

- 0 3** . **1** Write an equation, including state symbols, for the reaction with enthalpy change equal to the standard enthalpy of formation for  $\text{CF}_4(\text{g})$ .

[1 mark]

---

- 0 3** . **2** Explain why  $\text{CF}_4$  has a bond angle of  $109.5^\circ$ .

[2 marks]

---



---



---



---



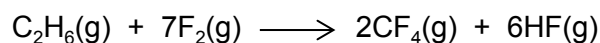
---

- 0 3** . **3** **Table 2** gives some values of standard enthalpies of formation ( $\Delta_f H^\ominus$ ).

**Table 2**

<b>Substance</b>	$\text{F}_2(\text{g})$	$\text{CF}_4(\text{g})$	$\text{HF}(\text{g})$
$\Delta_f H^\ominus / \text{kJ mol}^{-1}$	0	-680	-269

The enthalpy change for the following reaction is  $-2889 \text{ kJ mol}^{-1}$ .

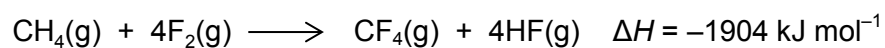


Use this value and the standard enthalpies of formation in **Table 2** to calculate the standard enthalpy of formation of  $\text{C}_2\text{H}_6(\text{g})$ .

[3 marks]

Standard enthalpy of formation of  $\text{C}_2\text{H}_6(\text{g}) =$  \_\_\_\_\_  $\text{kJ mol}^{-1}$

**0 3** . **4** Methane reacts violently with fluorine according to the following equation.



Some mean bond enthalpies are given in **Table 3**.

**Table 3**

<b>Bond</b>	<b>C–H</b>	<b>C–F</b>	<b>H–F</b>
<b>Mean bond enthalpy / kJ mol<sup>-1</sup></b>	412	484	562

A student suggested that one reason for the high reactivity of fluorine is a weak F–F bond .

Is the student correct? Justify your answer with a calculation using these data.

**[4 marks]**

---

---

**Turn over for the next question**