



Average Bond Enthalpy

A Level



The average bond enthalpy of the C–F bond in tetrafluoromethane is given by the standard enthalpy change for one of the following reactions. Which one is it?

- ☐ $2\text{F}_2(\text{g}) + \text{C}(\text{s}) \longrightarrow \text{CF}_4(\text{g})$
- ☐ $\frac{1}{4}\text{CF}_4(\text{g}) \longrightarrow \frac{1}{4}\text{C}(\text{g}) + \text{F}(\text{g})$
- ☐ $\text{CF}_4(\text{g}) \longrightarrow \text{CF}_3(\text{g}) + \text{F}(\text{g})$
- ☐ $\text{CF}_4(\text{s}) \longrightarrow \text{CF}_4(\text{g})$
- ☐ $\text{CF}_4(\text{g}) \longrightarrow \text{CF}_3^+(\text{g}) + \text{F}^-(\text{g})$

Adapted with permission from UCLES, OCSEB A Level Chemistry, June 1995, Paper 1, Question 10



Essential Pre-Uni Chemistry F2.4

A Level



Given that the bond energy of H–H is 4.53 eV, D–D is 4.59 eV, and the energy change on reaction $\text{H}_2 + \text{D}_2 \longrightarrow 2\text{HD}$ is +0.02 eV, find the bond energy of H–D. Give your answer to 3 significant figures.



Essential Pre-Uni Chemistry F2.1

GCSE



A Level

MEAN BOND ENTHALPIES (in kJ mol^{-1})

H–H	436	C–Cl	327
C–H (average)	413	I–I	151.2
C–H (in CH_4 and CH_3X)	435	H–I	298.3
C–C	347	C–I	228
C=C	612	Br–Br	193
$\text{C} \equiv \text{C}$	838	H–Br	366.3
H–Cl	432	$\text{N} \equiv \text{N}$	945.4
Cl–Cl	243.4	O=O	498.3

Use the mean bond enthalpies given above to calculate the reaction enthalpies for the following reactions in the gas phase:

Part A (a)

$\text{H}_2 + \text{Cl}_2 \longrightarrow 2 \text{HCl}$. Give your answer to 3 significant figures.

Part B (b)

$\text{H}_2 + \text{I}_2 \longrightarrow 2 \text{HI}$. Give your answer to one significant figure.

Part C (c)

$\text{CH}_4 + \text{Cl}_2 \longrightarrow \text{CH}_3\text{Cl} + \text{HCl}$. Give your answer to 2 significant figures.

Part D (d)

$\text{C}_2\text{H}_4 + \text{H}_2 \longrightarrow \text{C}_2\text{H}_6$. Give your answer to 3 significant figures.

Part E (e)

$\text{C}_2\text{H}_2 + 2\text{H}_2 \longrightarrow \text{C}_2\text{H}_6$. Give your answer to 3 significant figures.

Part F (f)

$\text{C}_4\text{H}_{10} \longrightarrow \text{C}_2\text{H}_6 + \text{C}_2\text{H}_4$. Give your answer to 2 significant figures.

Part G (g)

$\text{C}_2\text{H}_4 + \text{HCl} \longrightarrow \text{CH}_3\text{CH}_2\text{Cl}$. Give your answer to 2 significant figures.

Part H (h)

$\frac{1}{2}\text{Cl}_2 \longrightarrow \text{Cl}$. Give your answer to 4 significant figures.

Part I (i)

$\text{C}_2\text{H}_4 + \text{I}_2 \longrightarrow \text{C}_2\text{H}_4\text{I}_2$. Give your answer to 2 significant figures.

Part J (j)

$\text{CH}_2\text{CHCHCH}_2 + 2\text{H}_2 \longrightarrow \text{C}_4\text{H}_{10}$. Give your answer to 3 significant figures.



Essential Pre-Uni Chemistry F2.3

GCSE



A Level



Use some of the following bond enthalpies in kcal mol^{-1} to calculate the enthalpy changes for the reactions (in the gas phase):

C=C	146	C \equiv O	258
O=O	119	H–O	111
C–H	99	H–H	104
C=O	178		

Part A (a)

$\text{C}_2\text{H}_4 + \text{O}_2 \longrightarrow 2 \text{CH}_2\text{O}$. Give your answer to 2 significant figures.

Part B (b)

$\text{CO} + \text{H}_2\text{O} \longrightarrow \text{CO}_2 + \text{H}_2$. Give your answer to 2 significant figures.

Part C (c)

$\text{CH}_2\text{O} \longrightarrow \text{CO} + \text{H}_2$. Give your answer to 2 significant figures.

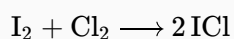


Essential Pre-Uni Chemistry F2.2

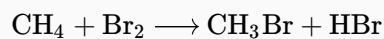
MEAN BOND ENTHALPIES (in kJ mol^{-1})

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Use the reaction enthalpies given (for the gas phase reaction), and the bond enthalpies above, to find the bond enthalpy requested:

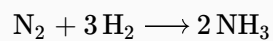
Part A $E(\text{I–Cl})$ ^

$\Delta_r H^\ominus = -70.2 \text{ kJ mol}^{-1}$, find $E(\text{I–Cl})$. Give your answer to 4 significant figures.

Part B $E(\text{C–Br})$ v

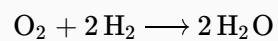
$\Delta_r H^\ominus = -28.3 \text{ kJ mol}^{-1}$, find $E(\text{C–Br})$.

Part C $E(\text{N}-\text{H})$



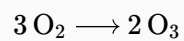
$\Delta_r H^\circ = -92.2 \text{ kJ mol}^{-1}$, find $E(\text{N}-\text{H})$.

Part D $E(\text{O}-\text{H})$



$\Delta_r H^\circ = -483.6 \text{ kJ mol}^{-1}$, find $E(\text{O}-\text{H})$.

Part E $E(\text{O}-\text{O})$



$\Delta_r H^\circ = 285.4 \text{ kJ mol}^{-1}$, find $E(\text{O}-\text{O})$.
