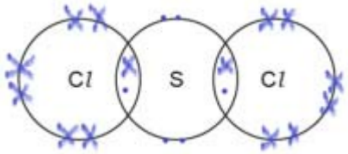
3. Chemical bonding

3.7 Dot-and-cross diagrams

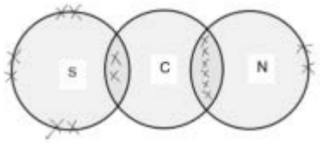
Paper 2

Marking Scheme

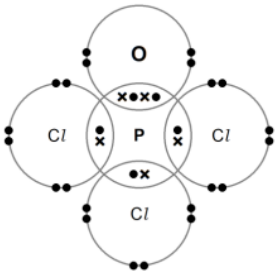
Q1.

(b)(i)	**M1** 1 shared pair of electrons between each S-C*l* shown as •× **M2** 6 non-bonding electrons around each C*l* shown as × **AND** 4 non-bonding electrons around S shown as • 	**2**
(b)(ii)	**M1** shape non-linear **M2** bond angle 103–105(°)	**2**

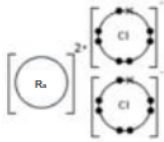
Q2.

(d)	 **M1** 6 electrons between C and N **AND** 2 electrons between C and S **M2** 3 lone pairs around S **AND** none around C **AND** 1 lone pair around N	**2**

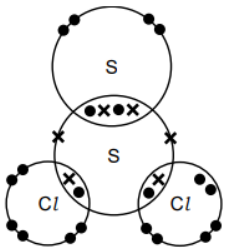
Q3.

(d)(iii)	 Correct bonding e⁻	**1**
	rest of electrons **correct (i.e. to make 32 electrons in total)**	**1**

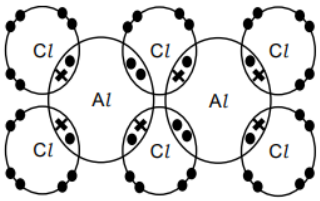
Q4.

(b)	Ra^{2+} and 2 x Cl^- 0 electrons surrounding 2Ra **AND** 8 electrons surrounding Cl 	1

Q5.

(d)(vi)	 **bonding** electrons	1
	all other electrons correct	1

Q6.

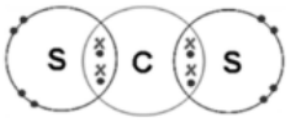
(c)(i)		1
	'dot-and-cross' diagram to show **M1** correct number and connectivity of Cl and Al atoms **M2** 2 correct dative bonds (••) between Cl and Al of $AlCl_3$ neighbour **AND** correct number of non-bonding electrons around each atom of Al_2Cl_6	1

(c)(ii)	reaction is exothermic so equilibrium shifts to the LHS OR equilibrium shifts to LHS because forward reaction is exothermic OR equilibrium shifts to LHS because backward reaction is endothermic OR endothermic reaction is favoured so more reactants / are $AlCl_3$ is made	1

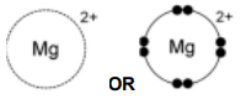
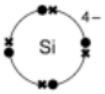
Q7.

(d)	**M1** correct conversion to consistent units P = 101 000 V = 100 / 1 000 000 = (1×10^{-4}) T = 293	1
	M2 use of all values from M1 in correct relationship, n = PV / RT	1
	M3 calculation = 4.15×10^{-3} mol	1

Q8.

(a)(ii)	 **M1** bonding pairs **M2** Correct number of remaining outer electrons	2

Q9.

(a)	**M1** *magnesium* +2 charge on **two** Mg AND both with 0 or 8 electrons 	1
	M2 *silicide* -4 charge on one Si and 8 electrons 	1