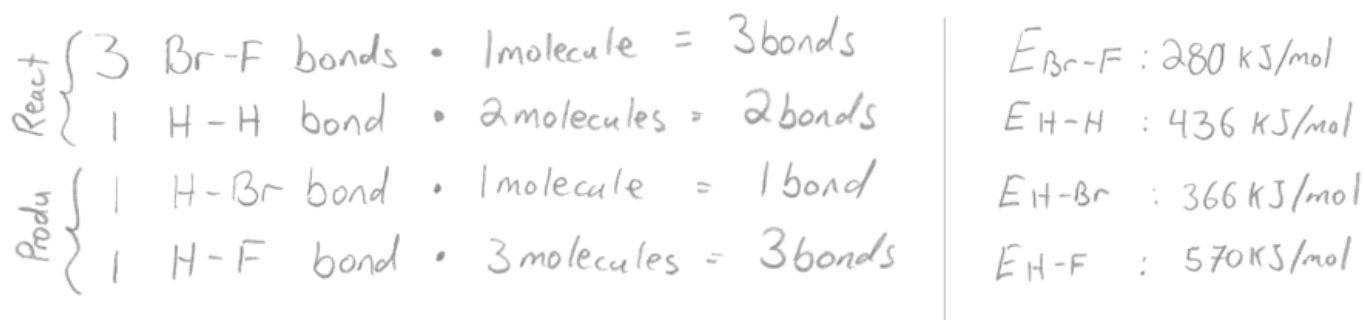
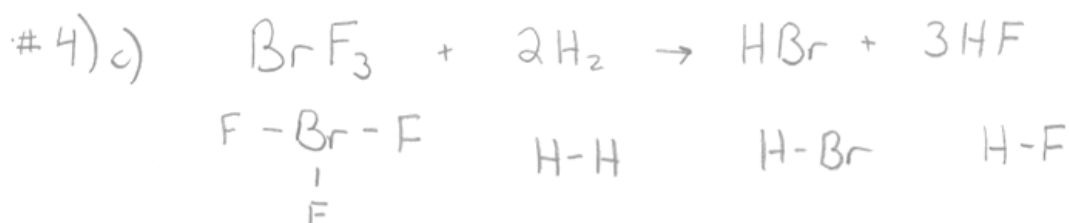
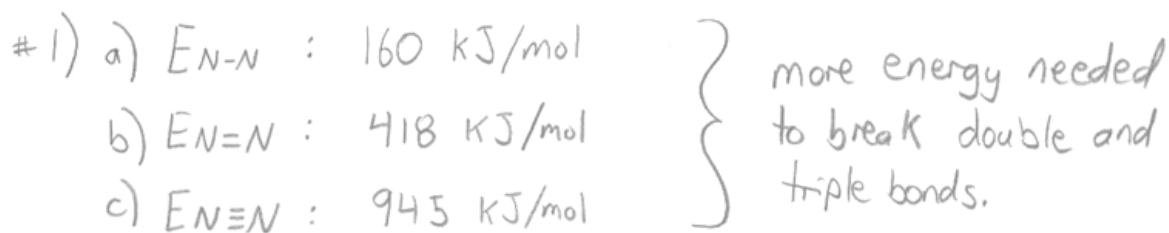


P160.



React:  $\Delta H_{\text{Bonds Broken}} = (3)(280) + 2(436) = 1712 \text{ kJ/mol}$

Prod:  $\Delta H_{\text{Bonds Formed}} = -((1)(366) + (3)(570)) = -2076 \text{ kJ/mol}$

$\Delta H = \Delta H_{\text{Bonds Broken}} + \Delta H_{\text{Bonds Formed}}$

$\Delta H = 1712 + (-2076)$

$\Delta H = -364 \text{ kJ/mol} \rightarrow \text{EXOTHERMIC}$

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(2 individual atoms) (1 molecule)  
(No Bonds)



React:  $\Delta H_{\text{Bonds Broken}} = 0 \text{ kJ/mol}$  (No Bonds were broken)

Prod:  $\Delta H_{\text{Bonds formed}} = -(945) = -945 \text{ kJ/mol}$

$$\Delta H = \Delta H_{\text{Bonds Broken}} + \Delta H_{\text{Bonds Formed}}$$

$$\Delta H = 0 + (-945)$$

$$\Delta H = -945 \text{ kJ/mol} \rightarrow \text{EXOTHERMIC}$$

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(2 molecules)      (13 molecules)      (8 molecules)      (10 molecules)

$$\begin{array}{l}
 \text{Reactants} \\
 \left\{ \begin{array}{l}
 3 \text{ C-C bonds} \times 2 \text{ molecules} = 6 \text{ bonds} \\
 10 \text{ C-H bonds} \times 2 \text{ molecules} = 20 \text{ bonds} \\
 1 \text{ O=O bond} \times 13 \text{ molecules} = 13 \text{ bonds}
 \end{array} \right.
 \end{array}$$

$$\begin{array}{l}
 \text{Products} \\
 \left\{ \begin{array}{l}
 2 \text{ C=O bonds} \times 8 \text{ molecules} = 16 \text{ bonds} \\
 2 \text{ O-H bonds} \times 10 \text{ molecules} = 20 \text{ bonds}
 \end{array} \right.
 \end{array}$$

$$E_{\text{C-C}} : 347 \text{ kJ/mol}$$

$$E_{\text{C-H}} : 413 \text{ kJ/mol}$$

$$E_{\text{O=O}} : 498 \text{ kJ/mol}$$

$$E_{\text{C=O}} : 745 \text{ kJ/mol}$$

$$E_{\text{O-H}} : 460 \text{ kJ/mol}$$

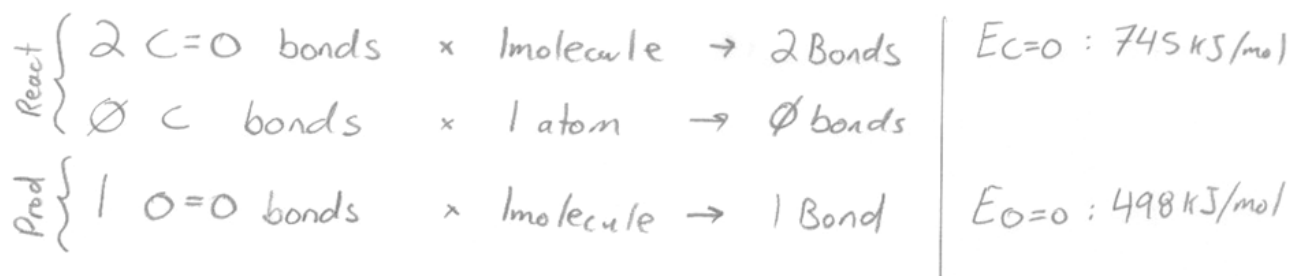
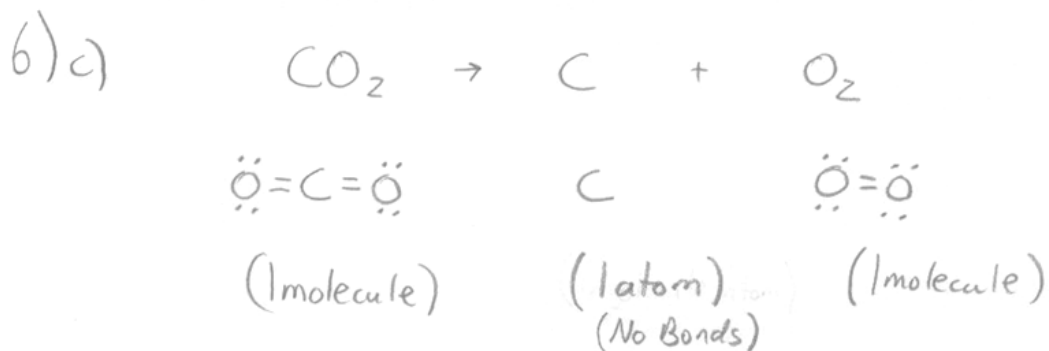
$$\text{React: } \Delta H_{\text{Bonds Broken}} = (6)(347) + (20)(413) + (13)(498) = 16816 \text{ kJ/mol}$$

$$\text{Prod: } \Delta H_{\text{Bonds formed}} = -((16)(745) + (20)(460)) = -21120 \text{ kJ/mol}$$

$$\Delta H = \Delta H_{\text{Bonds Broken}} + \Delta H_{\text{Bonds formed}}$$

$$\Delta H = 16816 + (-21120)$$

$$\Delta H = -4304 \text{ kJ/mol} \rightarrow \text{EXOTHERMIC}$$



Reactants :  $\Delta H_{\text{Bonds Broken}} = 2(745) = 1490 \text{ kJ/mol}$

Products :  $\Delta H_{\text{Bonds Formed}} = -(1)(498) = -498 \text{ kJ/mol}$

$\Delta H = \Delta H_{\text{Bonds Broken}} + \Delta H_{\text{Bonds Formed}}$

$\Delta H = 1490 + (-498)$

$\Delta H = 992 \text{ kJ/mol} \rightarrow \text{ENDOTHERMIC}$

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Reactants	{	1 C≡C bond × 2 molecules = 2 bonds		$E_{\text{C}\equiv\text{C}} : 839 \text{ kJ/mol}$
		2 C-H bonds × 2 molecules = 4 bonds		$E_{\text{C-H}} : 413 \text{ kJ/mol}$
		1 O=O bond × 5 molecules = 5 bonds		$E_{\text{O=O}} : 498 \text{ kJ/mol}$
Products	{	2 C=O bonds × 4 molecules = 8 bonds		$E_{\text{C=O}} : 745 \text{ kJ/mol}$
		2 H-O bonds × 2 molecules = 4 bonds		$E_{\text{H-O}} : 460 \text{ kJ/mol}$

React:  $\Delta H_{\text{Bonds Broken}} = (2)(839) + (4)(413) + (5)(498) = 5820 \text{ kJ/mol}$

Prod:  $\Delta H_{\text{Bonds Formed}} = -((8)(745) + (4)(460)) = -7800 \text{ kJ/mol}$

$\Delta H = \Delta H_{\text{Bonds Broken}} + \Delta H_{\text{Bonds Formed}}$

$\Delta H = 5820 + (-7800)$

$\Delta H = -1980 \text{ kJ/mol} \rightarrow \text{EXOTHERMIC}$