COVALENT BONDING WS 1

SECTION A

1 Which molecule contains only six bonding electrons?

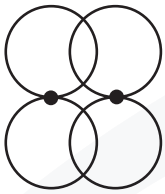
A C_2H_4 **B** C_2F_6 **C** H_2O **D** NF_3

[W'03 Q6]

2 Which diagram describes the formation of a π bond from the overlap of its orbitals?

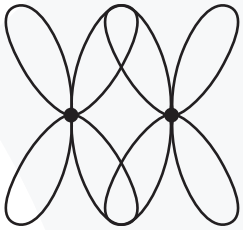
A

B



C

D



[W'06 Q5]

3 The CN^- ion is widely used in the synthesis of organic compounds.

What is the pattern of electron pairs in this ion?

	bonding pairs of electrons	lone pairs on carbon atom	lone pairs on nitrogen atom
A	2	1	1
B	2	2	1
C	3	1	1
D	3	1	2

4 In which species does the underlined atom have an incomplete outer shell?

A $\underline{Al}_2Cl_6$ **B** $\underline{C}H_3^+$ **C** $Cl_2\underline{O}$ **D** $H_2\underline{C}lC\bullet$

[J'12 1 Q11]

5 In which species does the underlined atom have an incomplete outer shell?

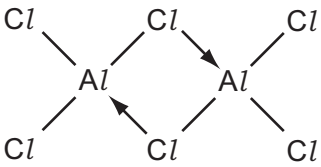
A $\underline{B}F_3$ **B** $\underline{C}H_3^-$ **C** $F_2\underline{O}$ **D** $H_3\underline{O}^+$

[M'1 Q12]

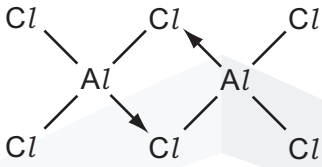
6 Aluminium chloride sublimes at 178 °C.

Which structure best represents the species in the vapour at this temperature?

A



B



C $Al^{\bullet} + 3Cl^{\bullet}$

D $Al^{3+}(Cl^-)_3$

[S'06 Q15]

7 Which element is expected to show the greatest tendency to form some covalent compounds?

A aluminium

B calcium

C magnesium

D sodium

[S'13 Q17]

8 What is the correct number of bonds of each type in the Al_2Cl_6 molecule?

	covalent	co-ordinate (dative covalent)
A	6	1
B	6	2
C	7	0
D	7	1

[S'16 Q2]

9 When solid aluminium chloride is heated, Al_2Cl_6 is formed.

Which bonding is present in Al_2Cl_6?

A covalent and co-ordinate (dative covalent)

B covalent only

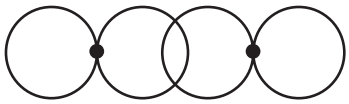
C ionic and co-ordinate (dative covalent)

D ionic only

[W'16 2 Q6]

10 Which diagram represents the overlap of two orbitals which will form a π bond?

A



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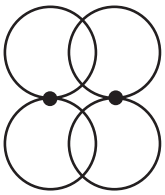

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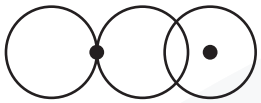
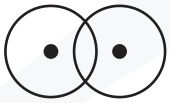


D



[W'15 1 Q4]

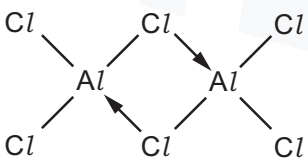
11 What is the correct number of bonds of each type in the Al_2Cl_6 molecule?

	covalent	co-ordinate (dative covalent)
A	6	1
B	6	2
C	7	0
D	7	1

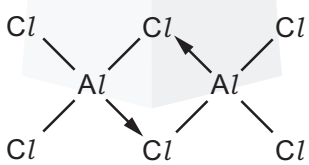
12 Solid aluminium chloride sublimes at 178 °C.

Which structure best represents the species in the vapour at this temperature?

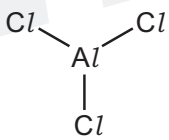
A



B



C



D

$Al^{3+}(Cl^-)_3$

[S'06 Q15]

13 Carbon and silicon have the same outer electronic structure.

Why is a Si–Si bond weaker than a C–C bond?

A Silicon atoms have a larger atomic radius than carbon atoms.

B Silicon has a greater nuclear charge than carbon.

C Silicon has a smaller first ionisation energy than carbon.

D Silicon is more metallic than carbon.

[S'16 2 6]

SECTION B

For each of the questions in this section, one or more of the three numbered statements **1** to **3** may be correct.

Decide whether each of the statements is or is not correct (you may find it helpful to put a tick against the statements that you consider to be correct).

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, 2 and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

No other combination of statements is used as a correct response.

1 Which of the following statements are correct for the sequence of compounds below considered from left to right?

NaF MgO A*l*N SiC

1 The electronegativity difference between the elements in each compound increases.

2 The formula-units of these compounds are isoelectronic (have the same number of electrons).

3 The bonding becomes increasingly covalent.

[W'03 1 Q34]

2 Sodium hydrogensulfide, NaSH, is used to remove hair from animal hides.

Which statements about the SH^- ion are correct?

1 It contains 18 electrons.

2 Three lone pairs of electrons surround the sulfur atom.

3 Sulfur has an oxidation state of +2.

[S'10 3 Q32]

3 Which elements have atoms which can form π bonds with atoms of other elements?

1 oxygen

2 nitrogen

3 fluorine

4 Which elements can form π bonds in their compounds?

1 carbon

2 oxygen

3 nitrogen

[M'16 2 Q31]

5 In the gas phase, aluminium chloride exists as the dimer, Al_2Cl_6.

By using this information, which of the following are structural features of the Al_2Cl_6 molecule?

1 Each aluminium atom is surrounded by four chlorine atoms.

2 There are twelve non-bonded electron pairs in the molecule.

3 Each aluminium atom contributes electrons to four covalent bonds.

COVALENT BONDS WS 2

1 Ethyne is a linear molecule with a triple bond, C≡C, between the two carbon atoms.

Draw a 'dot-and-cross' diagram of an ethyne molecule.

[1]

2 At low temperatures, aluminium chloride vapour has the formula Al_2Cl_6.
Draw a 'dot-and-cross' diagram to show the bonding in Al_2Cl_6.
Show outer electrons only.
Represent the aluminium electrons by ●.
Represent the chlorine electrons by ***x***.

[6]