



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

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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Page 2	Mark Scheme	Syllabus	Paper
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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

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Question	Answer	Marks
2(c)(i)	$\text{ClO}_2 / \text{O}_2\text{Cl}$ 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 \times 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 \times volume or $8 \times 512\,000$; = 4 096 000 (g) ;	2
3(d)(ii)	(length) = volume/area or $512\,000 / 160$; = 3200 (cm) ;	2

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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 <u>enzyme</u> action ;	1
	Total:	8

Page 5	Mark Scheme	Syllabus	Paper
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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

Page 6	Mark Scheme	Syllabus	Paper
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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 = $\frac{1}{4}$ or 0.25 or 25% ;	1
7(b)(i)	dominant ;	1
7(b)(ii)	phenotype ;	1
7(b)(iii)	heterozygous ;	1
	Total:	8

Page 7	Mark Scheme	Syllabus	Paper
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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)	<u>kinetic energy</u> 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

Page 8	Mark Scheme	Syllabus	Paper
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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

Page 9	Mark Scheme	Syllabus	Paper
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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)	$\begin{array}{c} \text{H} \\ \\ \text{H} - \text{C} - \text{H} \\ \\ \text{H} \end{array}$ one carbon atom shown ; All else correct ;	2								
11(c)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td>It burns to form carbon dioxide and water.</td> <td style="text-align: center;">✓</td> </tr> <tr> <td>It is a saturated compound.</td> <td style="text-align: center;">X</td> </tr> <tr> <td>It is produced in industry by cracking.</td> <td style="text-align: center;">✓</td> </tr> <tr> <td>It turns orange bromine solution colourless.</td> <td style="text-align: center;">✓</td> </tr> </tbody> </table> <p>[all correct two marks, 3 or 2 correct one mark] ;;</p>	It burns to form carbon dioxide and water.	✓	It is a saturated compound.	X	It is produced in industry by cracking.	✓	It turns orange bromine solution colourless.	✓	2
It burns to form carbon dioxide and water.	✓									
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It turns orange bromine solution colourless.	✓									

Page 10	Mark Scheme	Syllabus	Paper
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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

Page 11	Mark Scheme	Syllabus	Paper
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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