



CO-ORDINATED SCIENCES

0654/42

Paper 4 Theory (Extended)

October/November 2017

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.

Cambridge International is publishing the mark schemes for the October/November 2017 series for most Cambridge IGCSE[®], Cambridge International A and AS Level components and some Cambridge O Level components.

Question	Answer	Marks
1(a)(i)	oxygen transport ;	1
1(a)(ii)	no nucleus ; biconcave shape ; A large surface area (contains) haemoglobin ;	max 1
1(b)	<i>Accept any two of the following:</i> plasma platelets white blood cells ;	1
1(c)(i)	water leaves the red blood cell ; by osmosis ; water moves, from high to low water potential / down a water potential gradient ;	3
1(c)(ii)	red blood cell swells / bursts ; due to water entering the red blood cell ;	2

Question	Answer	Marks
2(a)(i)	lithium sodium potassium ; potassium iron copper ;	2
2(a)(ii)	potassium / K sodium / Na lithium / Li iron / Fe copper / Cu iron and copper in correct positions ; alkali metals in correct order relative to each other ;	2
2(b)(i)	hydrogen ;	1

Question	Answer	Marks
2(b)(ii)	(lithium hydroxide +) sulfuric (acid) ; → (lithium sulfate +) water LHS correct ; RHS correct ;	2
2(c)(i)	solution turns orange ;	1
2(c)(ii)	$Cl_2 + 2NaBr \rightarrow 2NaCl + Br_2$ correct formulae ; correctly balanced ;	2

Question	Answer	Marks
3(a)(i)	electrical to sound ;	1
3(a)(ii)	lots of fins – large surface area or large surface area – <u>more</u> , conduction / convection / radiation / transfer, of heat / energy ; black fins – black is a <u>good</u> emitter of radiation ; metal fins – metal is a <u>good</u> conductor of heat ;	max 2
3(b)(i)	decay is a random process / ref to background radiation ;	1
3(b)(ii)	$\begin{array}{c} 90 \\ Y \\ 39 \end{array}$ mass number correct ; atomic number correct ; $\begin{array}{c} 0 \\ e \\ -1 \end{array}$ both numbers correct ;	3
3(c)(i)	change in, speed / direction, of motion ;	1

Question	Answer	Marks
3(c)(ii)	133 N ;	1
3(c)(iii)	the force needed to extend a spring is directly proportional to the extension / elastic limit not exceeded ;	1

Question	Answer	Marks
4(a)	resistance increases over time ; resistance, plateaus / levels off, between 1992–1996 / from 2000 ; correct data quote ;	max 2
4(b)	change in gene / chromosome ;	1
4(c)	antibiotics will kill bacteria with no resistance ; resistant bacteria survive and reproduce ; pass on resistance to their offspring ; ref to natural selection ;	max 3

Question	Answer	Marks
5(a)(i)	<i>label to the monatomic particle</i> Group VIII atoms, are inert / do not need to bond / have complete outer shells ;	1
5(a)(ii)	<i>compound labelled</i> compounds contain different <u>types</u> of atom bonded together ;	1
5(b)	magnesium atom transfers electrons to sulfur atom ; <i>idea of two electrons</i> ; ionic bonding / ions of opposite charge attract ;	3
5(c)(i)	electrolysis ;	1
5(c)(ii)	it gains electrons ; each <u>ion</u> gains three electrons / is discharged ;	2

Question	Answer	Marks
5(c)(iii)	carbon monoxide ;	1

Question	Answer	Marks
6(a)(i)	2500 MHz ;	1
6(a)(ii)	0.9 kW ;	1
6(b)	lower wavelength same speed ;	1
6(c)(i)	water molecules gain kinetic energy / move faster ;	1
6(c)(ii)	latent heat of vaporisation / energy used to increase potential energy of the molecules ; to break bonds between molecules / to overcome attractive forces between molecules ; no change in kinetic energy so no increase in temperature ;	max 2

Question	Answer	Marks
7(a)	increased amplitude / bigger peaks ; increased frequency / peaks closer together ;	2
7(b)	increased, depth / frequency of breathing ; to gain / absorb, more oxygen ; for more respiration ;	max 2
7(c)	<i>increases</i> to transport more oxygen / glucose to respiring muscles / cells ; for more respiration ;	2
7(d)(i)	anaerobic respiration ; lactic acid produced ;	2
7(d)(ii)	(oxygen needed) to repay oxygen debt ;	1

Question	Answer	Marks
8(a)	potassium oxide – alkaline calcium oxide – alkaline carbon dioxide – acidic nitrogen dioxide – acidic 2 or 3 correct ; 4 correct ;	2
8(b)(i)	decreases ;	1
8(b)(ii)	rate of reaction, initially constant / steady ; then reaction rate decreases / eventually becomes zero ;	2
8(b)(iii)	line is higher than the first line ; levels off at the same value of volume ;	2
8(c)	moles of zinc = $2.6 \div 65 = 0.04$; moles of hydrogen = 0.04 ; volume of hydrogen = $0.04 \times 24 = 0.96 \text{ (dm}^3\text{)}$; $0.96 \text{ dm}^3 = 960 \text{ cm}^3$;	4

Question	Answer	Marks
9(a)	fastest moving / most energetic molecules escape ; remainder are slower / have less energy ; energy used taken from surroundings / molecules gain energy from body ;	3
9(b)	first 90° reflection correct ; second 90° reflection correct ;	2
9(c)	rotation of coil, cuts magnetic field / experiences changing magnetic field ; induces an emf ; current flows through lamp / pd across lamp causes lamp to light ;	3
9(d)(i)	frequency = 25 (Hz) ;	1

Question	Answer	Marks
9(d)(ii)	amplitude = 5 (V) ;	1
9(e)(i)	parallel ;	1
9(e)(ii)	$I = V / R$ or $12 / 5$; 2.4 (A) ;	2
9(e)(iii)	$R_T = \frac{R_1 R_2}{R_1 + R_2}$ or $R = 10 / 3 (\Omega)$; $= 3.3 (\Omega)$;	2

Question	Answer	Marks
10(a)(i)	cornea ;	1
10(a)(ii)	label pointing to iris ;	1
10(b)(i)	circular muscle in iris contracts / radial muscles in iris relax ; pupil size decreases / iris size increases ;	2
10(b)(ii)	automatic / requires no conscious thought ;	1
10(b)(iii)	retina ; (unconscious part of) brain ;	2

Question	Answer	Marks												
10(c)	<table border="1"> <tr> <td><i>feature</i></td> <td><i>hormonal control</i></td> <td><i>nervous control</i></td> </tr> <tr> <td><i>method of transmission</i></td> <td>via blood</td> <td><i>along neurones</i></td> </tr> <tr> <td><i>speed of transmission</i></td> <td>slow</td> <td>fast</td> </tr> <tr> <td><i>length of effects</i></td> <td>long-lasting</td> <td>short-term</td> </tr> </table> <p>1 row correct ; 2 rows correct ; 3 rows correct ;</p>	<i>feature</i>	<i>hormonal control</i>	<i>nervous control</i>	<i>method of transmission</i>	via blood	<i>along neurones</i>	<i>speed of transmission</i>	slow	fast	<i>length of effects</i>	long-lasting	short-term	3
<i>feature</i>	<i>hormonal control</i>	<i>nervous control</i>												
<i>method of transmission</i>	via blood	<i>along neurones</i>												
<i>speed of transmission</i>	slow	fast												
<i>length of effects</i>	long-lasting	short-term												

Question	Answer	Marks
11(a)(i)	propane ;	1
11(a)(ii)	$ \begin{array}{ccccc} & \text{H} & & \text{H} & & \text{H} \\ & & & & & \\ \text{H} & - \text{C} & - & \text{C} & = & \text{C} \\ & & & & & \\ & \text{H} & & & & \text{H} \end{array} $ <p>1 single bond and 1 double bond between the carbons ; all else correct ;</p>	2
11(b)(i)	nitrogen and argon from the air taken in with the fuel ; nitrogen and argon, are inert / do not react / do not burn / are unaffected ;	2

Question	Answer	Marks
11(b)(ii)	<i>two from</i> carbon dioxide carbon monoxide water vapour ;	1
11(c)(i)	cobalt oxide / CoO and copper oxide / CuO ; reference to transition metals ;	2
11(c)(ii)	it has a, giant / lattice, structure or large number of bonds / it is a macromolecule ; large amount of thermal <u>energy</u> required to break the bonds ;	2

Question	Answer	Marks
12(a)(i)	friction / description of friction ; transfer of electrons ;	2
12(a)(ii)	power = energy / time or 0.03 / 0.00036 ; = 83.3 (W) ;	2
12(a)(iii)	current = power / voltage or 83.3 / 12000 ; = 0.0069 (A) ;	2
12(b)	C then A ;	1
12(c)	use a magnet – aluminium is not magnetic steel is magnetic ;	1
12(d)	speed – has magnitude only / scalar or velocity – has magnitude and direction / vector ;	1

Question	Answer	Marks
13(a)	X respiration ;	1
13(b)	decomposer ;	1
13(c)	solar radiation enters atmosphere ; reflected from Earth's surface / atmosphere (as infrared) / Earth absorbs shorter wavelengths and warms up and gives out longer wavelengths (IR) / radiation (absorbed) and reradiated from Earth's surface / owtte ; carbon dioxide, absorbs radiation / prevents radiation escaping / less radiation emitted than absorbed ; ref to the (enhanced) greenhouse effect / carbon dioxide is a greenhouse gas ;	max 3
13(d)	soil erosion ; loss of habitat ; species extinction ; flooding ;	max 2