
CHEMISTRY

9701/22

Paper 2 AS Structured Questions

October/November 2017

MARK SCHEME

Maximum Mark: 60

Published

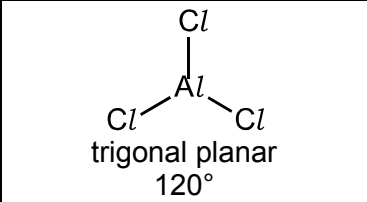
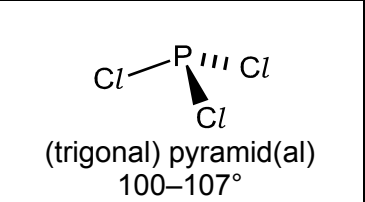
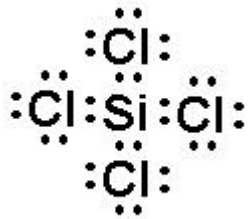
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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

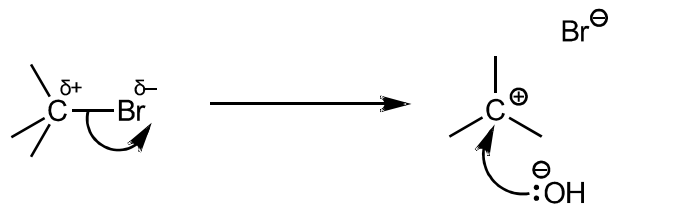
Cambridge International is publishing the mark schemes for the October/November 2017 series for most Cambridge IGCSE[®], Cambridge International A and AS Level components and some Cambridge O Level components.



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) owtte	1
1(b)(ii)	SiCl ₄ has more electrons ORA	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