



CO-ORDINATED SCIENCES

0654/42

Paper 4 Theory (Extended)

October/November 2018

MARK SCHEME

Maximum Mark: 120

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.

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This document consists of **12** 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:

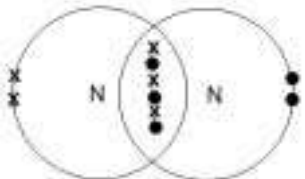
Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

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)	xylem labelled ; phloem labelled ;	2
1(b)	evaporation from leaves / water loss by transpiration ; creates, water potential gradient / difference in water potential ; pulls water molecules up xylem ; water molecules held together by cohesion ;	max 3
1(c)(i)	root hair cells ; elongated shape / increase surface area ;	2
1(c)(ii)	absorb, mineral (ions) / named mineral ions ; anchorage in soil ;	max 1

Question	Answer	Marks
2(a)	<u>78</u> (%) ;	1
2(b)	in the range -195 to -184 °C inclusive ; idea that temperature needs to be above the b.pt. of N and below the b. pt. of O ;	2
2(c)(i)	3 2 1 ;	1
2(c)(ii)	hydrogen ;	1

Question	Answer	Marks
2(d)(i)	 <p>1 mark for 3 shared pairs only ; 1 mark for two lone pairs only ;</p>	2
2(d)(ii)	<i>the idea that</i> the bond in N ₂ has to break ; the bond is very strong / there are multiple bonds ;	2
2(d)(iii)	pH is reduced ; nitrogen dioxide is an acidic oxide / non-metal oxides are acidic / nitrogen oxides react with (rain)water to form acid with water ;	2

Question	Answer	Marks
3(a)(i)	diagonal line starting at 0,5 and stopping at 8,15 ;	1
3(a)(ii)	acceleration = change in speed / time or $10 / 8 = 1.25$;	1
3(a)(iii)	force = mass \times acceleration or 60×1.25 ; = 75 (N) ;	2
3(a)(iv)	kinetic energy = $\frac{1}{2} mv^2$ or $\frac{1}{2} \times 60 \times 15 \times 15$; = 6750 (J) / 6800 (J) ;	2
3(b)	arrow drawn from middle to top or bottom of the wave ;	1

Question	Answer	Marks
3(c)(i)	double headed arrow from left to right ;	1
3(c)(ii)	water wave arrow up and down ;	1
3(c)(iii)	number of compressions produced by the source per unit time / number of waves that pass a certain point per unit time ;	1

Question	Answer	Marks
4(a)(i)	sterilises it / kills, harmful / unwanted bacteria ;	1
4(a)(ii)	bacteria, <u>anaerobically</u> respiring ; producing <u>lactic acid</u> ;	2
4(a)(iii)	bacteria / enzymes become inactive at low temperature ; enzyme-controlled reaction ; lower rate of collisions between enzyme and substrate / less energy of particles ;	max 2
4(b)(i)	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px 10px;">carbohydrate</div> <div style="border: 1px solid black; padding: 2px 10px;">butter</div> </div> <div style="display: flex; justify-content: space-around; align-items: center; margin: 5px 0;"> <div style="border: 1px solid black; padding: 2px 10px;">fat</div> <div style="border: 1px solid black; padding: 2px 10px;">rice</div> </div> <div style="display: flex; justify-content: space-around; align-items: center; margin: 5px 0;"> <div style="border: 1px solid black; padding: 2px 10px;">protein</div> <div style="border: 1px solid black; padding: 2px 10px;">satsuma fruit</div> </div> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px 10px;">vitamin C</div> <div style="border: 1px solid black; padding: 2px 10px;">tuna fish</div> </div> <p style="margin-top: 10px;">1 correct ; 2 or 3 correct ; 4 correct ;</p>	3
4(b)(ii)	scurvy ;	1

Question	Answer	Marks
5(a)(i)	coloured (compounds) ;	1
5(a)(ii)	hydrogen ;	1
5(a)(iii)	green precipitate / solid / owtte ;	1
5(b)(i)	carbon is more reactive than copper ;	1
5(b)(ii)	$2\text{CuO} + \text{C} \rightarrow \text{CO}_2 + 2\text{Cu}$ formulae ; balancing ;	2
5(c)(i)	copper sulfate ;	1
5(c)(ii)	copper <u>ions</u> , attracted / move to / are discharged at the cathode ; copper ions, gain two electrons from the cathode ;	2

Question	Answer	Marks
6(a)(i)	radio on right hand side and visible in the middle ;	1
6(a)(ii)	speed = frequency \times wavelength or $665 \times 10^{12} \times 450 \times 10^{-9} / 299\,250\,000$ (m/s) ; $299\,000\,000$ (m / s) ;	2
6(b)(i)	mirror drawn at point of reflection ; correct angle at point of reflection ;	2
6(b)(ii)	angle i correctly labelled ;	1
6(b)(iii)	30° AND angle of incidence = angle of reflection ;	1

Question	Answer	Marks
7(a)(i)	glucose used in respiration ; glucose used to release energy (for exercise) ; AVP ;	max 2
7(a)(ii)	low blood glucose concentration detected ; glucagon released by the pancreas ; glycogen converted to glucose by the liver ;	3
7(b)(i)	if blood glucose concentration, varies / increases / decreases, from normal ; cause steps to be taken to return blood glucose concentration to normal ;	2
7(b)(ii)	temperature control ;	1

Question	Answer	Marks
8(a)	making, lime / calcium oxide ; neutralisation of, acidic industrial waste / acidic soil ; used in blast furnace / for iron extraction ; AVP ;	max 2
8(b)(i)	12.5 ;	1
8(b)(ii)	$(75.0 - 72.5) \div 12.5 = 0.20$ (g / min) ;	1
8(b)(iii)	(rate increases) particles move more quickly / kinetic energy of particles increases ; which increases collision frequency / increases the chance of successful collision / more particles with activation energy ;	2

Question	Answer	Marks
8(c)(i)	aqueous / the substance is dissolved in water / is in water solution AND liquid / the substance is a liquid ;	1
8(c)(ii)	step 1 calculate $M_r \text{ CaCO}_3$, $40 + 12 + (16 \times 3) = 100$; number of moles = $2.0 \div 100 = 0.02$; step 2 moles of carbon dioxide = 0.02 ; step 3 volume of carbon dioxide = $24 \times 0.02 = 0.48 \text{ (dm}^3 \text{)}$;	4

Question	Answer	Marks
9(a)(i)	lead ;	1
9(a)(ii)	${}_{92}^{234}\text{U} \longrightarrow {}_{90}^{230}\text{Th} + {}_2^4\text{He}$ thorium correct ; helium correct ;	2
9(b)(i)	iron ;	1
9(b)(ii)	copper ;	1
9(b)(iii)	$V_2 = V_1 \times N_2 / N_1$ or $6 \times 10 / 5$; = 12 (V) ;	2

Question	Answer	Marks
9(c)(i)	mass and volume ;	1
9(c)(ii)	latent heat of fusion is the <u>energy</u> needed ; to overcome forces of attraction between particles ;	2
9(c)(iii)	913 J are / amount of energy, needed to raise the temperature of 1 kg by 1 °C ;	1
9(c)(iv)	0.6 (Ω) ;	1

Question	Answer	Marks												
10(a)(i)	<table border="1"> <thead> <tr> <th>name of part</th> <th>letter in Fig 10.1</th> <th>function</th> </tr> </thead> <tbody> <tr> <td>anther</td> <td>E</td> <td>produces pollen / male gamete</td> </tr> <tr> <td>ovary</td> <td>A</td> <td>produces the female gamete (ovule)</td> </tr> <tr> <td>sepal</td> <td>B</td> <td>protect flower in bud / AW</td> </tr> </tbody> </table> <p>1 row correct ; 2 rows correct ; 3 rows correct ;</p>	name of part	letter in Fig 10.1	function	anther	E	produces pollen / male gamete	ovary	A	produces the female gamete (ovule)	sepal	B	protect flower in bud / AW	3
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sepal	B	protect flower in bud / AW												
10(a)(ii)	smaller / absent / dull-coloured ;	1												
10(b)(i)	attached to, fur / hair ; eaten by animals and egested in faeces / droppings ; AVP ;	max 2												
10(b)(ii)	less competition / more space / more nutrients / more water / more sunlight ;	1												
10(c)	oxygen circled ;	1												

Question	Answer	Marks
11(a)	addition ; condensation ;	2
11(b)	Alkanes P Q S U ; Alkenes R T ; produce ethanol R ; produce ethane R ; combustion P Q R S T U / all of them ;	5
11(c)(i)	(acid or alkaline) hydrolysis ;	1
11(c)(ii)	amino acids ;	1

Question	Answer	Marks
12(a)(i)	$R = R_1 \times R_2 / R_1 + R_2$ or $16 \times 8 / 16 + 8$; 5.3(3) (Ω) ;	2
12(a)(ii)	current = voltage / resistance or 9 / 8 OR 1.1(25) (A) ; power = voltage \times current or 9×1.125 ; = 10(.125) ; Watts / W ;	4
12(b)(i)	conduction ;	1
12(b)(ii)	convection AND radiation ;	1
12(c)(i)	2.22×10^5 (Pa) ;	1
12(c)(ii)	$P_1 = (P_2 \times V_2) / V_1$ or $(2.22 \times 10^5 \times 1441) / 3168$; = 1.01×10^5 (N / m ²) ;	2

Question	Answer	Marks
13(a)(i)	nuclear ; cells ; chromosomes ;	3
13(a)(ii)	growth ; repair (of damaged tissue) ; replacement (of worn out cells) ; asexual reproduction ;	max 2
13(b)	are gametes ticked are haploid cells ticked contain unpaired chromosomes ticked 1 or 2 correct ; 3 correct ;	2