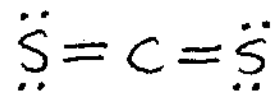
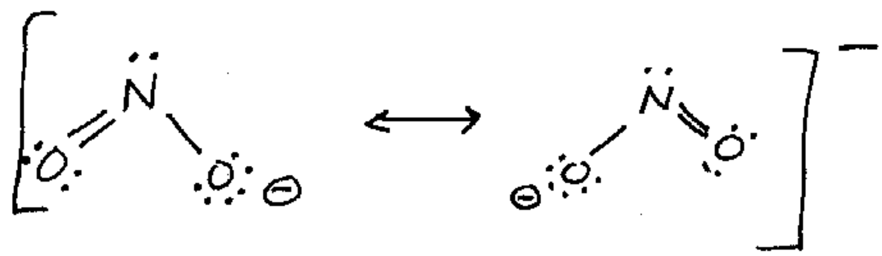
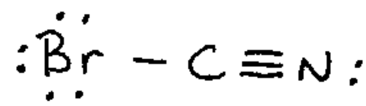
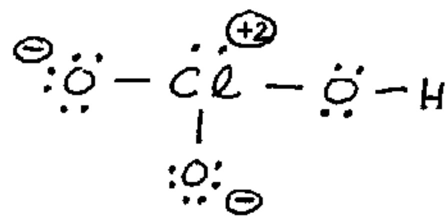
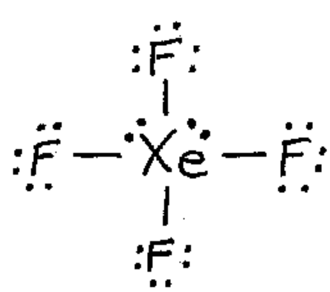
CHEM E-1a - CHAPTER 9 REVIEW

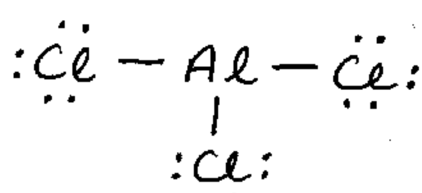
1. a) 

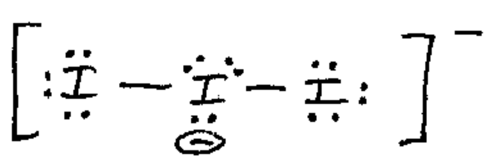
b) 

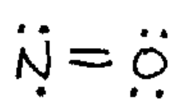
c) 

d) 

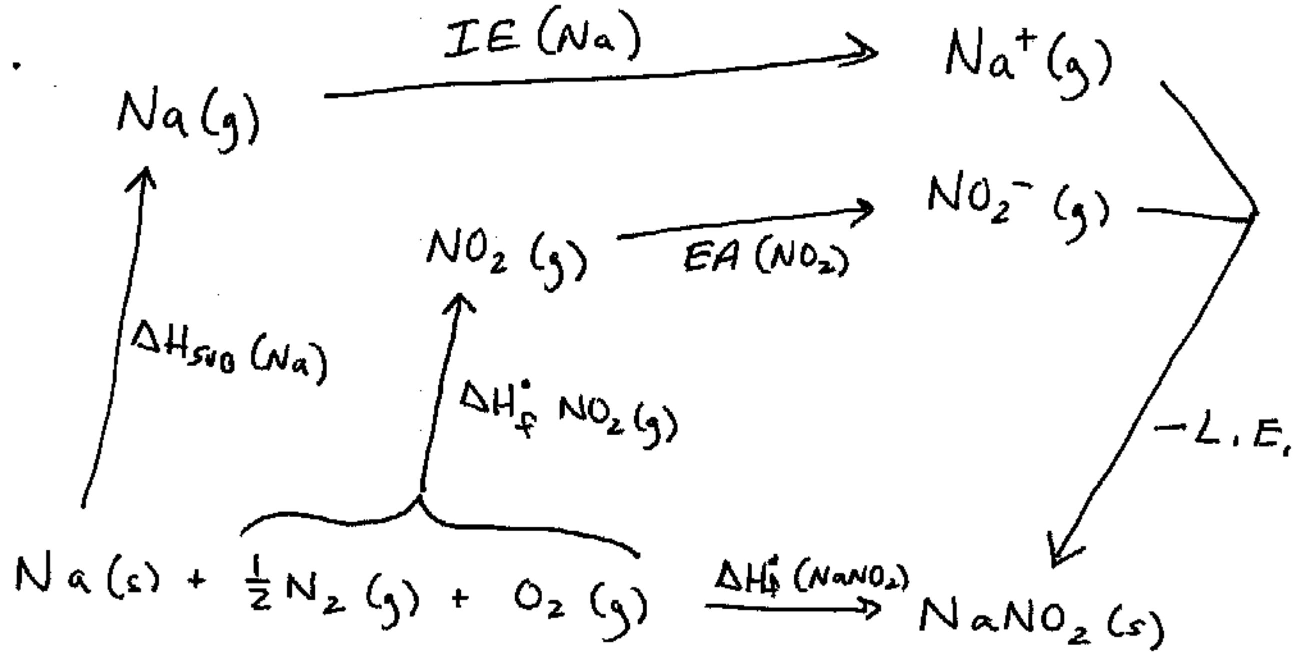
e) 

f) 

g) 

h) 

2.



$$\Delta H_{SUB}(Na) + \Delta H_f(NO_2(g)) + IE(Na) + EA(NO_2) - L.E. = \Delta H_f(NaNO_2(s))$$

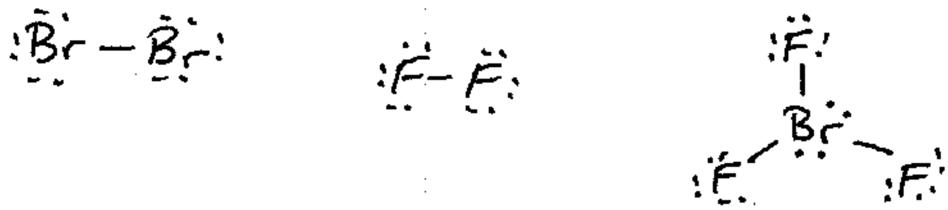
ALL IN kJ/MOL:

$$108 + 33.2 + 496 + EA(NO_2) - 777 = -359$$

$$\boxed{EA(NO_2) = -219.2 \text{ kJ/MOL}}$$

3. HEAT OF FORMATION REACTION:

$$\tfrac{1}{2} Br_2(\ell) + \tfrac{3}{2} F_2(g) \longrightarrow BrF_3(\ell) \qquad \Delta H = \Delta H_f(BrF_3(\ell))$$



WE CAN USE:

$$\Delta H_{RXN} = \sum D_{\text{BONDS BROKEN}} - \sum D_{\text{BONDS FORMED}}$$

BUT THIS ONLY WORKS WITH ALL REACTANTS AND PRODUCTS IN THE GAS PHASE!

TWO WAYS TO SOLVE:

FIRST: "HESS'S LAW" - STYLE! (ALL NUMBERS IN kJ/MOL)

$$\cancel{\tfrac{1}{2} Br_2(g)} + \tfrac{3}{2} F_2(g) \rightarrow \cancel{BrF_3(g)} \qquad \Delta H = \tfrac{1}{2} D_{Br-Br} + \tfrac{3}{2} D_{F-F} - 3 D_{Br-F}$$
$$= \tfrac{1}{2}(193) + \tfrac{3}{2}(155) - 3(237)$$
$$= -382 \text{ kJ/MOL}$$

$$\tfrac{1}{2} Br_2(\ell) \rightarrow \cancel{\tfrac{1}{2} Br_2(g)} \qquad \Delta H = \tfrac{1}{2} \Delta H_{VAP}(Br_2(\ell))$$
$$= \tfrac{1}{2}(30.71) = 15.4 \text{ kJ/MOL}$$

$$\cancel{BrF_3(g)} \rightarrow BrF_3(\ell) \qquad \Delta H = -\Delta H_{VAP}(BrF_3)$$
$$= -47.6 \text{ kJ/MOL}$$

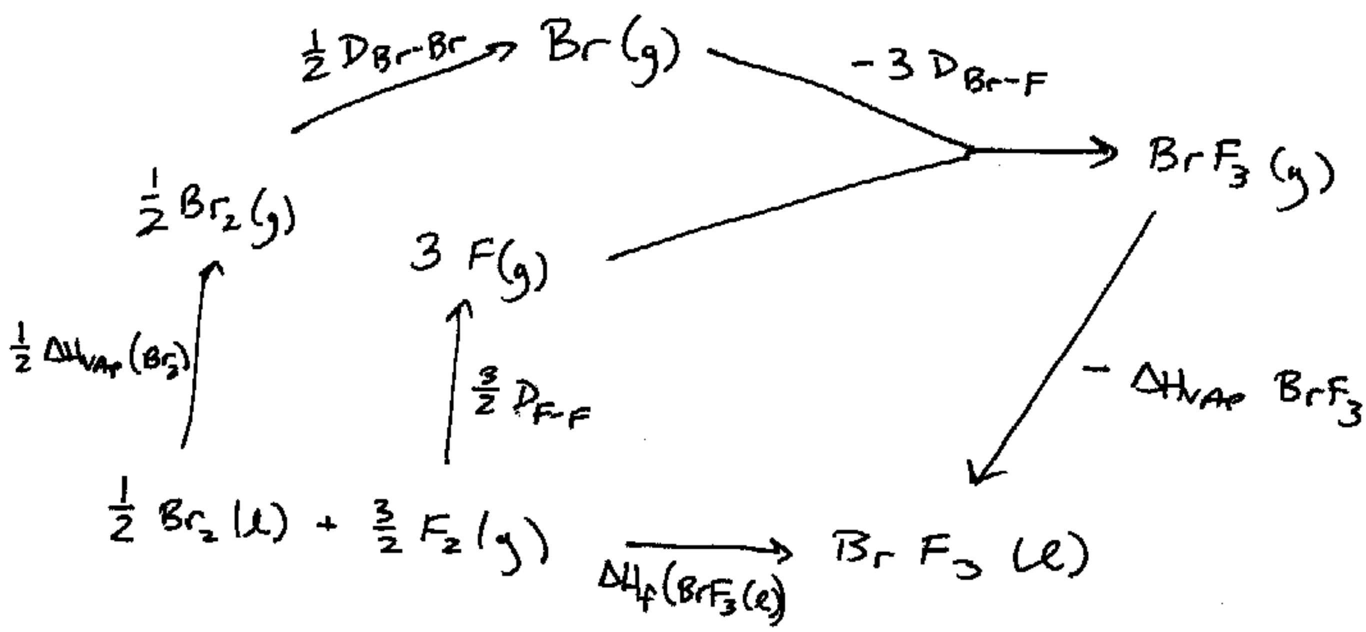
$$\tfrac{1}{2} Br_2(\ell) + \tfrac{3}{2} F_2(g) \rightarrow BrF_3(\ell) \qquad \Delta H_f = -382 + 15.4 + -47.6$$

$$\boxed{\Delta H_f = -414.2 \text{ kJ/MOL}}$$

3. (CONT.)

SECOND METHOD:

"BORN HABER CYCLE" - STYLE



$$\Delta H_f (BrF_3(l)) = \tfrac{1}{2}\Delta H_{vap}(Br_2) + \tfrac{3}{2} D_{F-F} + \tfrac{1}{2} D_{Br-Br} - 3 D_{Br-F} - \Delta H_{vap}(BrF_3)$$

$$\Delta H_f (BrF_3(l)) = \tfrac{1}{2}(30.71) + \tfrac{3}{2}(155) + \tfrac{1}{2}(193) - 3(237) - 47.6$$
$$= -414.2 \text{ kJ/mol}$$

$$\boxed{\Delta H_f\, BrF_3\, (l) = -414.2 \text{ kJ/mol}}$$