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PHYSICAL SCIENCE **0652/41**

Paper 4 Extended Theory **October/November 2017**

MARK SCHEME

Maximum Mark: 80

Published

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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 × 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 outer / valence shell ;	**1**
2(b)(i)	1:2 ratio Cl_2 : 2HCl ; (volume of Cl_2 =) 5 dm^3 ; OR 1:1 ratio Cl_2 : H_2 ; (volume of Cl_2 =) 5 (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)	$2AgBr \rightarrow 2Ag + Br_2$;; 1 for reagents and products (products in any order) 1 for balancing	**2**
2(c)(ii)	*any two from:* 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)	*max two from:* nuclei merge ; to form larger nucleus ; reference to mass energy ; *max two from:* collision of (two) nuclei ; nuclei small ; nuclei very fast moving ;	**3**
3(b)(ii)	$E = mc^2$; (correct substitution E =) $4 \times 10^7 \times (3 \times 10^8)^2$; = 3.6×10^{24} (J) ;	**3**

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

Question	Answer	Marks
4(d)	*test:* bromine water / Br_2(aq) ; *result with unsaturated HC*: decolourises ; *result with saturated HC*: 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)	*situation where:* 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)	*any two from:* each carbon atom attached to 4 others ; atoms arranged tetrahedrally / tetrahedral ; giant molecular / macromolecular ;	**max 2**
6(b)(ii)	*any three from:* graphite structure is in layers ; weak forces (between layers) ; layers slide over each other each carbon atom attached to (only) 3 others ; (thin) layer(s) of graphite left on paper ;	**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° ;	**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)	*any two from:* 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 = *I R* (→ *R* = 3 ÷ 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* = *V I* or 3 × 0.77 ; 2.31 (W) ;	**2**

Question	Answer	Marks
10(a)	**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**
10(b)	acid rain / smog ;	**1**

Question	Answer	Marks
10(c)(i)	*any three from:* (NO) converted to nitrogen ; reaction with carbon monoxide ; by reduction / loss of oxygen ; speeds up the removal (of the harmful gases) ; honeycombed surface / large surface area ; (which contains a) coating or layer of catalysts ;	**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)	nucleon number for Pb = 205 ; $^{4}_{2}\alpha$ correct ;	**2**