Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CO-ORDINATED SCIENCES **0654/23**

Paper 2 Core 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.

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Question	Answer	Marks
1(a)(i)	for protein synthesis ;	1
1(a)(ii)	magnesium ; for chlorophyll ;	2
1(b)	carbon dioxide / water ;	1
1(c)	no light ; prevents photosynthesis ;	2
1(d)(i)	grass/seeds → mouse → owl ; ; (1 for correct organisms in order, 1 for arrows orientated correctly)	2
1(d)(ii)	owl and mouse ;	1
	Total:	9

Question	Answer	Marks
2(a)(i)	Nitrogen ; 78% ;	2
2(a)(ii)	(named) noble gas / CO_2 / water vapour ;	1
2(a)(iii)	formed inside vehicle engines / released by vehicles ; extra detail e.g. ref. to fuel combustion / incomplete combustion ;	2
2(b)	sterilisation / kills (harmful) microorganisms / bacteria ; ensure water is safe to drink / avoid risk of disease / owtte ;	2

Question	Answer	Marks
2(c)(i)	ClO_2 / O_2Cl symbols ; subscripts ;	2
2(c)(ii)	gas ; melting point and boiling point are below RT / at RT the compound has boiled/owtte ;	2
	Total:	11

Question	Answer	Marks
3(a)(i)	**A** at (0,0) and **B** at (150,0) ;	1
3(a)(ii)	36 (m / s) ;	1
3(a)(iii)	(distance) = speed × time or 36 × 120 ; = 4320 (m) ;	2
3(a)(iv)	changed into thermal energy ;	1
3(b)	from 20 Hz to 20 000 Hz ;	1
3(c)	rails expand when hot ; they could buckle / to prevent buckling (damage) ;	2
3(d)(i)	(mass) = density × volume or 8 × 512 000 ; = 4 096 000 (g) ;	2
3(d)(ii)	(length) = volume / area or 512 000 / 160 ; = 3200 (cm) ;	2

Question	Answer	Marks
3(d)(iii)	N / newton ;	1
	Total:	**13**

Question	Answer	Marks
4(a)(i)	insects ;	1
4(a)(ii)	pollen ;	1
4(a)(iii)	to attract insects / pollinators ;	1
4(b)(i)	water / oxygen ;	1
4(b)(ii)	95% ;	1
4(b)(iii)	rate of germination increases with temperature, then decreases ; optimum temperature for germination is (around) 20 °C ;	2
4(b)(iv)	affects enzyme action ;	1
	Total:	**8**

Question	Answer	Marks
5(a)	sodium may explode / too reactive be safe ; sulfur does not react with dilute acid ;	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)	reference to oxidation as addition of oxygen ; oxygen from the air combines with hydrogen (when water forms) ;	2
5(b)(iii)	water vapour condensing / cold metal plate increasing in temperature / hot water cooling / other correct ;	1
	Total:	7

Question	Answer	Marks
6(a)	water is turned into steam ; thermal to kinetic energy ; steam drives turbine / generator ; kinetic to electrical ;	4
6(b)(i)	photographic film radiation badge / dosimeter ;	1
6(b)(ii)	cancer / mutation / radiation burns ;	1
6(c)	alpha beta gamma (in that order) ;	1

Question	Answer	Marks
6(d)(i)	gamma in left hand box ;	1
6(d)(ii)	transverse waves ;	1
	Total:	**9**

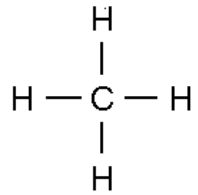
Question	Answer	Marks
7(a)(i)	female genotype = Gg ; gametes G, g, G, g ; offspring genotypes GG, Gg, (Gg), gg ; offspring phenotypes grey, grey, (grey), white ;	4
7(a)(ii)	probability = ¼ or 0.25 or 25% ;	1
7(b)(i)	dominant ;	1
7(b)(ii)	phenotype ;	1
7(b)(iii)	heterozygous ;	1
	Total:	**8**

Question	Answer	Marks
8(a)(i)	transition (series / metals) ;	1
8(a)(ii)	**A** ; **B** ;	2
8(b)(i)	step **2** filtration ; step **3** evaporation / crystallisation ;	2
8(b)(ii)	hydrochloric ; water ;	2
8(c)(i)	label line showing the solution ; (with or without zinc salt)	1
8(c)(ii)	zinc / carbon / graphite ;	1
8(c)(iii)	reference to the barrier that is formed ; (barrier) prevents air / oxygen and / or water from reacting with the steel ;	2
	Total:	11

Question	Answer	Marks
9(a)(i)	kinetic energy of particles increases / particles move faster ; more frequent collisions with tyre (wall) ;	2
9(a)(ii)	weight / force / area ;	1
9(b)(i)	L1 and L2 ;	1

Question	Answer	Marks
9(b)(ii)	1.5Ω ; combined resistance in parallel is less than the resistance of either of the individual resistors owtte ;	**2**
9(b)(iii)	I = V / R or 12 / 24 ; = 0.5 (A) ;	**2**
9(c)	use a magnet ; steel is magnetic and aluminium isn't / steel is attracted to magnet but aluminium not attracted ;	**2**
	Total:	**10**

Question	Answer	Marks
10(a)	oesophagus ; carries food to stomach ;	**2**
10(b)	amylase ; digests starch ;	**2**
10(c)	mouth opening labelled **I** ;	**1**
10(d)	mechanical digestion / AW ; increases surface area ; allows food to be swallowed ;	**max 2**
	Total:	**7**

Question	Answer	Marks
11(a)(i)	protons are positive and electrons are negative ; equal numbers of protons as electrons / the charges balance ;	**2**
11(a)(ii)	1 ;	**1**
11(b)(i)	hydrocarbon ;	**1**
11(b)(ii)	 one carbon atom shown ; All else correct ;	**2**
11(c)	<table><tr><td>It burns to form carbon dioxide and water.</td><td>✓</td></tr><tr><td>It is a saturated compound.</td><td>X</td></tr><tr><td>It is produced in industry by cracking.</td><td>✓</td></tr><tr><td>It turns orange bromine solution colourless.</td><td>✓</td></tr></table> [all correct two marks, 3 or 2 correct one mark] ;;	**2**

Question	Answer	Marks
11(d)(i)	(addition) polymerisation ; poly(ethene) / polyethene / polythene ;	2
11(d)(ii)	they join together into long chains ;	1
	Total:	11

Question	Answer	Marks
12(a)	radiation ;	1
12(b)(i)	wavelength labelled correctly ;	1
12(b)(ii)	amplitude labelled correctly ;	1
12(c)	ray shows refraction and dispersion ; red least violet most ;	2
12(d)	sound needs a medium / particles to travel through ;	1
12(e)(i)	principal focus / focal point ;	1
12(e)(ii)	enlarged and inverted ;	1
	Total:	8

Question	Answer	Marks
13(a)	carbon dioxide + water ; → glucose + oxygen ;	**2**
13(b)(i)	P = cuticle ; Q = palisade / mesophyll ; R = xylem ;	**3**
13(b)(ii)	carbon dioxide ;	**1**
13(c)	near the top of the leaf ; many chloroplasts ;	**2**
	Total:	**8**