Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CO-ORDINATED SCIENCES **0654/33**

Paper 3 Extended Theory **October/November 2016**

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 will not enter into discussions about these mark schemes.

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Question	Answer	Marks
1(a)	decomposer ;	1
1(b)	decay releases (named) nutrients ;	1
1(c)	no light ; prevents photosynthesis ;	2
1(d)(i)	grass / seeds → mouse → owl correct organisms in order ; arrows orientated correctly ;	2
1(d)(ii)	energy losses at each stage ; due to respiration / heat / excretion / not all eaten ; less energy available to the owls ;	max 2
	Total:	8

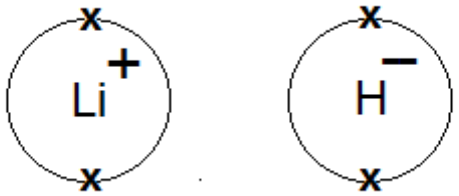
Question	Answer	Marks
2(a)(i)	any noble gas / carbon dioxide / water vapour ; [allow other trace gases]	1
2(a)(ii)	idea of incomplete combustion ; of fuel / named fuel ; which is a hydrocarbon ;	3
2(a)(iii)	6 / three pairs ;	1
2(b)(i)	$3O_2 \rightarrow 2O_3$ formula of oxygen ; balanced ;	2

Question	Answer	Marks
2(b)(ii)	sterilisation / kills (harmful) microorganisms/bacteria ;	1
	Total:	8

Question	Answer	Marks
3(a)(i)	(½ × 10 × 36 + 120 × 36 + ½ × 20 × 36) = 4860 (m) ;	1
3(a)(ii)	area under graph ;	1
3(a)(iii)	correct values shown from graph ; =36 / 10 (= 3.6 m / s^2) ;	2
3(b)(i)	(force =) mass × acceleration / ma / 7 × 10^4 × 3.6 ; 2.52 × 10^5 ; N ;	3
3(b)(ii)	(KE =) ½ mv^2 / ½ × 7 × 10^4 × 36 × 36 ; 4.5 × 10^7 (J) ;	2
3(c)(i)	(coil) spins / turns ; (current produces) magnetic field around coil / conductor / wire ; magnetic fields interact ; force on, coil / conductor / wire, carrying current in opposite directions ; force on opposite sides in opposite directions ;	max 3
3(c)(ii)	reverses current (every half turn) ; keeps the coil spinning (in the same direction) ;	2
	Total:	14

Question	Answer	Marks
4(a)	capillary ; lacteal ; epithelium ;	3
4(b)	increased surface area ; for absorption ;	2
4(c)(i)	nutrients absorbed less (efficiently) / loss of weight / AVP ;	1
4(c)(ii)	eat small amounts frequently / eat easily digested or absorbed foods / eat nutrient-dense foods ;	1
	Total:	7

Question	Answer	Marks
5(a)(i)	sodium may explode / too reactive (to be safe) ; sulfur does not react ;	2
5(a)(ii)	increases ; acid concentration decreases / acid is used up / solution becomes less acidic ;	2
5(b)(i)	cobalt chloride paper ; changes (from blue) to pink ; OR anhydrous copper sulfate ; changes (from white) to blue ;	2
5(b)(ii)	(smaller) burning of hydrogen is exothermic ; chemical potential energy transferred from reactants as thermal energy (to surroundings) ;	max 2

Question	Answer	Marks
5(c)(i)	 correct electron configurations ; correct charges ;	2
5(c)(ii)	(M_r LiH =) 8 ; moles of LiH = 100 ÷ 8 = 12.5 ; moles of hydrogen = 12.5 ÷ 2 = 6.25 ; calculate volume of hydrogen = 6.25 × 24 = 150 (dm^3) ;	4
	Total:	14

Question	Answer	Marks
6(a)(i)	temperature change = 80 °C ; (energy =) mass × SHC × change in temperature / (mC∆T / 5000 × 4200 × 80 ; 1.68 × 10^9 (J) ;	3
6(a)(ii)	latent heat (of vaporisation) / energy required to separate molecules from each other ;	1
6(a)(iii)	(water is) **B** most particles are touching and random arrangement ; (steam is) **C** particles are spread out (and random arrangement) ;	2
6(b)	4 half-lives / 1 / 16 remains ; 0.0625 kg ;	2

Question	Answer	Marks
6(c)	electric field – alpha deflected gamma not ; magnetic field – alpha deflected gamma not ; alpha is charged / gamma is not charged / is a wave ;	**3**
	Total:	**11**

Question	Mark Scheme Details	Marks
7(a)	amylase ;	**1**
7(b)	energy source ; can be converted to alcohol ; provides sweetness / flavour ;	**max 2**
7(c)(i)	<u>anaerobic</u> respiration ;	**1**
7(c)(ii)	glucose → alcohol + carbon dioxide ;	**1**
7(d)	(rate of yeast growth increases) increased respiration ; ref to oxygen / aerobic respiration ; (aerobic respiration releases) more energy (for growth) ; rate of beer / alcohol production increases because more yeast ; AVP ;	**max 3**
	Total:	**8**

Question	Answer	Marks
8(a)	butene ; alkenes ;	2
8(b)(i)	as M_r increases the boiling point increases ; heavier / larger molecules: have greater intermolecular (attractive) forces / require a larger amount of (thermal / heat) energy to separate molecules ;	2
8(b)(ii)	72 ; each member is 14 units greater than the previous so 58 + 14 = 72 ;	2
8(c)(i)	(addition) polymerisation ; poly(ethene) ;	2
8(c)(ii)	at least two carbon atoms with correct number of hydrogen atoms and only single bonds ; clear indication of continuation ;	2
	Total:	10

Question	Answer	Marks
9(a)	kinetic energy of particles increases / particles move faster ; more frequent collisions with tyre / hit tyre, with more force / harder ;	2
9(b)	use of $1/R_T = 1/R_1 + 1/R_2$ OR statement that combined resistance of 2 equal resistances in parallel is half one of the resistances ; $R_T = 2.5/2 = 1.25$ (Ω) ;	2
9(c)	relay uses a low current to switch on a high current ; safety / protection of low current, circuits / switches / cables ;	2
9(d)(i)	(**E** no mark) CSA of **E** is greater ;	1

Question	Answer	Marks
9(d)(ii)	(**D** no mark) nichrome (has greatest resistance for same length and CSA) ; greater length and least CSA ;	**2**
	Total:	**9**

Question	Answer	Marks
10(a)	light ; high surface area (to volume ratio) ;	**max 1**
10(b)(i)	seed ;	**1**
10(b)(ii)	anchorage / holds the seed still (for germination) / AW ;	**1**
10(c)(i)	no, because not correlated / owtte ;	**1**
10(c)(ii)	mass / weight / size ;	**1**
10(d)	colonises new areas / reduces competition (within the species) / AVP ;	**1**
10(e)(i)	animals ; AVP ;	**max 1**
10(e)(ii)	matching adaptation ;	**1**
	Total:	**8**

Question	Answer	Marks
11(a)	**A** and **E** ;	**1**
11(b)(i)	sulfuric (acid) ; water ;	**2**
11(b)(ii)	zinc is more reactive (than copper) / zinc atoms form ions more easily (than copper) / zinc displaces copper ;	**1**
11(b)(iii)	(copper ions) gain electrons ;	**1**
11(c)(i)	**X** cathode and **Y** anode ;	**1**
11(c)(ii)	(mass of negative electrode increases – no mark) copper ions are attracted / move to the cathode ; copper ions, gain electrons / are discharged, at the cathode ; copper atoms are formed at the cathode ;	**max 2**
	Total:	**8**

Question	Answer	Marks
12(a)	$3.8 \times 10^{26} / 4.2 \times 10^{-12}$; $= 9 \times 10^{37}$;	**2**
12(b)	fission – nuclei split (but fusion nuclei join) ;	**1**
12(c)(i)	 ;	**1**
12(c)(ii)	gamma ;	**1**

Question	Answer	Marks
12(d)	sound needs a medium / particles to travel through/sound does not travel through a vacuum ;	1
	Total:	6

Question	Answer	Marks
13(a)	$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ correct formulae of reactants and products ; balanced equation ;	2
13(b)(i)	P = cuticle ; Q = palisade/mesophyll ; R = xylem ;	3
13(b)(ii)	arrow coming in through the lower epidermis/stoma ;	1
13(c)(i)	palisade cells ; many chloroplasts / cells near the top of the leaf ;	2
13(c)(ii)	converted to chemical energy ;	1
	Total:	9