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**CHEMISTRY**

**0620/33**

Paper 3 Theory (Core)

**May/June 2017**

MARK SCHEME

Maximum Mark: 80

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**Published**

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This document consists of **8** printed pages.

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
1(a)(i)	<b>E</b>	<b>1</b>
1(a)(ii)	<b>C</b>	<b>1</b>
1(a)(iii)	<b>C</b>	<b>1</b>
1(a)(iv)	<b>D</b>	<b>1</b>
1(a)(v)	<b>A</b>	<b>1</b>
1(b)	number of electrons in $\text{Ca}^{2+}$ = 18	<b>1</b>
	number of neutrons in Mg = 14	<b>1</b>
	number of protons in Mg = 12 <b>AND</b> number of protons in $\text{Ca}^{2+}$ = 20	<b>1</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(a)(i)	8 (mg)	<b>1</b>
2(a)(ii)	hydrogencarbonate / $\text{HCO}_3^-$	<b>1</b>
2(a)(iii)	nitrate	<b>1</b>
2(a)(iv)	12.5 (mg)	<b>1</b>
2(b)	(damp) red litmus paper	<b>1</b>
	turns blue	<b>1</b>
2(c)	$\text{CaBr}_2$	<b>1</b>
2(d)(i)	negative electrode: calcium / Ca	<b>1</b>
	positive electrode: bromine / $\text{Br}_2$	<b>1</b>
2(d)(ii)	platinum / Pt	<b>1</b>

Question	Answer	Marks
3(a)	any 5 of: <b>P</b> has ionic bonding / ionic <b>P</b> particles are regularly arranged / lattice / in rows / uniformly arranged <b>P</b> particles (only) vibrating / not moving from place to place  <b>Q</b> has covalent bonding <b>Q</b> has irregular arrangement of particles / random arrangement <b>Q</b> particles moving slowly / moving randomly / sliding over each other  <b>R</b> no bonding (between atoms) / weak bonding between atoms / weak attractive forces between atoms <b>R</b> has irregular arrangement of particles / random arrangement <b>R</b> particles moving randomly / moving rapidly / freely moving / randomly (moving) / irregular (movement)	<b>5</b>
3(b)	volume increases	<b>1</b>
	particles get further apart	<b>1</b>
3(c)	<b>C</b> / boils (at 1330 °C)	<b>1</b>
	<b>D</b> / dissolves (readily in water)	<b>1</b>
	the change can be reversed by altering the conditions	<b>1</b>
3(d)	pencil (leads) / lubricant	<b>1</b>
	layers move <b>OR</b> slide over each other	<b>1</b>

Question	Answer	Marks
4(a)(i)	hematite / any other ore of iron	1
4(a)(ii)	from the reaction of carbon dioxide	1
	with carbon / coke	1
	<b>OR</b>	
	reaction of carbon / coke	1
	with insufficient oxygen for complete combustion / idea of oxygen not in excess or not limiting	1
4(a)(iii)	2 (Fe)	1
	3 (CO <sub>2</sub> )	1
4(a)(iv)	iron(III) oxide loses oxygen / iron(III) oxide loses oxygen	1
4(a)(v)	160 <b>IF</b> full credit is not awarded, allow 1 mark for (Fe =) 56 and (O =16)	2
4(b)(i)	hydrogen / H <sub>2</sub>	1
4(b)(ii)	gas syringe connected to flask <b>OR</b> this described in words	1
	closed apparatus / workable apparatus <b>OR</b> this described in words	1
	timer / stop-watch <b>OR</b> this described in words	1
4(c)	(aqueous) sodium hydroxide / aqueous ammonia	1
	green precipitate	1
4(d)	any 2 advantages from: saves energy / saves mining of ore / saves other finite resources / saves transport costs of bringing ore to factory / reduces dust pollution / exhaust gas pollution	2

Question	Answer	Marks
5(a)	circle drawn around the COOH group	1
5(b)	$C_2H_4O_3$	1
5(c)	grind up the (sugar) cane / crush the plant	1
	with a solvent	1
	filter (off the solution)	1
5(d)	addition of oxygen / loss of electrons / increase in oxidation number	1
5(e)(i)	decreases with an increasing number of carbon atoms <b>ORA</b>	1
5(e)(ii)	any value between 118 and 164 ( $^{\circ}C$ ) (exclusive of these values)	1
5(e)(iii)	solid	1
	$-10 (^{\circ}C)$ is below the melting point / melting point is higher than $-10 (^{\circ}C)$	1

Question	Answer	Marks
6(a)(i)	<b>J</b>	
	it is (very) strong / it is the strongest	<b>1</b>
	it is cheap	<b>1</b>
6(a)(ii)	<b>M</b> because it is the hardest	<b>1</b>
6(a)(iii)	<b>K</b> because its density is the lowest	<b>1</b>
6(b)(i)	line at a steeper gradient than <b>W</b>	<b>1</b>
	ends up at same mass loss	<b>1</b>
6(b)(ii)	<b>Y</b>	<b>1</b>
6(b)(iii)	1.05 days	<b>1</b>
6(b)(iv)	increasing temperature increases rate	<b>1</b>
	increasing concentration increases rate	<b>1</b>
6(c)	pH 12	<b>1</b>

Question	Answer	Marks
7(a)	pair of electrons in overlap area between O atom and <b>both</b> H atoms	<b>1</b>
7(b)	electrical conductivity	<b>1</b>
	melting point/boiling point	<b>1</b>
7(c)	iron < magnesium < cerium < lithium <b>IF</b> full credit is not awarded, allow 1 mark for either a correct sequence apart from a consecutive pair reversed <b>OR</b> for the whole sequence reversed	<b>2</b>
7(d)(i)	water	<b>1</b>
	air / oxygen	<b>1</b>
7(d)(ii)	any 2 methods from: greasing / covering with plastic / galvanising / painting / (electro)plating	<b>2</b>
7(e)	evaporate to crystallisation point / leave in a warm place until crystals form	<b>1</b>
	filter off crystals / pick out crystals <b>AND</b> dry on filter paper / heat in drying oven	<b>1</b>
7(f)	4 (CO <sub>2</sub> )	<b>1</b>
	4(H <sub>2</sub> O)	<b>1</b>