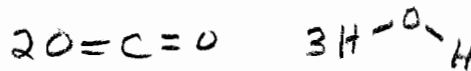
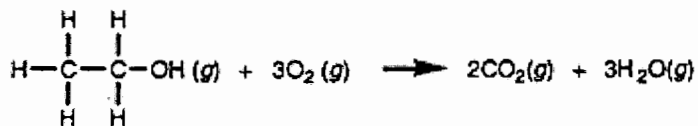


1. (5 Pts) Ethanol is sometimes used as an additive in oxygenated gasoline. Calculate its enthalpy of combustion using the bond energies given.

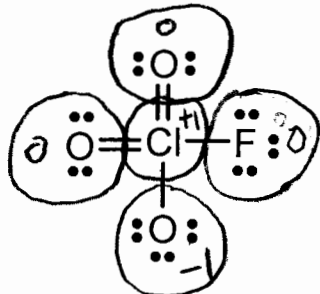


Bond:	C-C	C-H	C-O	C=O	O-H	O=O
Bond energy (kJ/mol):	347	413	358	799	467	498

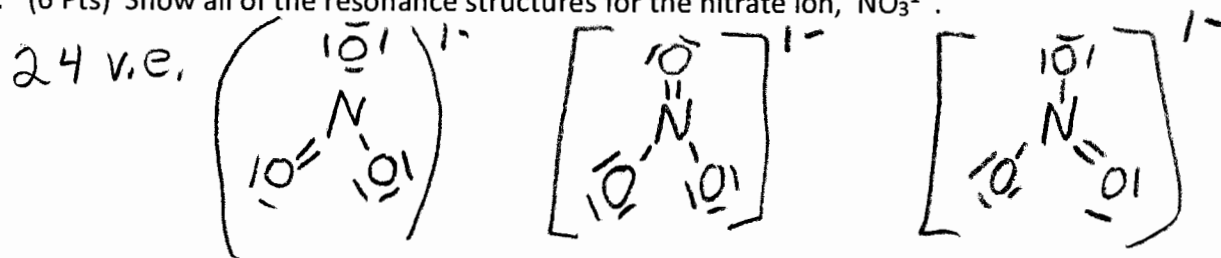
$\left. \begin{array}{l} \text{Breaking} \\ \text{C-C } 347 \\ \text{C-H } 5 \times 413 \\ \text{C-O } 358 \\ \text{O-H } 467 \\ \text{O}_2 \quad 3 \times 498 \end{array} \right\} + 4731 \text{ kJ}$ 
 $\left. \begin{array}{l} \text{making} \\ \text{C=O } 4 \times 799 \\ \text{O-H } 6 \times 467 \end{array} \right\} - 5998$ 

 $\Delta H = -1267$

1. (3 Pts) Show the formal charges on each element in the structure below:

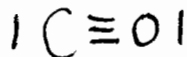


2. (6 Pts) Show all of the resonance structures for the nitrate ion,  $\text{NO}_3^{1-}$ .

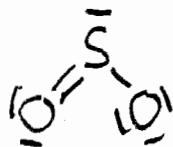


3. (6 Pts) Draw Lewis structures for each of the following.

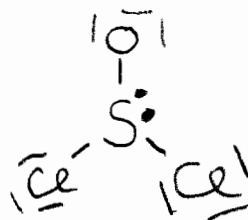
CO 10 v.e.



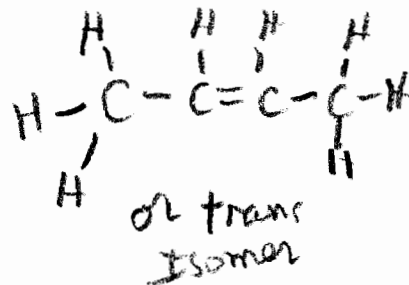
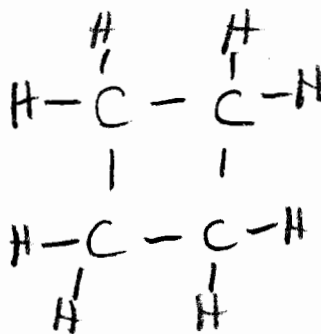
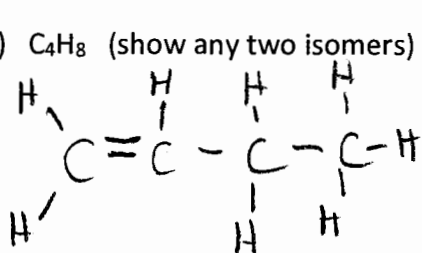
SO<sub>2</sub> 18 v.e.



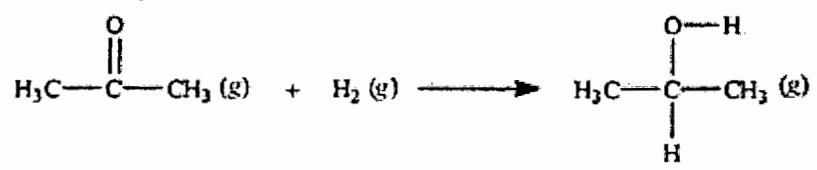
SOCl<sub>2</sub> 26 v.e.



4. (5 Pts) C<sub>4</sub>H<sub>8</sub> (show any two isomers)



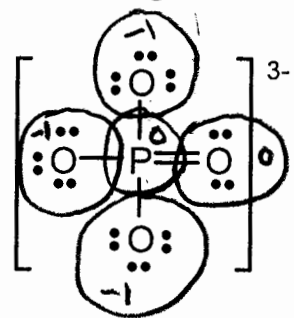
1. (5 Pts) Acetone can be easily converted to isopropyl alcohol by addition of hydrogen to the carbon-oxygen double bond. Calculate the enthalpy of reaction using the bond energies given.



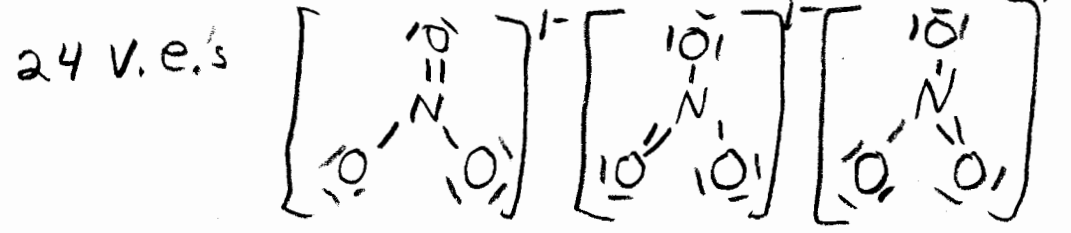
Bond:	C=O	H-H	C-H	O-H	C-C	C-O
Bond energy (kJ/mol):	745	436	414	464	347	351

Breaking $\left. \begin{array}{l} \text{C-C } 2 \times 347 \\ \text{C=O } 745 \\ \text{C-H } 6 \times 414 \\ \text{H-H } 436 \end{array} \right\} = +4359 \text{ kJ}$		Making $\left. \begin{array}{l} \text{C-C } 2 \times 347 \\ \text{C-O } 351 \\ \text{C-H } 7 \times 414 \\ \text{O-H } 464 \end{array} \right\} -4407$		$\Delta H = -48 \text{ kJ}$
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2. (3 Pts) Show the formal charges on each element in the structure below:

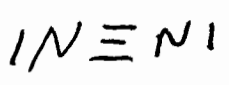


3. (6 Pts) Show all of the resonance structures for the nitrate ion,  $\text{NO}_3^{1-}$ .

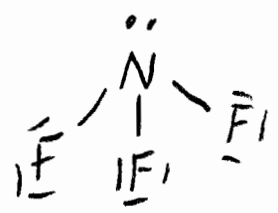


4. (6 Pts) Draw Lewis structures for each of the following.

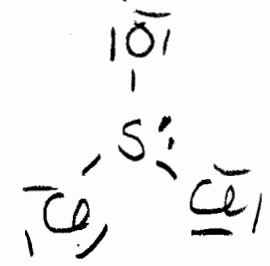
$\text{N}_2$  10 v.e.



$\text{NF}_3$  26 v.e.



$\text{SOCl}_2$  26 v.e.



5. (5 Pts)  $\text{C}_4\text{H}_8$  (show any two isomers)

See other version