1. CH_4 – VdW's SiH_4 – VdW's SnH_4 – VdW's

$\therefore$ B.p. $CH_4 < SiH_4 < SnH_4$

2. NH_3 – Hydrogen bonding PH_3 – VdW's AsH_3 – VdW's

$\therefore$ B.p. $PH_3 < AsH_3 < NH_3$ – Hydrogen bonding

3. HF – Hydrogen bonding HCl – dipole dipole HBr – dipole dipole

$\therefore$ B.p. HBr < HCl < HF

4. CH_3F – dipole dipole CH_3Cl – dipole dipole CH_4 – VdW's

$\therefore$ B.p. $CH_4 < CH_3F < CH_3Cl$

5. HF – Hydrogen bonding H_2O – Hydrogen bonding NH_3 – Hydrogen bonding

$\therefore$ B.p. $NH_3 < HF < H_2O$

(a)		M1	Electron arrangement = $1s^2 2s^2 2p^6 3s^2 3p^4$ *[accept upper case letters and subscripted numbers]*	1
		M2	Element **E** = S / sulphur *[Not conseq]* *[Not tied to M1]*	1
(b)	(i)	M1	Tendency / strength / ability / power of an atom / element / nucleus to attract / withdraw electrons / e- density / bonding pair / shared pair	1
		M2	In a <u>covalent</u> bond / shared/bonding pairs *(tied to M1 – unless silly slip in M1 – e.g. e^- retained/e^- cloud/single e^-/missing, e.g. 'atom')* *[CE if ions /<u>into</u> covalent bonds / lone pair / remove e^- = 0]*	1
	(ii)	M3	Trend in electronegativity = increasing *[Decrease/stays same = CE = 0]* *[allow 'general increase' but mention of deviations = 'con' M3]*	1
		M4	Increasing number of protons across period / inc nuclear charge *[Not increased atomic number / effective nuclear charge]*	1
		M5	Smaller size / bonding e- closer to nucleus /same shells / same shielding *[Not molecules]*	1
(c)	(i)	M1	F more electronegative (than H) / F is very/highly electronegative / reference to electronegativity difference / bonding electrons more attracted towards F [Not $\delta+/\delta-$]	1
	(ii)	M2	Trend = decreasing polarity *[Increase/stays same = CE = 0]*	1
		M3	Because electronegativity (difference) decreases	1
(d)	(i)	M1	HF has hydrogen bonding / allow H-bonding [Not H and F have H-bonding] *[Ions = CE = 0]* *[covalent bonds break = CE for M2 & M3]*	1
		M2	Other HX have van der Waals'/dipole-dipole	1
		M3	Hydrogen bonding stronger than other imf's / is strongest /	

			more energy to overcome / contra arguments	1
	(ii)	M4	van der Waals' forces / London forces / temporary / induced dipole-dipole / dispersion forces *[if "imf's" here <u>but clarified</u> by vdW mention in (d)(i), allow]* *[ignore dipole-dipole unless its trend said to be increasing, then 'con' M4]* *[Not 'fluctuating']*	1
		M5	increase with size /M_r / number of e$^-$s / surface area *[M5 tied to van der Waals']*	1
		M6	size /M_r / number of e-s / surface area increase (HCl to HI) / atomic size	1
(e)	(i)	M1	e$^-$ cloud distorted /e$^-$s or e$^-$ density unequally distributed / more –ve one side than other *[Atoms = CE = 0]*	1
	(ii)	M2	High charge density / high charge / small size *[Not small atomic radius]*	1

Total 18