Halogenoalkanes - Mark Scheme

Q1.

Question number	Answer	Mark
	C 2-chloro-2-methylpropane	1

Q2.

Question number	Answer	Additional guidance	Mark
(a)	• balanced equation (1) • all states correct (1)	$I_2(s) + Cl_2(g) \rightarrow 2ICl(l)$ Accept multiples	2

Question number	Answer	Additional guidance	Mark
(b)	• correct electronegativity values and correct dipole diagram	Cl = 3.0 **and** I = 2.5 δ+ I — Cl δ- Do not award full charges	1

Question number	Answer	Additional guidance	Mark
(c)(i)	• 1 mark each correct formula	 Allow 1 mark for 2 correct non-skeletal formulae	2

Question number	Answer	Additional guidance	Mark
(c)(ii)	An explantion that makes reference to the following points: • identification of correct isomer (1) • iodine is δ+ and is attacked by the π electrons (1) • more stable secondary carbocation formed. (1)	2-chloro-1-iodopropane	3

Question number	Answer	Additional guidance	Mark
(d)(i)	An answer that makes reference to the following points: • carry out in fume cupboard (1) • chlorine is toxic. (1)	Allow fume hood or similar description Do not allow 'harmful'	2

Question number	Answer	Additional guidance	Mark
(d)(ii)	• I in ICl = +1 I in ICl_3 = +3	Both needed for the mark	1

Question number	Answer		Additional guidance	Mark
(d)(iii)	• +5 **and** -1 to -1 (and -1)	(1)		2
	• not disproportionation because the chlorine has not undergone both oxidation and reduction	(1)		

Question number	Answer		Additional guidance	Mark
(e)(i)	• correct method	(1)	$Cl_2 = 2 \times 35.5 = 71$ $71 \div 24000$	2
	• answer with units	(1)	$= 0.0029583$ g cm^{-3} $= 3$ g dm^{-3}	

Question number	Answer		Additional guidance	Mark
(e)(ii)	An explanation that makes reference to the following points:			3
	• chlorine (gas) is more dense than air	(1)		
	• chlorine (gas) removed (from the equilibrium)	(1)		
	• position of equilibrium moves to the LHS (more brown liquid/ICl).	(1)		

Question number	Answer		Additional guidance	Mark
(f)	• calculation of mols of iodine and fluorine	(1)	Mols of iodine = $0.64 \div 126.9 = 5.04 \times 10^{-3}$ Mols of fluorine = $(1.31–0.64) \div 19 = 3.53 \times 10^{-2}$	2
	• calculation of whole number ratio and formula	(1)	Ratio 1:7 therefore formula IF_7	

Q3.

Question number	Answer	Mark
	D nucleophilic substitution	1

Q4.

Question number	Answer		Additional guidance	Mark
(a)	• KBr/potassium bromide **and** (50%) sulfuric acid	(1)	Both needed for M1 Ignore acid concentration Allow HBr (dry) PBr_3/Phosphorus(III) bromide PBr_5/Phosphorus(V) bromide	2
	• (heat under) reflux	(1)	Do not allow just heat M2 conditional on correct or near correct M1	

Question number	Answer		Additional guidance	Mark
(b)	• C-Br dipole reversed	(1)	Allow in any order	3
	• OH^- to C arrow reversed	(1)		
	• lone pair missing (from OH^-)	(1)		

Question number	Answer		Additional guidance	Mark
(c)	• KOH/potassium hydroxide	(1)	Allow NaOH/sodium hydroxide Ignore OH^- / alkali	2
	• ethanol(ic)/alcohol(ic) **and** heat (under reflux)	(1)	M2 dependent on M1	

Q5.

Question number	Answer	Mark
	D *E*-1-bromo-2-methylbut-1-ene	1