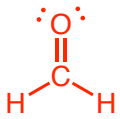
1. Draw Lewis structure for the following, indicating all bonds, lone pairs, and formal charges.

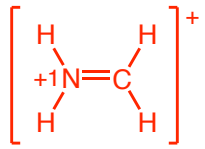
(a) HCOH (formaldehyde)



(b) CO

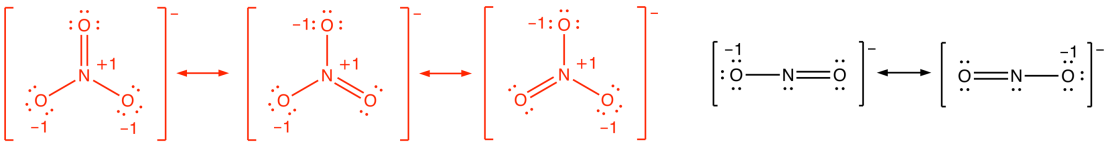
(c) XeF_2

(d) $H_2NCH_2^+$



2. Which molecule/ion of the following pairs has the longest NO bond length?
Draw Lewis structures to support your answers.

(a) NO_3^- and NO_2^- NO_3^- has an averaged 1.3-bond; NO_2^- has an averaged 1.5-bond



(b) NO and N_2O N_2O has a single bond in best resonance structure

3. Consider the combustion of ammonia: $4\ NH_3\ (g) + 5\ O_2\ (g) \rightarrow 4\ NO\ (g) + 6\ H_2O\ (g)$
Using the bond enthalpies given, estimate the heat of the combustion reaction (ΔH_{rxn}).

Bond	Bond Enthalpy (kJ/mol)
N – H	388
O – O	146
O = O	495
O – H	463
N – O	201
N = O	607
N ≡ O	678

$$\Delta H_{rxn} = \sum \Delta H(\text{bonds broken}) - \sum \Delta H(\text{bonds formed})$$
$$= \{12 \times [N-H] + 5 \times [O=O]\} - \{4 \times [N=O] + 12 \times [O-H]\}$$
$$= 12 \times \left[388 \frac{kJ}{mol}\right] + 5 \times \left[495 \frac{kJ}{mol}\right] - 4 \times \left[607 \frac{kJ}{mol}\right] - 12 \times \left[463 \frac{kJ}{mol}\right]$$
$$\Delta H_{rxn} = -852 \frac{kJ}{mol}$$

4. Draw the resonance structures for the $N(NO_2)_2^-$ ion, indicating all bonds, lone pairs, and formal charges in your Lewis structures.