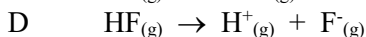
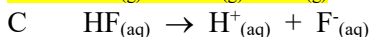
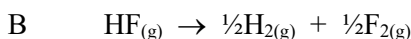


## Bond Energy Answers

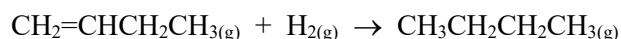
1 Which equation represents the bond enthalpy for the H-F bond?



2 Some bond energies are as follows:

Bond	Bond Enthalpy / $\text{kJ mol}^{-1}$
C-C	347
C=C	613
C-H	416
H-H	437

What is the change in enthalpy for the following chemical reaction?



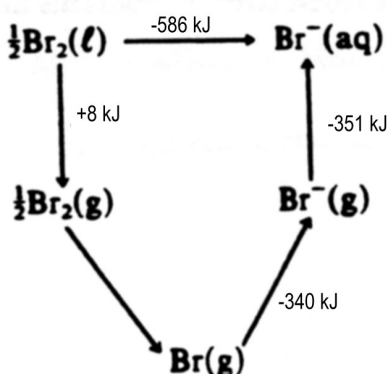
A  $-395 \text{ kJ mol}^{-1}$

**B**  $-129 \text{ kJ mol}^{-1}$

C  $129 \text{ kJ mol}^{-1}$

D  $395 \text{ kJ mol}^{-1}$

3 In the energy cycle shown below, what is the value in  $\text{kJ mol}^{-1}$  for the molar bond enthalpy of bromine?



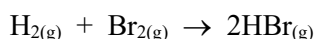
**A**  $+194$

B  $+97$

C  $+49$

D  $+57$

4 The reaction between hydrogen and bromine occurs with the release of 107 kJ of energy as shown below:



$$\Delta H = -107 \text{ kJ}$$

Bond	Bond energy / $\text{kJ mol}^{-1}$
H-H	436
Br-Br	193

What is the H-Br bond energy in  $\text{kJ mol}^{-1}$ ?

A  $261$

**B**  $368$

C  $422$

D  $522$

5 Consider the following reaction:  $\text{N}_2(g) + 3\text{H}_2(g) \rightarrow 2\text{NH}_3(g)$   $\Delta H^\circ = ?$

Bond enthalpies (in  $\text{kJ mol}^{-1}$ ) involved in the reaction are

Which calculation will give the value of  $\Delta H^\circ$ ?

$\text{N}\equiv\text{N}$	x
H-H	y
N-H	z

**A.**  $x + 3y - 6z$

B.  $6z - x + 3y$

C.  $x - 3y + 6z$

D.  $x + 3y - 2z$

6 What energy changes occur when chemical bonds are formed and broken?

A. Energy is absorbed when bonds are formed and when they are broken.

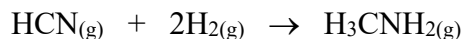
B. Energy is released when bonds are formed and when they are broken.

C. Energy is absorbed when bonds are formed and released when they are broken.

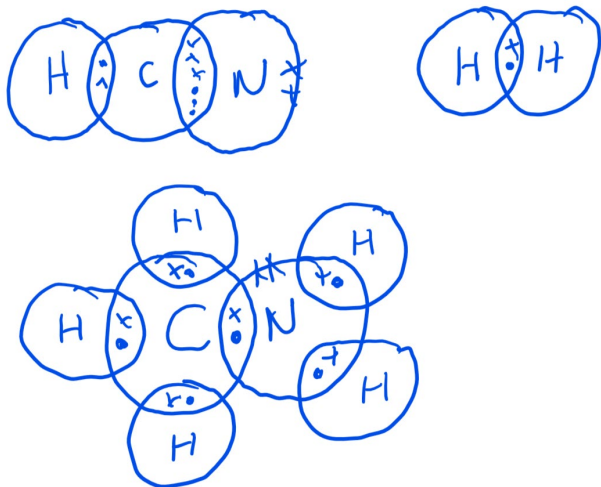
**D.** Energy is released when bonds are formed and absorbed when they are broken.

## Bond Energy Answers

7 Hydrogen cyanide can react with hydrogen to produce methylamine:



(a) Draw the complete dot cross structures for HCN, H<sub>2</sub> and H<sub>3</sub>CNH<sub>2</sub> and show all the valence electrons. [3]



(b) From a consideration of the appropriate bond energies (enthalpies) below, calculate the enthalpy change,  $\Delta H$ , for the reaction of hydrogen cyanide with hydrogen to produce methylamine. Some bond energies are: [3]

$$2163 - 2313 = -150 \text{ kJ mol}^{-1}$$

Bond	kJ mol <sup>-1</sup>
C-H	414
C-N	293
H-H	435
C=N	616
N-H	389
C≡N	879

(c) Also calculate  $\Delta H$  for the reaction above using enthalpies of formation [3]

$$= -158.5 \text{ kJ mol}^{-1}$$

Compound	$\Delta H_f / \text{kJ mol}^{-1}$
HCN <sub>(g)</sub>	130.5
H <sub>3</sub> CNH <sub>2(g)</sub>	-28

(d) Account for the fact that the values obtained in parts (b) and (c) are different. [2]

Bond energy values are averages