



CO-ORDINATED SCIENCES

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Paper 4 Theory (Extended)

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MARK SCHEME

Maximum Mark: 120

Published

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This document consists of **10** printed pages.

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)	${}_{39}^{90}\text{Y}$ ${}_{-1}^0\text{e}$ mass number correct ; atomic number correct ; 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"> <tbody> <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> </tbody> </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
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Question	Answer	Marks
11(a)(i)	propane ;	1
11(a)(ii)	$ \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \\ \text{H} - \text{C} - \text{C} = \text{C} \\ \quad \quad \\ \text{H} \quad \quad \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