2 The Period 3 elements show trends in physical and chemical properties across the period.

(a) **(i)** Explain why the elements Na to Al are good electrical conductors.

.....

..... [1]

(ii) Explain why the elements P, S and Cl do not conduct electricity.

.....

..... [1]

(b) Fig. 2.1 shows the variation in melting point of the Period 3 elements Si to Cl.

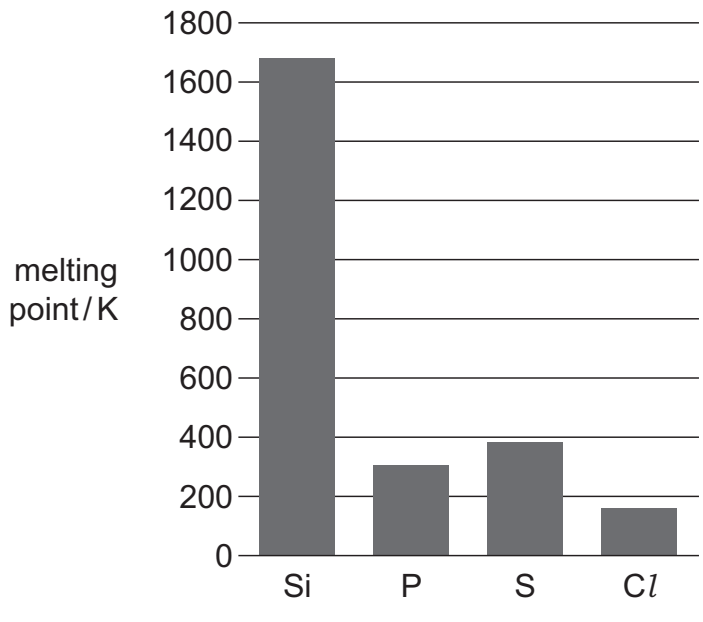

Fig. 2.1

The Period 3 elements Si to Cl are all non-metals.

Explain why there is a large difference between the melting point of Si and the melting points of P, S and Cl.

.....

.....

.....

..... [2]

(c) Table 2.1 gives some information about some Period 3 chlorides.

Row B refers to the pH of the solution that forms when the Period 3 chloride is added to water.

Table 2.1

	formula of Period 3 chloride	NaCl	MgCl_2	AlCl_3	SiCl_4	PCl_5
A	oxidation number of element bonded to Cl					
B	pH of solution		6.5			
C	bonding			ionic		
D	structure			giant		

Complete Table 2.1.

You may use the following abbreviations.

I = ionic, C = covalent, M = metallic
G = giant, S = simple

[4]

(d) **(i)** Write an equation for the formation of AlCl_3 from its elements.

.....

..... [1]

(ii) Write an equation for the formation of H_3PO_4 from PCl_5.

..... [1]

(e) S_2Cl_2(l) reacts with Cl_2(g) in a reversible reaction to form SCl_2(l). Under certain conditions, a dynamic equilibrium is established.

$$S_2Cl_2(l) + Cl_2(g) \rightleftharpoons 2SCl_2(l) \qquad \Delta H = -41\,kJ\,mol^{-1}$$

(i) State what is meant by dynamic equilibrium.

.....

..... [1]

(ii) Identify the condition necessary to establish dynamic equilibrium.

..... [1]

(iii) S_2Cl_2(l) is yellow and SCl_2(l) is red.

$$S_2Cl_2(l) + Cl_2(g) \rightleftharpoons 2SCl_2(l) \qquad \Delta H = -41\,kJ\,mol^{-1}$$

State what is observed when the following changes are made to an equilibrium mixture of S_2Cl_2(l) and SCl_2(l).

Explain your answers.

- The equilibrium mixture is warmed gently.

  observation .....

  explanation .....

  .....

  .....

- The overall pressure of the equilibrium mixture is increased.

  observation .....

  explanation .....

  .....

  .....

[4]

(f) Aqueous MgCl_2 reacts with aqueous Na_2CO_3 to form a white precipitate. Upon heating, the white precipitate undergoes thermal decomposition.

(i) Construct an equation to show the reaction of aqueous MgCl_2 with aqueous Na_2CO_3. Use state symbols in your equation.

..... [2]

(ii) Identify the products of the thermal decomposition of the white precipitate.

..... [1]

(iii) State the trend in thermal stability of the Group 2 carbonates down the group.

..... [1]

[Total: 20]