



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CO-ORDINATED SCIENCES

0654/32

Paper 3 Theory (Extended)

October/November 2016

MARK SCHEME

Maximum Mark: 120

Published

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Question	Answer	Marks
1(a)	diffusion / movement, of water ; from high to low water potential ; through a partially permeable membrane ;	3
1(b)	elongated / AW ; large surface area ; thin / permeable, (cell) wall ;	max 2
1(c)(i)	loses water / decrease in volume / becomes plasmolysed ; because seawater has a lower water potential ;	2
1(c)(ii)	wilt ; because receive less water from roots ;	2
1(d)(i)	carbon dioxide ;	1
1(d)(ii)	chlorophyll ;	1
	Total:	11

Question	Answer	Marks
2(a)(i)	outer electron shell is complete ; do not need to, gain / lose / share electrons ;	2
2(a)(ii)	highly reactive elements exist between magnesium and argon / examples given e.g. chlorine ;	1
2(b)(i)	1.2 (mol / dm ³) ; use of the proportionality between variables ;	2

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Question	Answer	Marks
2(b)(ii)	idea that there are more acid particles per volume ; at higher concentration the frequency of collision increases ;	2
	Total:	7

Question	Answer	Marks
3(a)	weight ;	1
3(b)	the extension of an elastic object is <u>directly</u> proportional to the force applied to it ;	1
3(c)(i)	38 m / s ;	1
3(c)(ii)	acceleration = change of speed/time or working ; = $38 / 4 = 9.5 \text{ m/s}^2$;	2
3(c)(iii)	area under graph or working ; $\frac{1}{2} \times 4 \times 38 + \frac{1}{2} \times 1 \times 38 = 95 \text{ m}$;	2
3(c)(iv)	KE = $\frac{1}{2}mv^2$ or working ; = $\frac{1}{2} \times 90 \times 38 \times 38 = 64\,980 \text{ J}$;	2
3(d)	man starts moving in opposite direction ;	1
	Total:	10

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Question	Answer	Marks
4(a)	X = bronchus ; Y = trachea ;	2
4(b)	less oxygen ; more carbon dioxide ; more water vapour ; warmer ;	max 3
4(c)(i)	61 – 19 = 42 minutes ;	1
4(c)(ii)	similar pattern curve rising from the existing line at 50 mins ; rises to higher peak ;	2
4(c)(iii)	combines with haemoglobin ; reduces oxygen carrying capacity of the blood ; less respiration / less energy released (for muscle contraction) ;	max 2
	Total:	10

Question	Answer	Marks
5(a)	aluminium ; iron ; chlorine / hydrogen ;	3
5(b)	decomposition ; endothermic ;	2
5(c)(i)	electrons are negatively charged and protons are positively charged / atoms contain equal numbers of protons and electrons ; calcium atom loses two electrons / calcium ion contains two more protons than electrons ; oxygen atom gains two electrons / oxide ion contains two fewer protons than electrons ;	3

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Question	Answer	Marks
5(c)(ii)	reference to charge balance ;	1
5(d)	STEP 1 (1000×0.95) = 950 (g) ; STEP 2 moles calcium carbonate ($950 \div 100$) = 9.5 moles calcium oxide = 9.5 ; STEP 3 ($40 + 16$) = 56 ; STEP 4 (56×9.5) = 532 (g) ;	4
	Total:	13

Question	Answer	Marks
6(a)	<i>copper or aluminium no mark</i> good heat conductor ; <i>plastic or wood no mark</i> good insulator ;	2
6(b)	particles closer together in liquid ; stronger forces in liquid ; particles move slower in liquid ;	3
6(c)	energy = mass \times SHC \times change in temperature / $E = mC\Delta T$ or working = $0.8 \times 4200 \times 70$; change in temperature = $90 - 20 = 70$ ($^{\circ}\text{C}$) ; = 235 200 (J) ;	3
	Total:	8

Page 6	Mark Scheme	Syllabus	Paper
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Question	Answer	Marks
7(a)(i)	homozygous ;	1
7(a)(ii)	heterozygous ;	1
7(a)(iii)	discontinuous (variation) ;	1
7(b)(i)	0.75/75% ;	1
7(b)(ii)	0.50/50% ;	1
7(c)	mutation ; spontaneous/random, change OR caused by, (named) ionising radiation / mutagens ;	2
	Total:	7

Question	Answer	Marks
8(a)	shared pair of electrons shown ; correct number of non-bonding electrons shown ;	2
8(b)	chloride ions move to the anode / ref to opposite charge attraction ; chloride ions are discharged / lose one electron ; chlorine atoms bond to form molecules ;	3
8(c)(i)	C no change in appearance / solution becomes (pale) green ; D solution becomes brown ;	2
8(c)(ii)	C chlorine less reactive than fluorine (so no reaction) ; D chlorine more reactive than iodine (so displaces it) ;	2
	Total:	9

Page 7	Mark Scheme	Syllabus	Paper
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Question	Answer	Marks
9(a)	<u>temperature</u> at which all of a liquid boils and turns into a gas/vapour ;	1
9(b)(i)	between X rays and visible light ;	1
9(b)(ii)	$300\,000 / 3 \times 10^5$ km/s ;	1
9(b)(iii)	$\alpha / \beta / \gamma$ / X-rays ;	1
9(c)	$P_1V_1 = P_2V_2$ or working ; $V_2 = 5 \times 10^4 \times 330 / 10^5 = 165$ cm ³ ;	2
9(d)(i)	principal focus correctly identified ;	1
9(d)(ii)	focal length correctly shown ;	1
	Total:	8

Question	Answer	Marks
10(a)	area 2, because has lowest pH ;	1
10(b)	area has, factories / traffic / burning of <u>fossil</u> fuels ;	1
10(c)	acidifies soil / rivers / lakes ; “burns” plant leaves ; kills fish ; erodes / corrodes, buildings ; AVP ;	max 2

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Question	Answer	Marks
10(d)	any two of: taxation of (use of) fossil fuels / fining excessive emissions ; encourage use of public transport ; use (named) alternative energy sources ; catalytic converters ; flue gas desulfurisation ; AVP ;;	max 2
	Total:	6

Question	Answer	Marks
11(a)(i)	petroleum / crude oil ;	1
11(a)(ii)	R at the top take-off point ;	1
11(a)(iii)	<i>diesel</i> molecules are on average the largest ; molecules have largest intermolecular forces ; so more thermal <u>energy</u> required to separate molecules ;	max 2
11(a)(iv)	carbon dioxide and water vapour ;	1
11(b)	<i>butane</i> X is saturated because it does not react with bromine / alkanes do not react quickly with bromine ; relates but– to four carbon atoms / prop– to three carbon atoms ;	2
11(c)(i)	$\text{CH}_4(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightarrow \text{CO}(\text{g}) + 3\text{H}_2(\text{g}) ; ; ;$	3
11(c)(ii)	nitrogen + hydrogen \rightarrow ammonia ;	1
	Total:	11

Page 9	Mark Scheme	Syllabus	Paper
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Question	Answer	Marks
12(a)(i)	0.13 A ;	1
12(a)(ii)	R = V/I or working ; = 12/0.13 = 92/92.3 ; Ω ;	3
12(a)(iii)	as temperature increases current increases ;	1
12(a)(iv)	as temperature increases resistance decreases ;	1
12(b)(i)	X = slip ring Y = coil Z = magnet ;;	2
12(b)(ii)	sine curve ; approx. equal wavelengths and amplitudes ;	2
12(c)(i)	f = v/ λ or working ; = 330/0.7 = 471 Hz ;	2
12(c)(ii)	one wavelength correctly shown ;	1
12(c)(iii)	compressions / rarefactions, closer together ;	1
	Total:	14

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Question	Answer	Marks
13(a)(i)	iris correctly labelled ;	1
13(a)(ii)	retina correctly labelled ;	1
13(b)(i)	becomes thinner / under tension ;	1
13(b)(ii)	relaxes ;	1
13(b)(iii)	under tension / taut / stretched ;	1
13(c)	less able to focus on near objects ;	1
	Total:	6