

3. Chemical bonding

3.7 Dot-and-cross diagrams

Paper 2

Question Paper

1 (b) A molecule of SCl_2 contains two S–Cl covalent bonds.

(i) Complete the dot-and-cross diagram in Fig. 2.1 to show the arrangement of the outer electrons in a molecule of SCl_2 .

Use \times to show electrons from the chlorine atoms.

Use \bullet to show electrons from the sulfur atom.

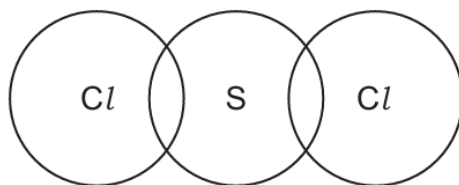


Fig. 2.1

[2]

(ii) Predict the shape of, and bond angle in, a molecule of SCl_2 by using VSEPR theory.

shape

bond angle

[2]

2 (d) SCN^- (aq) is colourless.

Complete the dot-and-cross diagram in Fig. 3.1 to show the arrangement of outer electrons in an SCN^- ion.

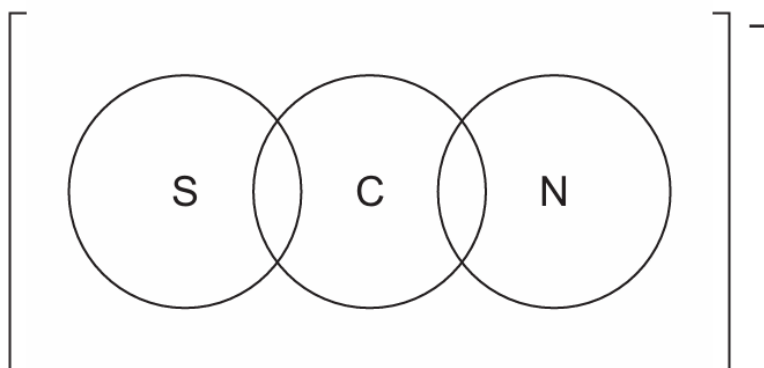


Fig. 3.1

[2]

- 3 (d)** POCl_3 shows similar chemical properties to PCl_5 .

POCl_3 has a melting point of 1°C and a boiling point of 106°C .

POCl_3 reacts vigorously with water, forming misty fumes and an acidic solution.

- (iii)** POCl_3 contains a double covalent bond between P and O.

Complete the dot-and-cross diagram, in Fig. 1.1, to show the bonding in POCl_3 .

Show outer shell electrons only.

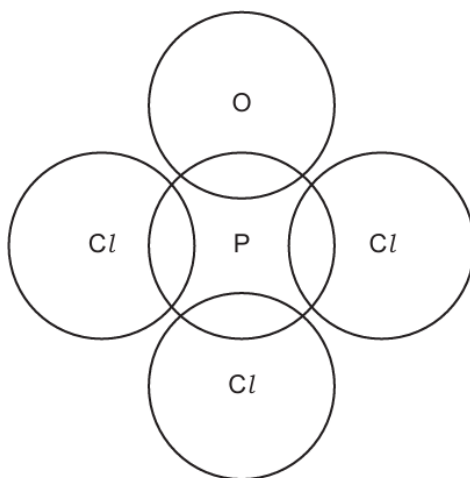


Fig. 1.1

[2]

- 4** Radium, Ra, is an element found in Group 2 of the Periodic Table. It is a crystalline solid at room temperature and conducts electricity.

Radium chloride, RaCl_2 , has a melting point of 900°C and is soluble in water.

- (b)** Draw a dot-and-cross diagram to show the arrangement of outer electrons in RaCl_2 .

[1]

- 5 Some of the common chlorides of Period 3 elements are shown in the list.



- (d) Sulfur, S_8 , reacts with chlorine to form several different chlorides. The most common are S_2Cl_2 and SCl_2 . SCl_2 forms when sulfur reacts with an excess of chlorine.

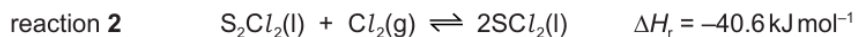
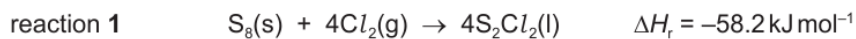


Fig. 3.1 shows the two structural isomers of S_2Cl_2 .

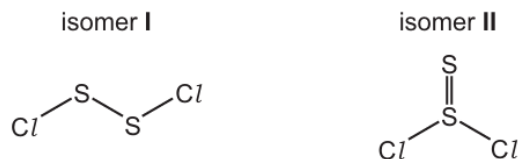
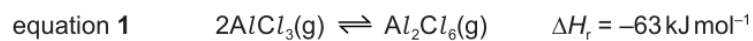


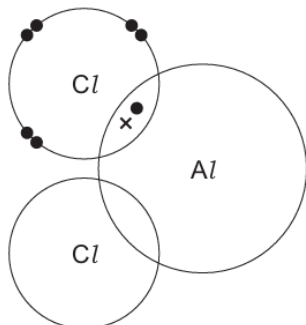
Fig. 3.1

- (vi) Draw a dot-and-cross diagram to show the bonding in isomer II. Show outer shell electrons only.

- 6 (c) In the gas phase, $AlCl_3(g)$ exists at equilibrium with $Al_2Cl_6(g)$ as shown.



- (i) Complete the dot-and-cross diagram to show the bonding in Al_2Cl_6 .



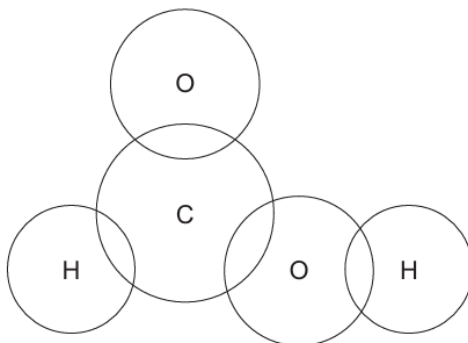
[2]

- (ii) State the effect of an increase in temperature on the equilibrium mixture in equation 1. Explain your answer.

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..... [1]

- 7 (d) Complete the 'dot-and-cross' diagram, showing outer electrons only, to show the bonding in methanoic acid, HCO_2H .



[2]

- 8** Sulfides are compounds that contain sulfur but not oxygen.
- (a) Carbon disulfide, CS_2 , is a volatile liquid at room temperature and pressure.
- (ii) Draw a 'dot-and-cross' diagram of the CS_2 molecule.

[2]

- 9** Magnesium silicide, Mg_2Si , is a compound made by heating magnesium with sand.
- (a) Draw a 'dot-and-cross' diagram to show the arrangement of outer electrons present in a formula unit of Mg_2Si . Assume magnesium silicide is an ionic compound.

[2]