept, 90° to the ice ;	<b>1</b>
9(a)(ii)	reflected ray to correct point in spectator area (symmetrical about the normal to the incident ray) <b>and</b> labelled 'reflected ray' ;	<b>1</b>
9(a)(iii)	angle drawn between the normal and the incident ray <b>and</b> labelled 'i' ;	<b>1</b>
9(b)(i)	0 °C ;	<b>1</b>
9(b)(ii)	in liquid water : molecules drawn touching in random arrangement ; in liquid water: random arrangement ;	<b>2</b>
9(c)	larger area; so smaller pressure;	<b>2</b>
9(d)	$\rho = m/v$ or 4600 / 5000 or 4.6 / 5000 seen ; 0.92 g/cm <sup>3</sup> ;	<b>2</b>
9(e)	friction ;	<b>1</b>

Question	Answer	Marks
10(a)	<b>X</b> sweat gland ; <b>Y</b> blood vessel ;	<b>2</b>
10(b)(i)	skin temperature increased (during exercise) and decreased (after exercise) ; peak at 50 mins / 38 °C ;	<b>2</b>
10(b)(ii)	sweating ; hair lies flat ; avp ;  <b>max 2</b>	<b>2</b>
10(c)(i)	brain ;	<b>1</b>
10(c)(ii)	homeostasis ;	<b>1</b>

Question	Answer	Marks
11(a)	nitrogen 78% ; oxygen 21% ;	<b>2</b>
11(b)(i)	<b>(Y)</b> natural gas is mainly methane / main gas in <b>Z</b> is not methane / owtte ;	<b>1</b>
11(b)(ii)	limewater ; turns milky / cloudy / white precipitate ;	<b>2</b>
11(c)(i)	hydrocarbon compound containing hydrogen and carbon ; <b>only</b> (hydrogen and carbon ) ; saturated contains only C-C single bonds ;	<b>3</b>
11(c)(ii)	carbon dioxide / CO <sub>2</sub> ; water (vapour) / H <sub>2</sub> O ;	<b>2</b>

Question	Answer	Marks
12(a)(i)	infrared ;	<b>1</b>
12(a)(ii)	8 minutes ;	<b>1</b>
12(a)(iii)	can cause cancer / cell mutations/damage to cells ;	<b>1</b>
12(a)(iv)	mention of sound waves and needing a medium to travel through / cannot travel through a vacuum ;	<b>1</b>
12(b)(i)	two rays meet at single point in middle of paper ;	<b>1</b>
12(b)(ii)	focal length ;	<b>1</b>
12(c)(i)	symbols correct ; cell, switch and lamp in series ;	<b>2</b>
12(c)(ii)	$R = V/I$ or 9/4.5 ; 2 ;	<b>2</b>

Question	Answer				Marks												
13(a)	R ; Q ;				<b>2</b>												
13(b)	<table border="1"> <tr> <td></td> <td>involves transfer of pollen grains</td> <td>involves ovules</td> <td>involves fusion of nuclei</td> </tr> <tr> <td>fertilisation</td> <td></td> <td>✓</td> <td>✓</td> </tr> <tr> <td>pollination</td> <td>✓</td> <td></td> <td></td> </tr> </table> ;;					involves transfer of pollen grains	involves ovules	involves fusion of nuclei	fertilisation		✓	✓	pollination	✓			<b>2</b>
	involves transfer of pollen grains	involves ovules	involves fusion of nuclei														
fertilisation		✓	✓														
pollination	✓																
13(c)	(named) insect / wind ;				<b>1</b>												
13(d)	water the seeds ; aerate the soil ; keep seeds warm / germinate indoors / use greenhouse ;  <b>max 2</b>				<b>2</b>												