Cambridge International AS Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary Level

PHYSICAL SCIENCE **8780/03**

Paper 3 Structured Questions **October/November 2017**

MARK SCHEME

Maximum Mark: 80

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.

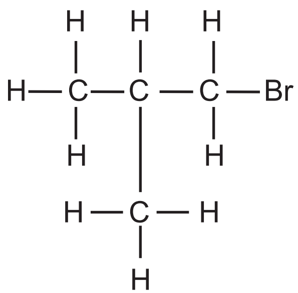
Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2017 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

Question	Answer	Marks
1(a)(i)	2	**1**
1(a)(ii)	4.2	**1**
1(b)	(% uncertainty =) 1.5 + 4.2 + 3.3 / 9.0	**1**
	(actual uncertainty = 9 × 20800 ÷ 100) 1872 / 1900	**1**

Question	Answer	Marks
2(a)	iodine has more electrons than chlorine	**1**
	strong(er) induced dipole–induced dipole forces / van der Waals' forces (in iodine)	**1**
2(b)	increasing **distance** of (outer) electron(s) from nucleus OR increasing **distance** of outer / valence shell from nucleus OR increased **shielding** / screening (from inner shells)	**1**
	reduces **attraction** / decreasing nuclear attraction / weaker attraction between nucleus and (outer) electron(s)	**1**
2(c)	*reagents:* chlorine (water) + any solution containing I^- ions	**1**
	equation: $Cl_2 + 2I^- \rightarrow I_2 + 2Cl^-$ $Cl_2 + 2NaI \rightarrow I_2 + 2NaCl$ $Cl_2 + 2KI \rightarrow I_2 + 2KCl$	**1**
	observation: formation of a red solution / dark grey brown / black solution or ppt	**1**

Question	Answer	Marks
3(a)	(work =) force × displacement / distance in the direction of the force	**1**
3(b)(i)	2.84 / 2.835 (J)	**1**
3(b)(ii)	2.84 (J)	**1**
3(c)(i)	600	**1**
	W / Js^{-1}	**1**
3(c)(ii)	(% power falling on panels converted input power = 1400 × 10 / 100 =) 140 (Wm^{-2})	**1**
	(power converted to useful power output =) 140 × 24 / 100 / 33.6	**1**
	(area = 600 / 33.6 =) 17.8 (m^2)	**1**

Question	Answer	Marks
4(a)(i)	2-bromo-2-methylpropane	**1**
4(a)(ii)	$Br_2 \rightarrow 2Br\bullet$	**1**
4(a)(iii)	$(CH_3)_3CH + Br\bullet \rightarrow (CH_3)_3C\bullet + HBr$	**1**
	$(CH_3)_3C\bullet + Br_2 \rightarrow (CH_3)_3CBr + Br\bullet$	**1**
4(a)(iv)		**1**

Question	Answer	Marks
4(a)(v)	$2(CH_3)_3C\bullet \rightarrow (CH_3)_3CC(CH_3)_3$ OR $2(CH_3)_3C\bullet \rightarrow C_8H_{18}$ / eqv	**1**
4(b)	**P** ammonia / NH_3	**1**
	Q $(CH_3)_3CNH_2$	**1**

Question	Answer	Marks
5(a)	(momentum =) mass × velocity	**1**
5(b)	(momentum before collision =) 0.5 × 4.0 / 2(.0)	**1**
	(momentum after collision =) [0.75 × 3.2] + [0.5 × v_A] OR 2.4 + [0.5 × v_A]	**1**
	(V_A =) – 0.8 (m s^{-1})	**1**
5(c)	(E_k before collision =) ½ × 0.5 × 4^2 = 4 (J)	**1**
	(E_k after collision =) ½ × 0.5 × $(–0.8)^2$ + ½ × 0.75 × 3.2^2) = 4 J OR 0.16 + 3.84 = 4 J AND so elastic	**1**

Question	Answer	Marks
6(a)(i)	*effect on rate:* rate increases AND *effect on yield* yield decreases	**1**
	rate explanation: (at higher temperature) more molecules / particles have $E \geqslant E_a$	**1**
	more / a higher frequency of collisions are successful	**1**
	yield explanation: as (forward) reaction is exothermic	**1**
6(a)(ii)	at 450 °C the rate is not too slow AND the yield is not too low OR above 450 °C yield too low AND below 450 °C rate too slow	**1**
6(b)	ΔH_R = Σ((–795.8) + 2(–285.8) + 2(–45.9)) – Σ(2(–314.6) + (–986.1))	**1**
	= (+)156.1 / 156	**1**
6(c)(i)	hydrogen bonding	**1**
6(c)(ii)	high electronegativity difference (in both molecules)	**1**

Question	Answer	Marks
7(a)(i)	(monochromatic light is) light of a single frequency / wavelength	**1**
7(a)(ii)	(coherent sources produce beams of light that have a) constant phase difference between them	**1**
7(b)(i)	fringes are closer (together)	**1**
7(b)(ii)	(violet) light has shorter wavelength	**1**
	smaller path difference required for the same phase difference	**1**
7(c)	(double) slits closer to each other	**1**
	screen further away (from the double slits)	**1**

Question	Answer	Marks
8(a)	$n(HNO_3) = 175 \times 10^{-3} \times 1.5 = 0.2625$ (mol)	**1**
	$n(Mg(NO_3)_2) = \frac{1}{2} \times 0.2625 = 0.131$ (mol)	**1**
	Mass $Mg(NO_3)_2 = 148.3 \times 0.131 = 19.4 / 19.46 / 19.5$ (g)	**1**
8(b)(i)	describes the formation of a brown gas OR describes the relighting of a glowing splint	**1**
8(b)(ii)	$nMg(NO_3)_2 = 3.47 / 148.3 = 0.0234$ (mol)	**1**
	$n(\text{gas}) = 5/2 \times 0.0234 = 0.0585$ (mol)	**1**
8(b)(iii)	$(V = nRT / P =) \dfrac{0.211 \times 8.31 \times 298}{100000}$	**1**
	$= 5.2(3) \times 10^{-3}$ (m^3)	**1**

Question	Answer	Marks
9(a)	current is proportional to potential difference	**1**
9(b)	the temperature (of the filament) increases	**1**
	resistance increases	**1**
9(c)(i)	diode	**1**
	current is in one direction only	**1**
9(c)(ii)	first quadrant characteristic of lamp	**1**
	third quadrant characteristic of diode	**1**

Question	Answer	Marks
10(a)(i)	**3**CuS(s) + **8**HNO_3(aq) → 3$CuSO_4$(aq) + **8**NO(g) + **4**H_2O(l)	**1**
10(a)(ii)	*element reduced:* nitrogen / N	**1**
	explanation: oxidation number of N goes from +5 to +2	**1**
10(b)(i)	*$1s^2$* $2s^22p^63s^23p^63d^{10}4s^1$ / $2s^22p^63s^23p^64s^13d^{10}$	**1**
	$1s^2$ $2s^22p^63s^23p^63d^9$	**1**
10(b)(ii)	Cu^{2+} + $2e^-$ → Cu	**1**
10(b)(iii)	*diagram* shows a regular lattice of circles, each with a +ve charge / Cu^{2+} AND negative charge or electrons;	**1**
	explanation **attraction** between positive ions and **delocalised** electrons	**1**

Question	Answer	Marks
11(a)(i)	$I_1 - I_2 - I_3 = 0$	**1**
11(a)(ii)	$E - I_3 R_v - I_1 R_2 = 0$	**1**
11(a)(iii)	$I_2 R_1 - I_3 R_v = 0$	**1**
11(b)	reading will decrease	**1**
	more current through R_2, therefore larger potential difference across it	**1**

Question	Answer	Marks
12	*unchanged* *any one from:* positive or small nucleus nucleus containing most of mass (of atom) electrons surround or outside of nucleus	**1**
	changed *any two from:* (Rutherford electrons in any orbit) Bohr electrons in (fixed) orbit(als) (Rutherford electrons or orbits have any energy) Bohr electrons or orbit(als) have discrete energies Bohr electrons orbit at fixed distance from nucleus Bohr electrons orbit without emitting radiation Bohr electrons gain or lose energy by moving between orbitals	**2**