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Paper 4 Theory (Extended) **October/November 2017**

MARK SCHEME

Maximum Mark: 120

Published

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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)	*Accept any **two** of the following:* 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 → 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 – more, conduction / convection / radiation / transfer, of heat / energy ; black fins – black is a good emitter of radiation ; metal fins – metal is a good conductor of heat ;	**max 2**
3(b)(i)	decay is a random process / ref to background radiation ;	**1**
3(b)(ii)	$^{90}_{39}Y$ mass number correct ; atomic number correct ; $^{0}_{-1}e$ 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)	*label to the monatomic particle* Group VIII atoms, are inert / do not need to bond / have complete outer shells ;	**1**
5(a)(ii)	*compound labelled* compounds contain different <u>types</u> of atom bonded together ;	**1**
5(b)	magnesium atom transfers electrons to sulfur atom ; *idea of* two electrons ; 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)	*increases* 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**

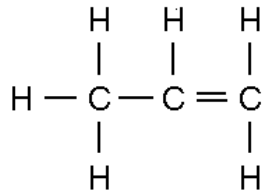
Question	Answer	Marks
8(a)	potassium oxide – alkaline calcium oxide – alkaline carbon dioxide – acidic nitrogen dioxide – acidic 2 or 3 correct ; 4 correct ;	**2**
8(b)(i)	decreases ;	**1**
8(b)(ii)	rate of reaction, initially constant / steady ; then reaction rate decreases / eventually becomes zero ;	**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 ÷ 65 = 0.04 ; moles of hydrogen = 0.04 ; volume of hydrogen = 0.04 × 24 = 0.96 (dm^3) ; 0.96 dm^3 = 960 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 (Ω) ; = 3.3 (Ω) ;	**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><tr><td>*feature*</td><td>*hormonal control*</td><td>*nervous control*</td></tr><tr><td>*method of transmission*</td><td>**via blood**</td><td>*along neurones*</td></tr><tr><td>*speed of transmission*</td><td>**slow**</td><td>**fast**</td></tr><tr><td>*length of effects*</td><td>**long-lasting**</td><td>**short-term**</td></tr></table> 1 row correct ; 2 rows correct ; 3 rows correct ;	**3**

Question	Answer	Marks
11(a)(i)	propane ;	**1**
11(a)(ii)	 1 single bond and 1 double bond between the carbons ; all else correct ;	**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)	*two from* 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**