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A' Level Chemistry

Year 1

Unit 3: Shapes

Summer Examination Revision Pack

The questions in this pack should be attempted **AFTER** completing all other revision.

Grade Accelerator

Recall Definitions
Drawing Diagrams
Using Equations
Drawing Graphs

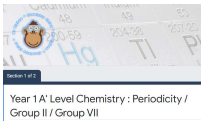
Quizlet

Quizlet Classes

Flashcard Based
Games
Tests & Quizzes
Keyword Spell Checker

Condensed Notes

Keywords & Definitions
Key Concepts
Application
Key Skills



Online Forms

Take Time to Answer
Use Paper & Calculator
Work It Out
Review Missed Marks

Use the 3 Wave Process when completing these revision packs.

1. Complete the questions without assistance
(Can't answer a question? Leave it and move on)
2. Use your notes to fill any gaps after step 1
3. Use the mark scheme to fill in any remaining gaps.

1. Having gaps after step 1 is normal, that's why we are doing revision!
2. If your notes don't help during step 2, they are not good enough!
(Change your note taking method and try to understand the problem)
3. If you don't understand why the mark scheme answer is correct, **see Andy.**

If you struggle with the questions in the pack, **STOP!** and complete some more revision.

If you come to a complete dead-end, **STOP!** and speak to **Andy** asap.

7 Ammonia reacts with aluminium chloride as shown by the equation:

$$NH_3 + AlCl_3 \rightarrow H_3NAlCl_3$$

0 7 . 1 Draw diagrams to illustrate the shapes of NH_3 molecules and of $AlCl_3$ molecules.

Include in your diagrams any lone pairs of electrons that influence the shape.

Indicate the values of the bond angles.

[3 marks]

0 7 . 2 Name the type of bond formed between N and Al in H_3NAlCl_3 and explain how this bond is formed.

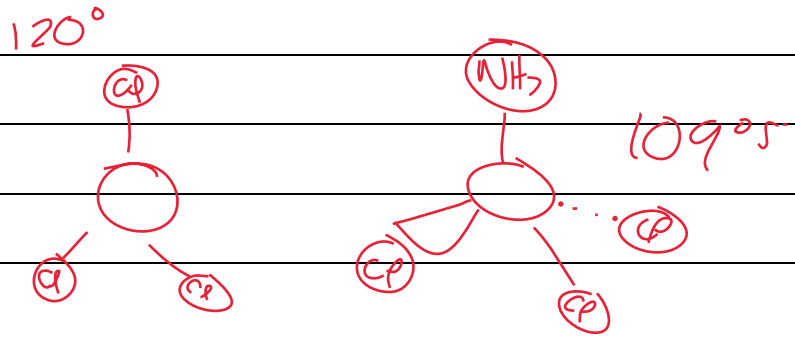
[2 marks]

Type of bond _____

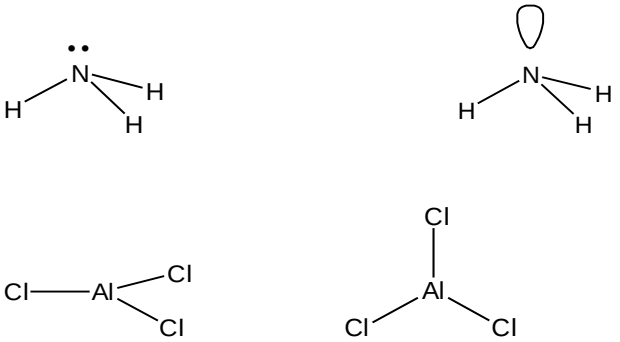
Explanation _____

0 7 . 3 Explain how the value of the Cl-Al-Cl bond angle in $AlCl_3$ changes, if at all, on formation of the compound H_3NAlCl_3

[2 marks]



Turn over for the next question

Question	Marking Guidance	Mark	Comments
07.1	Correct diagram of NH_3 including LP on N Correct diagram of $AlCl_3$ bond angles in range 106-108° and bond angle of 120° 	1 1 1	Ignore shape names
07.2	Dative (covalent) /co-ordinate bond Shared pair of / both electrons come from the N(H_3)	1 1	Wrong bond CE=0 but mark on if covalent quoted
07.3	Aluminium is now surrounded by 4 electron pairs/bonds or is tetrahedral Therefore Cl-Al-Cl bond angle decreases / changes (from 120° in $AlCl_3$) to allow range 107-111° in H_3NAlCl_3	1 1	Independent

0 5 This question is about intermolecular forces.

0 5 . 1 Give the meaning of the term electronegativity.

[1 mark]

0 5 . 2 Explain how permanent dipole-dipole forces arise between hydrogen chloride molecules.

[2 marks]

0 5 . 3 Complete **Table 4** by naming the shape of each molecule.

Place a tick (✓) in the final column if the molecule has a permanent dipole.

[4 marks]

Table 4

Molecule	Name of shape	Tick (✓) if molecule has a permanent dipole
SiH_4		
PH_3		
$BeCl_2$		
CH_3Cl		

7

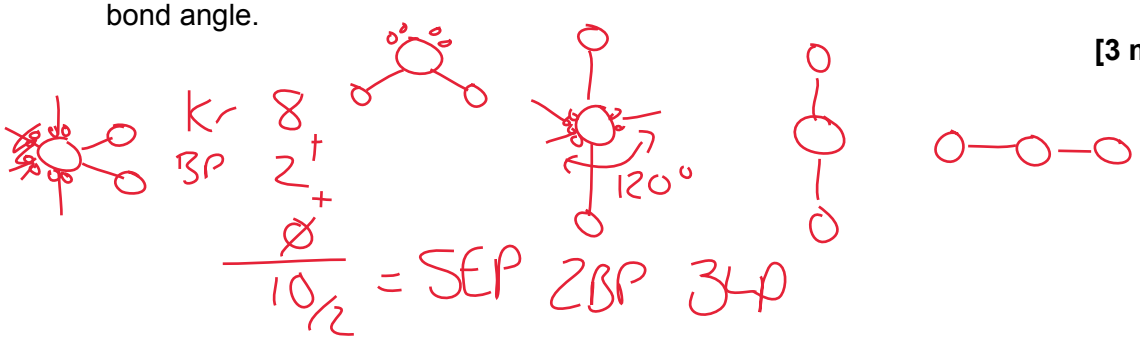
Question	Marking Guidance	Mark	Additional Comments/Guidance
05.1	Power of an atom to attract a pair of electrons in a covalent bond.	1	Allow power of an atom to attract a bonding/shared pair of electrons Allow power of an atom to withdraw electron density from a covalent bond Not lone pair Not Element
05.2	<u>Difference in electronegativity</u> leads to bond polarity (dipoles don't cancel the molecule has an overall permanent dipole) and there is an attraction between ∂+ on one molecule and ∂- on another	1 1	If chloride (ions) mentioned then CE=0 partial charges should be correct if shown and can score M2 from diagram

05.3	SiH_4	**Tetrahedral**		1 shape & no tick	If shapes are drawn rather than named then penalise first mark gained
	PH_3	**Pyramidal (trigonal) Allow tetrahedral**	√	1 shape & tick	
	$BeCl_2$	**Linear**		1 shape & no tick	
	CH_3Cl	**(Distorted)Tetrahedral**	√	1 shape & tick	

0 9 This question is about compounds containing fluorine.

0 9 . 1 Draw the shape of a molecule of krypton difluoride (KrF_2).
Include in your answer any lone pairs of electrons that influence the shape.
Name the shape produced by the atoms in a KrF_2 molecule and suggest a bond angle.

[3 marks]



Name of shape _____

Bond angle _____

0 9 . 2 There are two lone pairs of electrons on the oxygen atom in a molecule of oxygen difluoride (OF_2).

Explain how the lone pairs of electrons on the oxygen atom influence the bond angle in oxygen difluoride.

[2 marks]

_____

_____

_____

_____

_____

_____

_____

Turn over ►

0 9 . 3 Silicon tetrafluoride (SiF_4) is a tetrahedral molecule.

Deduce the type of intermolecular forces in SiF_4
Explain how this type of intermolecular force arises and why no other type of intermolecular force exists in a sample of SiF_4

[3 marks]

Intermolecular forces in SiF_4 _____

Explanation _____

_____

_____

_____

_____

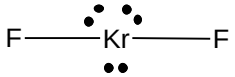
_____

_____

_____

_____

8

Qu	Marking Guidance	Additional Comments	Mark
9.1	 Linear 180^{o}	Allow diagram with 2 bonds and 3 lone pairs	1 1 1
9.2	Lone pairs repel more than bond pairs bond angle will be lower (than regular tetrahedral angle) / bond angle of 103-106^{o}	 Allow idea of reducing bond angle	1 1
9.3	Van der Waals forces (Uneven distribution of electrons in) one molecule induces dipole in neighbouring/another/nearby molecule symmetrical molecule / dipoles cancel OR no hydrogens bonded to F (N or O), therefore no hydrogen bonding	Allow London forces, dispersion forces, induced dipole-dipole Apply List for M1. Allow M2 if vdW mentioned in M1, otherwise CE=0	1 1 1

Do not write outside the box

0 1 . 3 The ion H_2F^+ is formed when hydrogen fluoride gains a proton as shown in the equation

$$HF + H^+ \rightarrow H_2F^+$$

Name the type of bond formed when HF reacts with H^+
Explain how this bond is formed.

[2 marks]

Type of bond _____

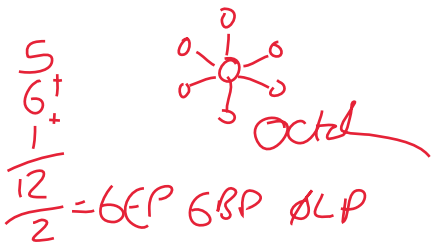
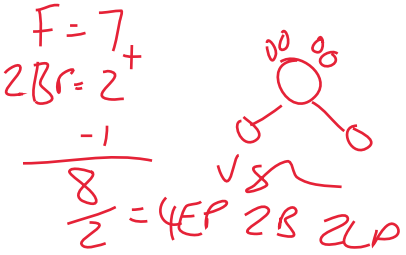
Explanation _____

0 1 . 4 Fluoroantimonic acid contains two ions, SbF_6^- and H_2F^+

Draw the shape of the SbF_6^- ion and the shape of the H_2F^+ ion. Include any lone pairs that influence the shape.

Name the shape of each ion.

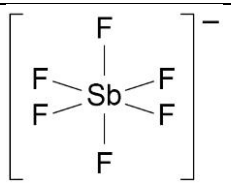
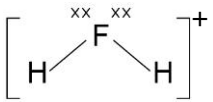
[4 marks]

	SbF_6^-	H_2F^+
Shape		
Name of shape		

<table>
<tr><th>Question</th><th>Marking guidance</th><th>Additional Comments/Guidelines</th><th>Mark</th></tr>
<tr><td>01.3</td><td>Type of Bond: Coordinate bond / dative (covalent) bond

Explanation: A (lone) pair of electrons is donated from F</td><td>If just covalent, then do not award M1 but mark on

Allow both electrons (in the shared pair) come from F</td><td>1

1</td></tr>
<tr><td>01.4</td><td><table>
<tr><td>Shape</td><td>  </td><td>  </td></tr>
<tr><td>Name of shape</td><td>Octahedral</td><td>Bent / V-shaped / angular</td></tr>
</table></td><td>Lone pairs on H_2F^+ are essential (can be shown in lobes)
Ignore missing charges

Mark independently</td><td>1
1

1

1</td></tr>
</table>

Do not write outside the box

0 6 This question is about shapes of molecules and ions.

Draw the shape of NCl_3 and of NCl_4^+

Include any lone pairs of electrons that influence the shape.

Name the shape of NCl_3

State and explain the bond angle in NCl_4^+

[5 marks]

Shape of NCl_3 **Shape of NCl_4^+**

Name of shape of NCl_3 _____

Bond angle in NCl_4^+ _____

Explanation of bond angle in NCl_4^+ _____

_____

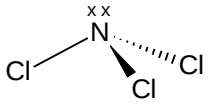
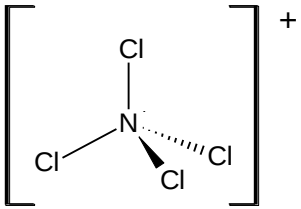
_____

_____

_____

5

Turn over for the next question

Question	Marking guidance	Additional Comments/Guidelines	Mark
06	Shapes:  	Must show lp on NCl_3 Must have some indication that shape is 3D	1 1
	Name of shape of NCl_3 = Pyramidal	Allow tetrahedral	1
	Bond Angle = 109.5°	Allow 109 – 109.5°	1
	(4 bp and 0 lp) electron pairs repel equally / electron pairs repel to be as far apart as possible	Do not allow atoms repel equally Allow bonds repel equally	1

Do not write outside the box

0 3 This question is about shapes of molecules.

Complete **Table 2** by drawing the shapes of both the AsF_5 and KrF_2 molecules, showing all lone pairs of electrons that influence the shape.

Deduce the bond angle(s) in AsF_5

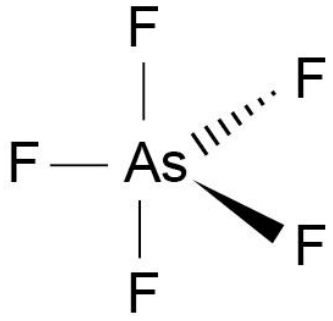
[3 marks]

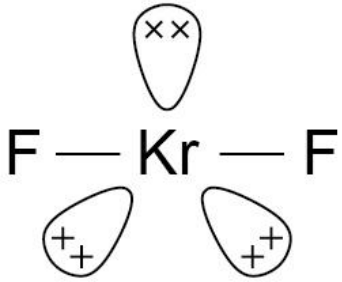
Table 2

	AsF_5	**KrF_2**
Diagram of shape		
Bond angle(s)		

3

Turn over for the next question

<table>
<tr><th>Question</th><th>Marking guidance</th><th>Additional Comments/Guidelines</th><th>Mark</th></tr>
<tr><td>03.1</td><td>
<table>
<tr><th></th><th>AsF_5</th><th>KrF_2</th></tr>
<tr><td>Diagram of shape</td><td> 

M1</td><td> 

M2</td></tr>
<tr><td>Bond angle(s)</td><td>M3: 90 and 120</td><td></td></tr>
</table>
</td><td>KrF_2 must show lone pairs (either as lobes or crosses/dots) and must be linear.

Ignore any lone pairs on fluorine.</td><td>3
(3 x AO1)</td></tr>
</table>

Do not write outside the box

0 3 . 3 Molecules of propan-2-ol and propanone each contain three carbon atoms.

Complete **Table 1** to suggest the shape and a bond angle around the central C atom in a molecule of each compound.

[2 marks]

Table 1

Compound	propan-2-ol $CH_3CH(OH)CH_3$	propanone CH_3COCH_3
Shape around central C atom		
Bond angle around central C atom		

0 3 . 4 Explain why propanone has a lower boiling point than propan-2-ol.

[3 marks]

15

Turn over for the next question

Question	Marking guidance	Additional Comments/Guidelines	Mark
03.3	**M1** propan-2-ol: tetrahedral and 109.5° **M2** propanone: trigonal planar and 120°	**M1** allow 104–110° **M2** allow 115–123° Any two correct boxes scores one mark	1 1
03.4	**M1** propan-2-ol has stronger intermolecular forces **M2** propan-2-ol has hydrogen bonds between molecules **M3** propanone has dipole-dipole forces and/or van der Waals' forces	Penalise **M1** and **M2** for any reference to breaking covalent bonds, (but **M3** could score) For **M2** ignore reference to dipole-dipole forces in propan-2-ol	1 1 1