6 Poly(chloroethene) is a polymer.

It is made from its monomer, chloroethene.

(a) Chloroethene has the percentage composition by mass

C = 38.4% H = 4.8% Cl = 56.8%

Show, by calculation, that the empirical formula of chloroethene is C_2H_3Cl

(3)

(b) The molecular formula of chloroethene is also C_2H_3Cl

Chloroethene can be prepared by a two-stage process.

In stage 1, ethene reacts with chlorine in the presence of an iron(III) chloride catalyst to form dichloroethane.

The reaction is exothermic.

$$C_2H_4 + Cl_2 \rightarrow C_2H_4Cl_2$$

(i) Give the formula of iron(III) chloride.

(1)

(ii) State the purpose of using a catalyst.

(1)

(iii) State the meaning of the term **exothermic**.

(1)

(iv) What type of reaction occurs in stage 1 between ethene and chlorine?

(1)

- ☒ **A** addition
- ☒ **B** displacement
- ☒ **C** neutralisation
- ☒ **D** substitution

(v) In stage 2, dichloroethane decomposes into chloroethene and hydrogen chloride.

Give a chemical equation for this reaction.

(1)

(c) (i) Draw the displayed formula of

- chloroethene
- the repeat unit of poly(chloroethene)

(3)

chloroethene	repeat unit of poly(chloroethene)

(ii) Draw a dot-and-cross diagram to represent a molecule of chloroethene.

Show only the outer electrons of each atom.

(2)

(Total for Question 6 = 13 marks)

9 (a) Diamond is a naturally-occurring form of carbon.

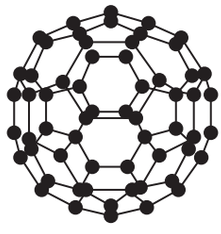
It has a giant molecular structure.

Explain, with reference to its structure and bonding, why diamond has a high melting point.

(3)

(b) C_{60} fullerene is another form of carbon.

The diagram shows a molecule of C_{60} fullerene.



(i) Explain why C_{60} fullerene has a much lower melting point than diamond.

(2)

(ii) C_{60} fullerene is used by doctors when injecting medicines into their patients.

C_{60} fullerene allows medicines, which might damage some parts of the body, to reach the part of the body where they are needed.

Suggest why C_{60} fullerene is suitable for this purpose.

(1)

(c) Graphite is another naturally-occurring form of carbon.
Graphite can be used in pencils because it is soft and can leave marks on paper.
Graphite can also be used as a conductor of electricity.

Explain why graphite is soft and conducts electricity.
Refer to structure and bonding in your answer.

(5)

(Total for Question 9 = 11 marks)