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**CO-ORDINATED SCIENCES**

**0654/43**

Paper 4 Theory (Extended)

**May/June 2018**

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.

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This document consists of **14** 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.

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
1(a)(i)	smaller / less area ; regular / circular shape ;	<b>2</b>
1(a)(ii)	(blood) is under high pressure ;	<b>1</b>
1(a)(iii)	valve ; prevents backflow / blood going wrong way ;	<b>2</b>
1(b)(i)	person C (no mark) oldest / smoker / (very) overweight ;	<b>1</b>
1(b)(ii)	family history / genetic factors ; stress ; gender ;	<b>max 2</b>
1(b)(iii)	lose weight ; exercise ;	<b>2</b>

Question	Answer	Marks
2(a)(i)	transition ;	1
2(a)(ii)	high density ; high melting point ; forms coloured compounds ; reference to catalysis ;	max 2
2(b)(i)	chlorine / $Cl_2$ ; only one type of atom / found in Periodic Table ;	2
2(b)(ii)	$Cu^+$ ; reference to ionic charge balance / $Cl$ has gained one electron so $Cu$ must have lost one electron ;	2
2(c)(i)	aqueous / water solution and solid ;	1
2(c)(ii)	dark / brown / pink layer forms on (grey) zinc / blue colour of copper ion solution fades / temperature of solution increases / loss of zinc ;	1
2(c)(iii)	zinc is more reactive than copper ;	1
2(c)(iv)	oxidised – $Zn$ and reduced – $Cu^{2+}$ ; $Zn$ (atom) loses electrons and $Cu^{2+}$ (ion) / copper gains electrons ;	2

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
3(a)(i)	weight = 480 (N) ;	<b>1</b>
3(a)(ii)	acceleration = force / mass or 600 / 300 ; = 2 ; m / s <sup>2</sup> ;	<b>3</b>
3(b)(i)	wave speed = frequency × wavelength ; 90 300 000 × 3.32 ; (m / s)	<b>2</b>
3(b)(ii)	time = distance / speed or 400 000 / 300 000 or 400 000 000 / 300 000 000 ; = 1.3 (s) ;	<b>2</b>
3(b)(iii)	radio waves in right hand box ;	<b>1</b>
3(b)(iv)	sound waves need a medium / air OR space is a vacuum ;	<b>1</b>

Question	Answer	Marks									
4(a)(i)	traps <u>light energy</u> ; converts it to <u>chemical energy</u> ; for formation of / producing carbohydrates ;	3									
4(a)(ii)	$6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$  left-hand side correct ; right-hand side correct ;	2									
4(b)	<table border="1"> <thead> <tr> <th>mineral ion</th> <th>function</th> <th>effect of deficiency</th> </tr> </thead> <tbody> <tr> <td>magnesium ;</td> <td>chlorophyll synthesis / component of chlorophyll ;</td> <td>yellowing of leaves</td> </tr> <tr> <td>nitrate ;</td> <td>protein synthesis</td> <td>stunted / poor, growth ;</td> </tr> </tbody> </table>	mineral ion	function	effect of deficiency	magnesium ;	chlorophyll synthesis / component of chlorophyll ;	yellowing of leaves	nitrate ;	protein synthesis	stunted / poor, growth ;	4
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magnesium ;	chlorophyll synthesis / component of chlorophyll ;	yellowing of leaves									
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Question	Answer	Marks
5(a)(i)	blue / purple ;	1
5(a)(ii)	$2\text{Li} + 2\text{H}_2\text{O} \rightarrow 2\text{LiOH} + \text{H}_2$  correct formulae ; correct balancing ;	2
5(b)(i)	ions / charged particles must be able to move / migrate ;	1
5(b)(ii)	cathode / negative electrode because opposite charges attract / Li ions positive, cathode negative ;	1
5(b)(iii)	ions gain electrons ;	2

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
6(a)	same magnitudes but opposite directions ;	<b>1</b>
6(b)(i)	work = force $\times$ distance or $12\,000 \times 2000$ ; = 24 000 000 (J) ;	<b>2</b>
6(b)(ii)	power = work / time or $24\,000\,000 / 120$ ; = 200 000 (W) ;	<b>2</b>
6(c)	water molecules have more energy / move faster ; more molecules have enough energy to escape/overcome attractive forces ;	<b>2</b>



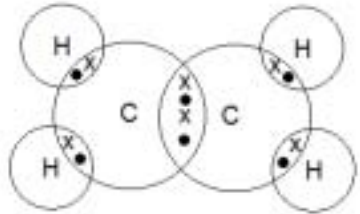
Question	Answer	Marks										
7(a)	<b>X</b> labelled to placenta ;	<b>1</b>										
7(b)	<table border="0" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; width: 50%;"><b>part</b></th> <th style="text-align: left; width: 50%;"><b>function</b></th> </tr> </thead> <tbody> <tr> <td style="border: 1px solid black; padding: 5px;">amniotic fluid</td> <td style="border: 1px solid black; padding: 5px;">transports nutrients and waste between fetus and mother</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">amniotic sac</td> <td style="border: 1px solid black; padding: 5px;">keeps fetus in place during pregnancy</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">cervix</td> <td style="border: 1px solid black; padding: 5px;">contains amniotic fluid</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">umbilical cord</td> <td style="border: 1px solid black; padding: 5px;">protects fetus from bumps and knocks</td> </tr> </tbody> </table> <p>1 correct ;                  2/3 correct ;                  4 correct ;</p>	<b>part</b>	<b>function</b>	amniotic fluid	transports nutrients and waste between fetus and mother	amniotic sac	keeps fetus in place during pregnancy	cervix	contains amniotic fluid	umbilical cord	protects fetus from bumps and knocks	<b>3</b>
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7(c)	large surface area ; good blood supply ; thin membrane ; moist ;	<b>max 2</b>										

Question	Answer			Marks																		
7(d)	<table border="1"> <thead> <tr> <th>substance</th> <th>pass from mother to fetus</th> <th>pass from fetus to mother</th> </tr> </thead> <tbody> <tr> <td>amino acids</td> <td>✓</td> <td></td> </tr> <tr> <td>carbon dioxide</td> <td></td> <td>✓</td> </tr> <tr> <td>glucose</td> <td>✓</td> <td></td> </tr> <tr> <td>oxygen</td> <td>✓</td> <td></td> </tr> <tr> <td>urea</td> <td></td> <td>✓</td> </tr> </tbody> </table>	substance	pass from mother to fetus	pass from fetus to mother	amino acids	✓		carbon dioxide		✓	glucose	✓		oxygen	✓		urea		✓			2
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	3 correct ; 5 correct ;																					

Question	Answer	Marks
8(a)(i)	alloy ;	1
8(a)(ii)	strength / malleability / conductivity / ductility / sonority / density / etc. ;	1
8(a)(iii)	reference to sacrificial / zinc corrodes in preference to iron ; because zinc is more reactive than iron ;	2
8(b)	<u>step 1</u> $13.0 \div 65 = 0.2$ ;  <u>step 2</u> $0.4 \times 0.2 = 0.08$ ;  <u>step 3</u> (not enough acid) would need (at least) 0.2 moles of acid / the idea of 1:1 reacting ratio ;	3
8(c)	add solution of (acidified) barium ions / barium chloride or nitrate ; white precipitate ;	2

Question	Answer	Marks
9(a)(i)	${}_{13}^{28}\text{Al} \rightarrow {}_{14}^{28}\text{Si} + {}_{-1}^0\beta$ ${}_{-1}^0\beta$ ; ${}_{14}\text{Si}$ ; ${}^{28}$ ;	<b>3</b>
9(a)(ii)	(one of 2 or more forms of an element which have) atoms with the same proton number but different neutron number / same number of protons but different number of neutrons ;	<b>1</b>
9(a)(iii)	3 half-lives ; 405 (seconds) ;	<b>2</b>
9(b)	kinetic energy / speed of atoms does not increase ; latent heat of vaporisation is heat energy required, for atoms to separate / for change of state ; energy is required to overcome force between atoms / energy required to do work separating the atoms ;	<b>max2</b>
9(c)(i)	does not change increases decreases  1 / 2 correct ; 3 correct ;	<b>2</b>
9(c)(ii)	SHC = energy/mass $\times$ $\Delta T$ or $40\,000 / 2 \times 21$ ; $950 \text{ (J / kg } ^\circ\text{C)}$ ;	<b>2</b>

Question	Answer	Marks
10(a)(i)	50 ;	1
10(a)(ii)	45 ;	1
10(b)(i)	(produces) cells with haploid nucleus / sperm and eggs ;	1
10(b)(ii)	<i>advantage</i> produces (genetic) variation ;	2

Question	Answer	Marks
11(a)	ammonia ; calcium oxide ; chlorine ; gasoline ;	4
11(b)(i)	high temperature / high pressure ;	1
11(b)(ii)	bromine solution is brown / yellow ; alkene decolourises bromine ; ref to unsaturation / double bond ;	3
11(b)(iii)	 <p>4 electrons showing double bond ; single bonds correct and no extra electrons anywhere ;</p>	2

Question	Answer	Marks
11(b)(iv)	ethane / $C_2H_6$ / diagram ; ethanol / $C_2H_6O$ / diagram ; dibromoethane / $C_2H_4Br_2$ / diagram ; poly(ethene) / $(C_2H_4)_n$ / diagram ;	max 2

Question	Answer	Marks
12(a)(i)	$R = R_1 \times R_2 / R_1 + R_2$ or $R = 12 \times 6 / 12 + 6$ or $1/R = 1/R_1 + 1/R_2$ or $1/R = 1/12 + 1/6$ ; 4.0 ( $\Omega$ ) ;	2
12(a)(ii)	$I = V / R$ or $9.0 / 12$ or 0.75 (A) ; $P = VI$ or $9.0 \times 0.75$ ; = 6.75 (W) ;	3
12(b)	two <u>straight</u> lines drawn at correct angles ; angle of incidence and angle of reflection correctly labelled ;	2
12(c)(i)	electromotive force ;	1
12(c)(ii)	stronger magnet ; spin magnet faster / pedal faster / owtte ; more turns on coil ;	max 1
12(d)(i)	distance between two adjacent compressions / two rarefactions shown ;	1
12(d)(ii)	Increases ;	1

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
13(a)(i)	<u>auxin</u> ;	<b>1</b>
13(a)(ii)	(auxin) accumulates on shady side ; causes cell elongation ; faster growth on shady side ;	<b>max 2</b>
13(b)	no growth / no change ; auxin produced in tip (of shoot) ;	<b>2</b>
13(c)(i)	environment ; responses ;	<b>2</b>
13(c)(ii)	growth circled ;	<b>1</b>