



PHYSICAL SCIENCE

0652/41

Paper 4 Extended Theory

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.

© IGCSE is a registered trademark.

This document consists of **9** printed pages.

Question	Answer	Marks
1(a)(i)	use of gradient of the graph ; (correct read off of points and use of $\Delta y / \Delta x =$) 9.6 ; correct unit m/s^2 ;	3
1(a)(ii)	$F = ma$ or 0.15×9.6 ; $= 1.44$ (N) ;	2
1(a)(iii)	$W = f \times d$ or 1.44×4.2 ; 6.05 ;	
1(b)(i)	gradient decreases ;	1
1(b)(ii)	frictional force / air resistance increases (increases with increasing speed) ;	1

Question	Answer	Marks
2(a)	7 electrons in the <u>outer</u> / <u>valence</u> shell ;	1
2(b)(i)	1:2 ratio $\text{Cl}_2 : 2\text{HCl}$; (volume of $\text{Cl}_2 =$) 5 dm^3 ; OR 1:1 ratio $\text{Cl}_2 : \text{H}_2$; (volume of $\text{Cl}_2 =$) $5 (\text{dm}^3)$;	2
2(b)(ii)	(sunlight) provides the energy (for the reaction to occur) / Cl_2 absorbs the UV light / Cl_2 molecule is split by UV ;	1

Question	Answer	Marks
2(c)(i)	$2\text{AgBr} \rightarrow 2\text{Ag} + \text{Br}_2$; ; 1 for reagents and products (products in any order) 1 for balancing	2
2(c)(ii)	<i>any two from:</i> exposure (of AgBr) to light ; metallic silver causes darkening ; gain an electron (from bromine) ; by silver ions ; unexposed silver bromide is removed ;	max 2

Question	Answer	Marks
3(a)	(nuclear) fusion ;	1

Question	Answer	Marks
3(b)(i)	<p><i>max two from:</i></p> <p>nuclei merge ;</p> <p>to form larger nucleus ;</p> <p>reference to mass energy ;</p> <p><i>max two from:</i></p> <p>collision of (two) <u>nuclei</u> ;</p> <p>nuclei small ;</p> <p>nuclei very fast moving ;</p>	3
3(b)(ii)	<p>$E = mc^2$;</p> <p>(correct substitution $E =$) $4 \times 10^7 \times (3 \times 10^8)^2$;</p> <p>$= 3.6 \times 10^{24}$ (J) ;</p>	3

Question	Answer	Marks
4(a)	alkane ;	1
4(b)	wax/polish ;	1
4(c)(i)	C_2H_4 ;	1
4(c)(ii)	<p>high temperatures ;</p> <p>high pressure ;</p>	2
4(c)(iii)	increase the rate (of reaction) ;	1

Question	Answer	Marks
4(d)	<i>test:</i> bromine water / Br ₂ (aq) ; <i>result with unsaturated HC:</i> decolourises ; <i>result with saturated HC:</i> no change / stays orange-brown ;	3

Question	Answer	Marks
5(a)	material 1 and material 2 different suitable metals ; material 1 and material 3 the same suitable metals ;	2
5(b)	9.2 – 1.1 or 8.1 or alternate methods ; 8.1 / 100 = 0.081 V / deg ; T = –14 (°C) ;	3
5(c)(i)	<i>situation where:</i> high or low temperatures / rapidly changing temperatures / remote reading of temperature / measurement of temperature at a point ;	1
5(c)(ii)	metals have high melting points / junction very small / not much energy needed to raise its temperature / hostile environment / junction very small ;	

Question	Answer	Marks
6(a)	does not conduct AND covalent	1

Question	Answer	Marks
6(b)(i)	<p><i>any two from:</i></p> <p>each carbon atom attached to 4 others ;</p> <p>atoms arranged <u>tetrahedrally</u> / <u>tetrahedral</u> ;</p> <p>giant molecular / macromolecular ;</p>	max 2
6(b)(ii)	<p><i>any three from:</i></p> <p>graphite structure is in layers ;</p> <p>weak forces (between layers) ;</p> <p>layers slide over each other</p> <p>each carbon atom attached to (only) 3 others ;</p> <p>(thin) layer(s) of graphite left on paper ;</p>	max 3
6(c)	carbon + oxygen → carbon dioxide	1
6(d)	gain in oxygen ;	1

Question	Answer	Marks
7(a)	ray emerging with an angle of refraction > ray 1 but < ray 3 ;	1
7(b)(i)	c correctly identified and marked ;	1
7(b)(ii)	total internal reflection (with $i \approx r$) ;	1

Question	Answer	Marks
7(c)	$n = \sin i / \sin r$ ($1.34 = \sin 38 / \sin r$) ; $\sin r = \sin 38 / 1.34$ or 0.46 ; $r = 27^\circ$;	3

Question	Answer	Marks
8(a)	(calcium) reacts more quickly (than magnesium) ; calcium more reactive / calcium above magnesium in reactivity series ;	max 2
8(b)	aluminium has an oxide / Al_2O_3 / protective layer ;	1
8(c)	<i>any two from:</i> low density ; can be alloyed ; resists corrosion / resists weathering ; malleable ;	max 2
8(d)	(aluminium is) more reactive than carbon / higher in reactivity series ;	1
8(e)	amphoteric ;	1

Question	Answer	Marks
9(a)(i)	0.53 (A) ;	1

Question	Answer	Marks
9(a)(ii)	use of $V = IR$ ($\rightarrow R = 3 \div 0.53$) ; 5.7 (Ω) ;	2
9(a)(iii)	3.2 (Ω) ;	1
9(b)(i)	100 (cm) ;	1
9(b)(ii)	use of $P = VI$ or 3×0.77 ; 2.31 (W) ;	2

Question	Answer	Marks				
10(a)	<table border="1"> <tbody> <tr> <td>carbon monoxide</td> <td>incomplete combustion (of carbon containing substances / of fuel in cars) ;</td> </tr> <tr> <td>sulfur dioxide</td> <td>combustion of fossil fuels / combustion of fuels with sulfur impurities ;</td> </tr> </tbody> </table>	carbon monoxide	incomplete combustion (of carbon containing substances / of fuel in cars) ;	sulfur dioxide	combustion of fossil fuels / combustion of fuels with sulfur impurities ;	2
carbon monoxide	incomplete combustion (of carbon containing substances / of fuel in cars) ;					
sulfur dioxide	combustion of fossil fuels / combustion of fuels with sulfur impurities ;					
10(b)	acid rain / smog ;	1				

Question	Answer	Marks
10(c)(i)	<p><i>any three from:</i></p> <p>(NO) converted to nitrogen ;</p> <p>reaction with carbon monoxide ;</p> <p>by reduction / loss of oxygen ;</p> <p>speeds up the removal (of the harmful gases) ;</p> <p>honeycombed surface / large surface area ;</p> <p>(which contains a) coating or layer of catalysts ;</p>	3
10(c)(ii)	carbon dioxide / CO ₂ ;	1
10(d)	triple bond ;	1

Question	Answer	Marks
11(a)(i)	84 ;	1
11(a)(ii)	125 ;	1
11(b)	<p>nucleon number for Pb = 205 ;</p> <p>${}^4_2\alpha$ correct ;</p>	2