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CHEMISTRY**9701/22**

Paper 2 AS Structured Questions

October/November 2017

MARK SCHEME

Maximum Mark: 60

Published

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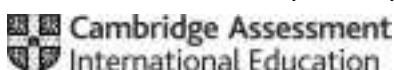
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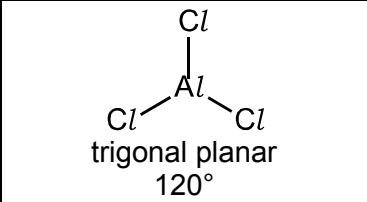
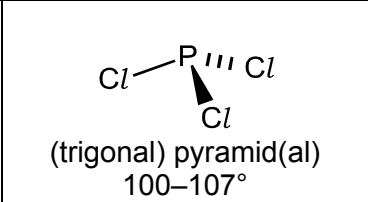
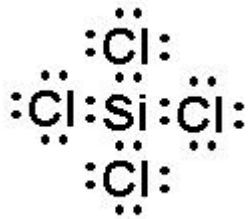
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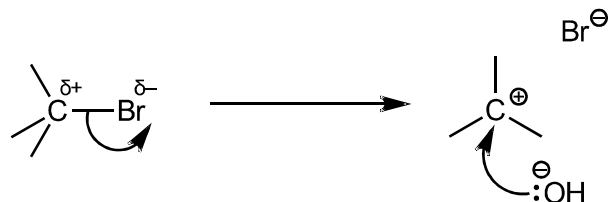


Cambridge Assessment
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Question	Answer	Marks
1(a)	 trigonal planar 120°  (trigonal) pyramid(al) 100–107° 3 marking points for each box: diagram, name and shape. for each box: all three correct = 2 marks two correct = 1 mark	4
1(b)(i)	SiCl ₄ simple / molecular AND Van der Waals' / id-id forces / London / dispersion forces / IMFs	1
	NaCl ionic OR giant	1
	bonding (in NaCl) stronger (than forces in SiCl ₄)	1
1(b)(ii)	SiCl ₄ has more electrons OR	1
	stronger Van der Waals' / id-id forces / London / dispersion forces / IMFs	1
1(b)(iii)		1

Question	Answer	Marks
2(a)	–444	1
2(b)(i)	(higher rate / rate increases) due to higher frequency of successful collisions	1
	more molecules / particles with $E \geq E_a$	1
2(b)(ii)	(percentage decomposition of PCl_5) increases	1
	(forward) reaction is endothermic	1
2(c)	<u>rates</u> of forward and reverse / backward reactions are equal	1
	closed / sealed system/container	1
2(d)(i)	$n_{\text{TOTAL}} = 1.20 + 0.80 + 0.80$ OR 2.80 (mol) OR mole fraction = $1.20 / 2.80$ OR 0.429	1
	$p\text{PCl}_5 = 1 \times 10^5 \times (1.20 / 2.80) = 4.29 \times 10^4 \text{ (Pa)}$	1
2(d)(ii)	$K_p = \frac{p\text{PCl}_3 \times p\text{Cl}_2}{p\text{PCl}_5}$	1
2(d)(iii)	1.91×10^4	1
	Pa	1

Question	Answer	Marks
3(a)	(IE) <u>decreases / lower</u> because increasing distance of outer electron(s) from nucleus OR increasing distance of outer / valence shell from nucleus OR increased shielding / screening (from inner shells)	1
	reduces nuclear attraction (for electrons)	1
3(b)(i)	(Melting point) <u>increases / higher</u> because (molecules have an) increasing (number of) electrons	1
	increasing strength / number / amount of IMFs / Van der Waals' / id-id / London / dispersion (forces)	1
3(b)(ii)	increased metallic / (cat)ionic radius / size OR decreasing (cat)ion charge-density	1
	decreased attraction (of ions) for delocalised / outer electrons	1
3(c)(i)	reaction 1: HNO_3 or nitric(V) acid	1
	reaction 2: water / H_2O	1
3(c)(ii)	barium oxide	1
	$2\text{Ba} + \text{O}_2 \rightarrow 2\text{BaO}$	1
3(c)(iii)	NO_2 / nitrogen dioxide / nitrogen(IV) oxide AND O_2 / oxygen	1
	(red / yellow-)brown gas OR gas given off that relights glowing splint	1
3(c)(iv)	<u>white</u> ppt / solid / suspension	1
	of BaSO_4 / barium sulfate OR $\text{Mg}(\text{OH})_2$ / magnesium hydroxide	1
	BaSO_4 is insoluble OR $\text{Mg}(\text{OH})_2$ is insoluble / partially / slightly / sparingly soluble	1

Question	Answer			Marks											
4(a)	<table><tr><td>1</td><td><u>concentrated</u> H_2SO_4 / H_3PO_4 AND NaBr OR (red) P / Br_2 OR HBr</td><td>substitution</td></tr><tr><td>2</td><td>aqueous / dilute NaOH / KOH</td><td>hydrolysis OR substitution</td></tr><tr><td>3</td><td><u>concentrated</u> H_2SO_4 / H_3PO_4 OR Al_2O_3 / P_4O_{10} / pumice / porous pot / SiO_2</td><td>dehydration</td></tr><tr><td>4</td><td>(ethanolic) HBr</td><td>addition</td></tr></table> 4 marks for column 1 (one per row) 1 mark for col 2	1	<u>concentrated</u> H_2SO_4 / H_3PO_4 AND NaBr OR (red) P / Br_2 OR HBr	substitution	2	aqueous / dilute NaOH / KOH	hydrolysis OR substitution	3	<u>concentrated</u> H_2SO_4 / H_3PO_4 OR Al_2O_3 / P_4O_{10} / pumice / porous pot / SiO_2	dehydration	4	(ethanolic) HBr	addition		5
1	<u>concentrated</u> H_2SO_4 / H_3PO_4 AND NaBr OR (red) P / Br_2 OR HBr	substitution													
2	aqueous / dilute NaOH / KOH	hydrolysis OR substitution													
3	<u>concentrated</u> H_2SO_4 / H_3PO_4 OR Al_2O_3 / P_4O_{10} / pumice / porous pot / SiO_2	dehydration													
4	(ethanolic) HBr	addition													
4(b)	 M1 correct dipole on $\delta^+\text{C}-\text{Br}^{\delta-}$ AND curly arrow from C—Br bond to Br M2 correct intermediate with + charge M3 curly arrow from lone pair on ^-OH to C^+ of carbocation			3											

Question	Answer	Marks
4(c)(i)	(different molecules) same molecular formula / same numbers of atoms of each (type of) element	1
	different structural formulae / displayed formulae	1
	chain / skeletal functional group position(al) / regioisomerism two types correct = 1 mark, all three correct = 2 marks	2
4(c)(ii)	S _N / nucleophilic substitution	1
	no (stable) (carbo)cation / intermediate is formed	1
	only one alkyl group / fewer alkyl / methyl groups (compared to reaction 2) AND limited (+)I / inductive effect / less electron donating (effect)	1
4(d)(i)	mirror images are super(im)posable OR not chiral / no chirality / no chiral/asymmetric carbon/centre / achiral	1
	one or both C/end of double bond has identical groups / 2 methyl groups / 2 H (atoms)	1
4(d)(ii)	addition	1
	$ \begin{array}{cc} \text{H}_3\text{C} & \text{H} \\ & \\ \text{---C} & \text{---C---} \\ & \\ \text{H}_3\text{C} & \text{H} \end{array} $ marking points: • correct number of tetravalent carbon atoms in backbone, with extension bonds • correct groups on backbone carbon atoms and only one repeat unit	2
4(d)(iii)	not/non- biodegradable / harmful combustion products	1

Question	Answer	Marks
4(e)	2-bromo-2-methylpropane	1
	1-bromo-2-methylpropane	1