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PHYSICAL SCIENCE **0652/31**

Paper 3 Extended Theory **October/November 2016**

MARK SCHEME

Maximum Mark: 80

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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Question	Answer	Marks
1(a)(i)	(distance travelled =) 31.4 – 25.0 or 6.4 (cm) ; <u>Use of</u> speed = distance / time (= 6.4 / 0.04) ; 160 (cm / s) ;	3
1(a)(ii)	(constant) acceleration ;	1
1(b)	diagonal line from *y*-axis upwards to **B ;** horizontal line to **C ;**	2
1(c)	gradient (of the graph) ;	1

Question	Answer	Marks
2(a)	increase ;	1
2(b)	energy released in making bonds / energy taken in to break bonds / making bonds is exothermic / breaking bonds is endothermic ; energy released (in making bonds) is great<u>er</u> than the energy required (to break bonds) ;	2
2(c)	increase concentration / increase the temperature ;	1
2(d)	$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$;	1
2(e)(i)	Mr glucose OR Mr water / 180 OR 18 ; 6 water:1 glucose ratio or divided by 6 ; 1.67 / 1.66(66...) / 1.7 ;	3

Question	Answer	Marks
2e(ii)	(sun)light / energy from the sun ; (takes place in) chloroplasts / (absorbed by) chlorophyll ;	2

Question	Answer	Marks
3(a)(i)	<u>Use of</u> (work done =) force × distance (= 8.5 × 5000) ; = 4.25×10^4 / 42 500 (J) ;	2
3(a)(ii)	(efficiency is the ratio) of the (useful) work done or work done by motor / <u>useful</u> power <u>out</u>put / <u>useful</u> energy <u>out</u>put to the (total) energy input or work input or power input ;	1
3b	<u>use of</u> (power =) work done ÷ time taken (= 4.25×10^4 / 12) ; 3.5×10^3 / 3 500 / 3542 ; watts / W / Js^{-1} ;	3

Question	Answer	Marks
4(a)	most reactive: C B A least reactive: D ;;	**2**
Common to **all 4(b)** mark is for the reason **NOT** the choice of metal		
4(b)(i)	**aeroplane:** (aluminium) low density / resist corrosion ;	**1**
4(b)(ii)	**saucepan**: (copper / (stainless) steel / aluminium / (cast) iron) good conductor (of heat) / resistant to corrosion / no reaction (with food/water) ;	**1**
4(b)(iii)	**cutlery:** ((stainless) steel / silver / gold) resistant to corrosion / malleable / shiny / hard / non-toxic / unreactive (with food/water) ;	**1**
4(c)	any 3 from: lattice / giant structure / positive (cat)ions ; delocalised or free / sea / cloud of electron(s) ; (electrons) can move or are mobile ; (electrons) carry a (–) charge ;	**max 3**
5(a)(i)	waves curved with convex shape at front ; three wavefronts with arc centred on the centre of the harbour entrance ; wavelengths / gap between first and second wave equal to incident wavelength / gap by eye ;	**3**
5(a)(ii)	diffraction ;	**1**

Question	Answer	Marks
5(a)(iii)	waves spread into the sheltered area or to where the boats are ;	1
5(b)(i)	use of frequency = number of waves ÷ time (= 6 ÷ 60) ; 0.05 (Hz) ;	2
5(b)(ii)	25 (m) ;	1
5(b)(iii)	use of speed = wavelength × frequency (= 25 × 0.05) ; 1.25 (m/s) ;	2

Question	Answer	Marks
6(a)	copper ;	1
6(b)(i)	iron (or it) is less reactive than carbon / iron is lower than carbon in reactivity series ;	1
6b(ii)	Any two from: burns the coke or carbon / forms carbon monoxide ; carbon monoxide reduces the iron ore ; $C + O_2 \rightarrow CO_2$; as reaction is exothermic ; (increased temperature) increases rate of reaction ;	max 2
6b(iii)	$(Fe_2O_3 + 3CO) \rightarrow 2Fe + 3CO_2$;	2
6(c)	removes or reacts (acidic) impurities / forms slag / forms calcium silicate / reacts with SiO_2 ;	1
6(d)(i)	calcium carbonate → calcium oxide + carbon dioxide ;	1
6d(ii)	(thermal) decomposition ;	1

Question	Answer	Marks
7(a)	1.2 (V) ;	1
7(b)(i)	use of $W = V\,I\,t$ (= 4.2 × 0.40 × 5 × 60) ; 500 / 504 ; joule / J ;	3
7(b)(ii)	R_B = 0.40 and R_C = 0.40 ;	1
7(c)(i)	Use of $1/R = 1/R_1 + 1/R_2$ (1 / 18 + 1 / 6 = 4 / 18) ; R = 4.5 (Ω) ;	2
7(c)(ii)	($I = V/R$ = 9 / 4.5 =) 2 (A) ;	1
7(c)(iii)	use of $Q = I\,t$ (= 2 × 30) ; 60 (C) ;	2

Question	Answer	Marks
8(a)	value between 0.176 and 0.196 ;	1
8(b)	2 ;	1
8(c)	Any four from: one magnesium and two chlorines ; eight electrons in chlorine outer shell ; one electron gained by chlorine from magnesium ; eight or no electrons in magnesium outer shell ; correct charges on ions / Mg^{2+} and Cl^{-} ;	max 4

Question	Answer	Marks
9(a)	P: <u>slip</u> ring ; Q: brush ;	2
9(b)	AB moves in the magnetic field ; cutting the (magnetic) field (at right angles) ;	2
9(c)(i)	(current continually) changes direction ;	1
9(c)(ii)	same maxima and same minima throughout ; varying signal and constant frequency ;	2

Question	Answer	Marks
10(a)(i)	**hardness**: (both) have (strong) covalent bonds ; **one from diamond:** (diamond is harder than graphite) each carbon (atom) in diamond is joined to 4 others ; forms a giant (covalent) structure or giant molecule ; **one from graphite:** in graphite each carbon atom joined to 3 other carbon atoms ; arranged in layers / 2-dimensional giant structure / layers slide over each other ; weak forces between layers ;	max 3
10(a)(ii)	**melting point:** (diamond and graphite have similar high melting point) both have strong (covalent) bonds which need to be broken / a lot of energy needed to break (strong covalent) bonds or because the bonds are strong ;	1
10(b)	(catalytic) addition ;	1
10(c)	double bond between two carbons ; rest of molecule correct ;	2