

**GCE**

**Chemistry A**

Unit **F321**: Atoms, Bonds and Groups

Advanced Subsidiary GCE

**Mark Scheme for June 2015**

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All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations available in Scoris.

Annotation	Meaning
	Benefit of doubt given
	Contradiction
	Incorrect response
	Error carried forward
	Ignore
	Not answered question
	Benefit of doubt not given
	Power of 10 error
	Omission mark
	Rounding error
	Error in number of significant figures
	Correct response

Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

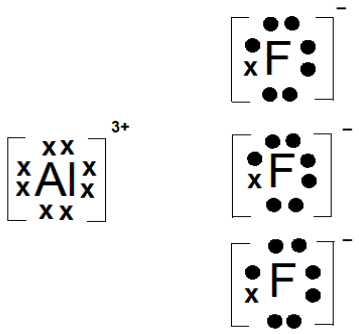
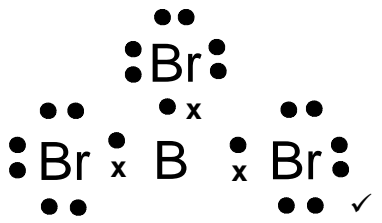
<b>Annotation</b>	<b>Meaning</b>
<b>DO NOT ALLOW</b>	Answers which are not worthy of credit
<b>IGNORE</b>	Statements which are irrelevant
<b>ALLOW</b>	Answers that can be accepted
( )	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
<b>ECF</b>	Error carried forward
<b>AW</b>	Alternative wording
<b>ORA</b>	Or reverse argument

The following questions should be annotated with ticks to show where marks have been awarded in the body of the text:

Q2d Q6b

Question			Answer	Mark	Guidance												
1	(a)	(i)	<table border="1"> <thead> <tr> <th>Particle</th> <th>Relative charge</th> <th>Number of particles present in a <math>^{140}\text{Ce}^{2+}</math> ion.</th> </tr> </thead> <tbody> <tr> <td>Protons</td> <td>+1</td> <td>58</td> </tr> <tr> <td>Neutrons</td> <td>Nil (or 0)</td> <td>82</td> </tr> <tr> <td>Electrons</td> <td>-1</td> <td>56</td> </tr> </tbody> </table> <p>One mark per column ✓ ✓</p>	Particle	Relative charge	Number of particles present in a $^{140}\text{Ce}^{2+}$ ion.	Protons	+1	58	Neutrons	Nil (or 0)	82	Electrons	-1	56	2	<p><b>DO NOT ALLOW</b> '+' or '-' without '1'</p> <p><b>DO NOT ALLOW</b> 1 without charge</p> <p><b>ALLOW</b> 1+ AND 1-</p> <p><b>IGNORE</b> '-' (ie a dash) for relative charge of a neutron</p>
			Particle	Relative charge	Number of particles present in a $^{140}\text{Ce}^{2+}$ ion.												
			Protons	+1	58												
			Neutrons	Nil (or 0)	82												
Electrons	-1	56															
(b)	(i)	Hydrogen ✓	1	<p><b>ALLOW</b> H<sub>2</sub></p> <p><b>IGNORE</b> 'H'</p>													
		(ii)	<p>Ce<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> ✓</p> <p>(Cerium) loses <b>three</b> electrons (to form 3+ ion) ✓</p>	2	<p><b>ALLOW</b> alternative phrases for 'loses' eg 'gives away', 'donates'</p> <p><b>IGNORE</b> '3 electrons transferred' unless a correct direction is given eg <b>ALLOW</b> (Ce) transfers 3 electrons to ... <b>OR</b> (Ce) transfers 3 electrons forming Ce<sup>3+</sup></p> <p><b>IGNORE</b> references to sulfate gaining electrons</p> <p><b>IGNORE</b> references to reduction and oxidation</p>												
		(iii)	A hydrogen <b>ion</b> (of an acid) has been replaced by a metal <b>ion</b> ✓	1	<p>For hydrogen ion:</p> <p><b>ALLOW</b> 'H<sup>+</sup>' <b>OR</b> 'proton'</p> <p>but <b>DO NOT ALLOW</b> 'H' <b>OR</b> 'hydrogen' without 'ion'</p> <p>For metal ion:</p> <p><b>ALLOW</b> 'cerium ion' <b>OR</b> 'Ce<sup>3+</sup>' <b>OR</b> 'Ce<sup>2+</sup>' <b>OR</b> 'Ce ion'</p> <p>But <b>DO NOT ALLOW</b> 'Ce' without 'ion' <b>OR</b> 'cerium' without 'ion'</p> <p><b>IGNORE</b> 'ammonium ion'</p>												

Question		Answer	Mark	Guidance	
	(c)	<p>Check the answer line. If answer = 1080 cm<sup>3</sup> award 2 marks</p> <p>Amount of Eu = 9.12/ 152.0 = 0.06(00) mol ✓</p> <p>Amount of O<sub>2</sub> = 0.0600 x 3/4 = 0.045(0) mol <b>and</b> Volume of O<sub>2</sub> = 0.0450 x 24000 = 1080 cm<sup>3</sup> ✓</p>	2	<p>If there is an alternative answer, check to see if there is any ECF credit possible using working below. <b>ALLOW</b> calculator value or rounding to 2 significant figures or more but <b>IGNORE</b> 'trailing zeroes' eg 0.200 is allowed as 0.2.</p> <p><b>ALLOW</b> incorrectly calculated <i>amount</i> of Eu x 3/4 and x 24000 correctly calculated for 2<sup>nd</sup> mark Eg 2605.7 would come from (9.12/63) x 3/4 x 24000 (note: a mass of Eu x 3/4 and x 24000 would not score M2)</p>	
1	(d)	(i)	The simplest <b>whole</b> number ratio of <b>atoms</b> (of each element) present in a compound ✓	1	<b>ALLOW</b> smallest <b>OR</b> lowest for simplest <b>ALLOW</b> molecule for compound
		(ii)	<p>Check the answer line. If answer = O<sub>12</sub>S<sub>3</sub>Tm<sub>2</sub> award 2 marks</p> <p>O = 30.7/ 16.0 S 15.4/32.1 Tm = 53.9 / 168.9 <b>OR</b> 1.9(2) mol          0.480 mol          0.319 mol ✓</p> <p>O<sub>12</sub>S<sub>3</sub>Tm<sub>2</sub> ✓</p>	2	<p><b>ALLOW</b> 0.479 OR 0.48 for mol of S <b>ALLOW</b> 0.32 for mol of Tm</p> <p><b>DO NOT ALLOW</b> Tm<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> as empirical formula <b>IGNORE</b> Tm<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> if seen in working.</p>
	(e)	(i)	32 ✓	1	
		(ii)	9 ✓	1	
			<b>Total</b>	<b>13</b>	

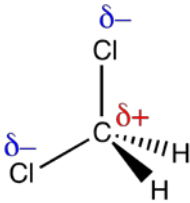



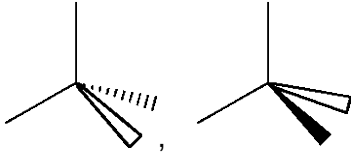
Question		Answer	Mark	Guidance
2	(a)	$2\text{Al} + 3\text{F}_2 \rightarrow 2\text{AlF}_3$ ✓	1	<b>ALLOW</b> multiples <b>IGNORE</b> state symbols
	(b) (i)	Repeating pattern ✓ of oppositely charged ions ✓	2	<b>ALLOW</b> 'regular' <b>OR</b> 'alternating' <b>OR</b> 'uniform (arrangement)' for 'repeating pattern' <b>ALLOW</b> positive and negative ions <b>OR</b> aluminium ions and fluoride ions <b>ALLOW</b> oppositely charged ions from a labelled diagram
	(ii)	 <p>Al with 8 (or no) outermost electrons <b>AND</b> 3 x fluoride (ions) with 'dot-and-cross' outermost octet ✓ Correct charges ✓</p>	2	For first mark: If 8 electrons are shown in the cation then the 'extra' electron in the anion must match the symbol chosen for the electrons in the cation <b>IGNORE</b> inner shells <b>IGNORE</b> circles  <b>ALLOW</b> one mark if both electron arrangements and charges are correct but only one F is drawn.  <b>ALLOW</b> one mark if incorrect symbol is the only error, unless ECF from 2(a) in which both marks are available  <b>DO NOT ALLOW</b> any marks for $\text{BF}_3$  <b>ALLOW</b> $3[\text{F}^-]$ $3[\text{F}]^-$ $[\text{F}^-]_3$ (brackets not required)  <b>DO NOT ALLOW</b> $[\text{F}_3]^-$ $[\text{F}_3]^{3-}$ $[3\text{F}]^{3-}$ $[\text{F}]_3^-$
	(c) (i)	A shared pair of electrons.	1	
	(c) (ii)		1	

Question	Answer	Mark	Guidance
(d)	<p><i>Conductivity of Al mark</i> M1: Aluminium conducts in solid and molten states ✓</p> <p><i>Reason for conductivity of Al mark</i> M2: Aluminium has delocalised electrons ✓</p> <p><i>Conductivity and reason for molten <math>AlF_3</math> mark</i> M3: Aluminium fluoride conducts when molten <b>AND</b> because it has mobile <b>ions</b> ✓</p> <p><i>Conductivity and reason for solid <math>AlF_3</math> mark</i> M4: Aluminium fluoride does not conduct when solid <b>AND</b> Solid aluminium fluoride has <b>ions</b> which are fixed (in position) <b>OR ions</b> are held (in position) <b>OR ions</b> are not mobile <b>AND</b> In an (ionic) lattice <b>OR</b> (ionic) structure <b>OR</b> by (ionic) bonds ✓</p>	5	<p><b>ALLOW</b> 'carries charge' for conducts <b>IGNORE</b> 'charge carriers' for 'electrons' or 'ions' for M2, M3 and M4.</p> <p><i>Quality of written communication:</i> 'delocalis(z)ed' spelled correctly and used in context for the second marking point.</p> <p><b>DO NOT ALLOW</b> M2 if incorrect bonding is seen for Al <b>DO NOT ALLOW</b> 'ions move' for solid Al. <b>IGNORE</b> 'ions move' for molten Al.</p> <p><b>IGNORE</b> references to 'aqueous' <math>AlF_3</math> for M3 <b>IGNORE</b> 'delocalised ions' <b>OR</b> 'free ions' for mobile ions in M3 <b>DO NOT ALLOW</b> M3 if incorrect bonding is seen in <math>AlF_3</math> <b>DO NOT ALLOW</b> any mention of electrons moving for M3 <b>DO NOT ALLOW</b> suggestion that it is only positive or only negative ions moving for M3 For conductivity parts of M3 + M4 <b>ALLOW</b> '<math>AlF_3</math> only conducts when molten'</p> <p><b>ALLOW</b> Solid <math>AlF_3</math> is a poor conductor for M4 <b>ALLOW</b> second and third statements to be unlinked in separate sentences for M4 <b>IGNORE</b> 'there are no delocalised electrons' for M4 <b>DO NOT ALLOW</b> M4 if incorrect bonding is seen in <math>AlF_3</math> Lattice <b>OR</b> structure <b>OR</b> ionic bonds can be seen anywhere in relation to <math>AlF_3</math>.</p> <p><b>ALLOW</b> Solid <math>BBr_3</math> is a poor conductor for M5 <b>ALLOW</b> electrons are fixed in position <b>OR</b> used in bonds</p>



Question			Answer	Mark	Guidance
			<p><i>Conductivity and reason for BBr<sub>3</sub> mark</i></p> <p>M5 Boron tribromide does not conduct in solid and molten states</p> <p><b>AND</b></p> <p>Boron tribromide has no mobile electrons <b>OR</b> no (mobile) ions <b>OR</b> no mobile charge carriers <b>OR</b> no mobile charged particles ✓</p>		<p><b>IGNORE</b> 'there are no delocalised electrons' <b>OR</b> 'there are no free electrons' for M5</p> <p><b>DO NOT ALLOW</b> M5 if incorrect bonding is seen in BBr<sub>3</sub> eg 'ions are fixed in position'</p> <p><b>ALLOW</b> 'no (free) ions'</p>
2	(e)	(i)	$\text{Al}^{2+}(\text{g}) \rightarrow \text{Al}^{3+}(\text{g}) + \text{e}^{-} \checkmark$	1	<p>State symbols required (ignore states on electrons)</p> <p><b>ALLOW</b> <math>\text{Al}^{2+}(\text{g}) - \text{e}^{-} \rightarrow \text{Al}^{3+}(\text{g})</math></p> <p><b>ALLOW</b> e for e<sup>-</sup></p>
		(ii)	<p>All (thirteen) ionisation energies show an increase ✓</p> <p>The two largest increases are between the third and fourth</p> <p><b>AND</b></p> <p>the eleventh and twelfth ionisation energies ✓</p>	2	<p><b>IGNORE</b> line if drawn</p> <p><b>IGNORE</b> 0 if included</p> <p><b>ALLOW</b> one mark for three lines (no crosses) showing an increase between: first and third; fourth and eleventh; twelfth and thirteenth</p> <p><b>AND</b></p> <p>Largest increases between each line</p> <p><b>ALLOW</b> crosses outside grid</p>
			<b>Total</b>	<b>15</b>	

Question		Answer	Mark	Guidance
3	(a)	Cl (has been oxidised) from Cl = -1 to Cl = 0 ✓ Mn (has been reduced) from Mn = +4 to Mn = +2 ✓	2	<b>ALLOW</b> 4+ <b>OR</b> 4 <b>OR</b> 2+ <b>OR</b> 2 <b>ALLOW</b> oxidation numbers written above the equation but <b>IGNORE</b> these if oxidation numbers are given in the text  <b>ALLOW</b> one mark for Cl is oxidised because the oxidation number increased by 1 <b>AND</b> Mn is reduced because the oxidation number decreased by 2 <b>ALLOW</b> one mark if all oxidation numbers are correct but redox is incorrect. <b>IGNORE</b> HCl is oxidised <b>AND</b> MnO <sub>2</sub> is reduced <b>IGNORE</b> correct references to electron loss/gain <b>DO NOT ALLOW</b> incorrect references to electron loss/gain
	(b)	1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>6</sup> 3s <sup>2</sup> 3p <sup>6</sup> 3d <sup>5</sup> 4s <sup>2</sup> ✓	1	<b>ALLOW</b> 4s <sup>2</sup> 3d <sup>5</sup> <b>IGNORE</b> 1s <sup>2</sup> seen twice
	(c)	Cl <sub>2</sub> + 2NaOH → NaClO + NaCl + H <sub>2</sub> O ✓	1	<b>ALLOW</b> multiples <b>IGNORE</b> state symbols <b>ALLOW</b> OH <sup>-</sup> and ClO <sup>-</sup> , i.e. Cl <sub>2</sub> + 2OH <sup>-</sup> → ClO <sup>-</sup> + Cl <sup>-</sup> + H <sub>2</sub> O <b>ALLOW</b> NaOCl
3	(d) (i)	(The solution would turn) yellow <b>OR</b> orange <b>OR</b> brown ✓	1	<b>ALLOW</b> shades and colours (eg dark yellow, yellow-orange)  <b>DO NOT ALLOW</b> 'purple'
	(d) (ii)	Cl <sub>2</sub> (g) + 2I <sup>-</sup> (aq) → I <sub>2</sub> (aq) + 2Cl <sup>-</sup> (aq) ✓	1	<b>ALLOW</b> multiples State symbols required <b>ALLOW</b> Cl <sub>2</sub> (aq)
	(e) (i)	The ability of an atom to attract electrons ✓  (Electron pair) in a (covalent) bond ✓	2	<b>ALLOW</b> 'Measure' for ability  <b>ALLOW</b> 'attraction' for 'ability to attract'  <b>ALLOW</b> 'The ability of an atom to attract a shared pair of electrons' for two marks

Question			Answer	Mark	Guidance
3	(e)	(ii)	 <p>Correct orientation of 3-D tetrahedral arrangement of bonds around C atom ✓</p> <p>δ+ on C atom <b>AND</b> δ- on both Cl atoms ✓</p>	2	<p>For a 3D structure,</p> <p>For bond in the plane of paper, a solid line is expected:</p>  <p>For bond out of plane of paper, a solid wedge is expected:</p>  <p>For bond into plane of paper, <b>ALLOW</b>:</p>  <p><b>ALLOW</b> a hollow wedge for 'in bond' <b>OR</b> an 'out bond', provided it is different from the other in or out wedge e.g.:</p>  <p><b>ALLOW</b> any 3D representation with a minimum of one bond into the plane of paper <b>AND</b> minimum of one out of plane of paper</p> <p><b>ALLOW</b> 2 lines in the plane + 2 different bonds for M1</p> <p><b>IGNORE</b> dipole charges on H</p>
		(iii)	<p>The dipoles do not cancel out <b>OR</b> Because the molecule is non-symmetrical ✓</p>	1	<p><b>ALLOW</b> partial charges do not cancel</p> <p><b>IGNORE</b> charges do not cancel</p> <p><b>ALLOW</b> (the more) electronegative atoms are on one side of the molecule</p>
	(f)		55% ✓	1	
<b>Total</b>				<b>12</b>	

Question			Answer	Mark	Guidance
4	(a)	(i)	Mol of $\text{H}_2\text{SO}_4 = 0.100 \times 18.00/1000 = 1.80 \times 10^{-3} \text{ mol}$ ✓	1	<b>ALLOW</b> calculator value or rounding to 2 significant figures or more but <b>IGNORE</b> 'trailing zeroes' throughout Q4. eg 0.200 is allowed as 0.2
		(ii)	Mol of NaOH in = $1.80 \times 10^{-3} \times 2 \times 1000/25.0 = 0.144 \text{ mol dm}^{-3}$ ✓	1	<b>ALLOW</b> ECF for (a)(i) $\times 2 \times 1000/25$
	(b)	(i)	<p><b>Check the answer line.</b>  <b>If answer = 0.0184 mol award 2 marks</b></p> <p>Mol of <math>\text{NaHCO}_3</math> in <math>25.0 \text{ cm}^3 = [0.100 \times 11.50/1000] \times 2 = 0.00230 \text{ mol}</math> ✓</p> <p>Mol of <math>\text{NaHCO}_3</math> in <math>200 \text{ cm}^3 = 0.00230 \times 200/25.0 = 0.0184 \text{ mol}</math> ✓</p>	2	<p><b>If there is an alternative answer, check to see if there is any ECF credit possible using working below.</b></p> <p><b>ALLOW</b> for an alternative method for M1  Total mol of <math>\text{H}_2\text{SO}_4</math> used = <math>[0.100 \times 29.50/1000] = 0.00295 \text{ mol}</math></p> <p>Mol of <math>\text{H}_2\text{SO}_4</math> reacting with <math>\text{NaHCO}_3 = 0.00295</math> – answer to (a)(i)  Expected answer = <math>.00295 - 0.00180 = 0.00115 \text{ mol}</math></p> <p>Mol of <math>\text{NaHCO}_3</math> in <math>25.0 \text{ cm}^3 = 0.00115 \times 2 = 0.00230 \text{ mol}</math></p> <p><b>ALLOW</b> ECF for <b>mol</b> of <math>\text{NaHCO}_3 \times 200/25.0</math></p> <p>For ECF in M2 titration values of 11.50 or 29.50 must have been used in M1</p> <p>Second marking point is for scaling up number of mol of <math>\text{NaHCO}_3</math> by <math>200/25.0</math> (Usually seen as '8')</p>
		(ii)	Mass of $\text{NaHCO}_3 = 0.0184 \times 84.0 = 1.55 \text{ g}$ ✓ <b>(must be three significant figures)</b>	1	<b>ALLOW</b> ECF for <b>(b)(i)</b> $\times 84.0$ correctly calculated and rounded to three significant figures.
<b>Total</b>				<b>5</b>	

Question			Answer	Mark	Guidance
5	(a)	(i)	$2\text{Ca} + \text{O}_2 \rightarrow 2\text{CaO}$ ✓	1	<b>ALLOW</b> multiples e.g. $\text{Ca} + \frac{1}{2}\text{O}_2 \rightarrow \text{CaO}$ <b>IGNORE</b> state symbols
		(ii)	Thermal decomposition ✓	1	
	(b)		Base: A substance which readily accepts $\text{H}^+$ ions (from an acid) ✓  Alkali: releases $\text{OH}^-$ ions into (aqueous) solution ✓	2	<b>ALLOW</b> proton acceptor  <b>ALLOW</b> Is soluble and releases $\text{OH}^-$ ions (into aqueous solution)
	(c)		Effervescence <b>OR</b> fizzing <b>OR</b> bubbling <b>OR</b> gas produced <b>AND</b> The solid <b>OR</b> calcium <b>OR</b> the metal would dissolve <b>OR</b> disappear <b>OR</b> a (colourless) solution forms ✓  $\text{Ca} + 2\text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2 + \text{H}_2$ ✓	2	<b>IGNORE</b> 'hydrogen produced' but <b>ALLOW</b> 'hydrogen gas produced' <b>DO NOT ALLOW</b> an incorrectly named gas (eg $\text{CO}_2$ ) produced  <b>ALLOW</b> multiples <b>IGNORE</b> state symbols
	(d)		Nitric acid <b>OR</b> $\text{HNO}_3$ ✓  $\text{CaCO}_3 + 2\text{HNO}_3 \rightarrow \text{Ca}(\text{NO}_3)_2 + \text{H}_2\text{O} + \text{CO}_2$ ✓	2	<b>ALLOW</b> reagent mark if no response is seen but $\text{HNO}_3$ is seen in the equation <b>IGNORE</b> calcium carbonate on reagent line  <b>ALLOW</b> multiples <b>IGNORE</b> state symbols  <b>DO NOT ALLOW</b> $\text{H}_2\text{CO}_3$ for $\text{H}_2\text{O} + \text{CO}_2$
			<b>Total</b>	<b>8</b>	

Question	Answer	Mark	Guidance
6 (a)	<p>The attraction (between nuclei and outermost electrons) increases (across the period) <b>AND</b> The nuclear charge increases <b>OR</b> The number of protons increase ✓</p> <p>(Outer) electrons are in the same shell <b>OR</b> (Outer) electrons experience similar shielding <b>OR</b> Same number of shells <b>OR</b> Atomic radius decreases ✓</p>	2	<p><b>ALLOW</b> There is no change in shielding But <b>DO NOT ALLOW</b> 'there is no shielding'</p> <p><b>DO NOT ALLOW</b> electrons are at the same distance</p>

Question	Answer	Mark	Guidance
(b)	<p><i>M1 NH<sub>3</sub> forces mark</i> NH<sub>3</sub> has hydrogen bonding ✓</p> <p><i>M2 F<sub>2</sub> AND Br<sub>2</sub> forces mark</i> F<sub>2</sub> AND Br<sub>2</sub> have van der Waals' (forces) ✓</p> <p><i>M3 Type of particle mark</i> Forces <b>OR</b> attractions are between molecules <b>OR</b> are intermolecular for ammonia <b>AND</b> Forces <b>OR</b> attractions are between molecules <b>OR</b> are intermolecular for fluorine <b>OR</b> for bromine ✓</p>	5	<p><i>Quality of written communication:</i> 'molecule(s)' or 'intermolecular' spelled correctly once and used in context for the third marking point.</p> <p><b>ALLOW</b> H-bonding for hydrogen bonding <b>IGNORE</b> van der Waals' forces <b>AND</b> permanent dipoles in M1 <b>IGNORE</b> covalent bonds for M1 <b>AND</b> M2</p> <p><b>ALLOW</b>, for van der Waal's: vdWs <b>OR</b> induced dipole temporary <b>OR</b> instantaneous dipole (-dipole) forces <b>ALLOW</b> for forces: attractions <b>OR</b> interactions;</p> <p><b>DO NOT ALLOW</b> M3, M4 or M5 if covalent <b>OR</b> ionic bonds are the forces between the particles in that mark</p> <p>M3 can be seen anywhere eg in M1 NH<sub>3</sub> has hydrogen bonding between molecules <b>AND</b> the intermolecular force in Br<sub>2</sub> is stronger than that of F<sub>2</sub> eg a generic statement such as 'boiling point of these substances is determined by strength of <i>intermolecular bonding</i>' eg 'All these <i>molecules</i> are <i>held</i> together by weak forces'</p>

Question	Answer	Mark	Guidance
	<p><i>M4 Br<sub>2</sub> / F<sub>2</sub> comparison mark</i>            The van der Waals' forces in Br<sub>2</sub> are greater than in F<sub>2</sub>  <b>AND</b>            Because bromine has more electrons than fluorine ✓</p> <p><i>M5 Br<sub>2</sub> / NH<sub>3</sub> / F<sub>2</sub> comparison mark</i>            The van der Waals' forces in Br<sub>2</sub> are greater than hydrogen bonding in NH<sub>3</sub>  <b>AND</b>            hydrogen bonding in NH<sub>3</sub> is stronger than van der Waals' forces in F<sub>2</sub> ✓</p>		<p>If correct force is given in M2 <b>ALLOW</b>, for M4, 'intermolecular force in Br<sub>2</sub> is stronger than that in F<sub>2</sub>'</p> <p><b>ALLOW</b> more van der Waals' for greater van der Waals'  <b>ALLOW</b> more shells of electrons</p> <p><b>IGNORE</b> 'permanent dipoles' in NH<sub>3</sub> for M5 if quoted in addition to hydrogen bonding</p> <p>If correct force is given in M1 <b>AND</b> M2 <b>ALLOW</b>, for M5, 'intermolecular force in Br<sub>2</sub> is stronger than that in NH<sub>3</sub>'  <b>AND</b> 'intermolecular force in NH<sub>3</sub> is stronger than that in F<sub>2</sub>'</p> <p>If incorrect intermolecular force is given in M1 <b>OR</b> M2 <b>ALLOW</b> this as ECF for M5 but <b>DO NOT ALLOW</b> if the comparison is based only on van der Waals' forces            Eg <b>DO NOT ALLOW</b> the van der Waals' forces in bromine are stronger than those in ammonia which in turn are stronger than those in fluorine</p>
	<b>Total</b>	<b>7</b>	



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