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Cambridge International General Certificate of Secondary Education

PHYSICAL SCIENCE

0652/31

Paper 3 Extended Theory

October/November 2016

MARK SCHEME

Maximum Mark: 80

Published

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Question	Answer	Marks
1(a)(i)	(distance travelled =) 31.4 – 25.0 or 6.4 (cm) ; <u>Use of speed</u> = 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 <u>greater</u> than the energy required (to break bonds) ;	2
2(c)	increase concentration/increase the temperature ;	1
2(d)	$\text{H}_2\text{SO}_4 + 2\text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$;	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

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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 \times distance (= 8.5×5000) ; $= 4.25 \times 10^4 / 42\,500$ (J) ;	2
3(a)(ii)	(efficiency is the ratio) of the (useful) work done or work done by motor / <u>useful</u> power <u>output</u> / <u>useful</u> energy <u>output</u> to the (total) energy input or work input or power input ;	1
3b	<u>use of</u> (power =) work done \div time taken (= $4.25 \times 10^4 / 12$) ; $3.5 \times 10^3 / 3\,500 / 3542$; watts / W / Js ⁻¹ ;	3

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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

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

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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 \rightarrow calcium oxide + carbon dioxide ;	1
6d(ii)	(thermal) decomposition ;	1

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

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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

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Question	Answer	Marks
10(a)(i)	<p>hardness: (both) have (strong) <u>covalent</u> bonds ;</p> <p>one from diamond: (diamond is harder than graphite) each carbon (atom) in diamond is joined to 4 others ;</p> <p>forms a giant (covalent) structure or giant molecule ;</p> <p>one from graphite: in graphite each carbon atom joined to 3 other carbon atoms ;</p> <p>arranged in layers / 2-dimensional giant structure / layers slide over each other ;</p> <p>weak forces between layers ;</p>	max 3
10(a)(ii)	<p>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 ;</p>	1
10(b)	(catalytic) addition ;	1
10(c)	<p>double bond between two carbons ;</p> <p>rest of molecule correct ;</p>	2