

a.

	Reactants		Products	
Species	CH4(g)	H2O(g)	CO(g)	H2(g)
Coefficient (mol)	1	1	1	3
$\Delta_f H_m^\circ$ (kJ/mol)	-74.6	-241.8	-110.5	0
$\Sigma n \Delta_f H_m^\circ$	= [(1 mol $\times$ -74.6 kJ/mol) + (1 mol $\times$ -241.8 kJ/mol)] = -316.4 kJ		= [(1 mol $\times$ -110.5 kJ/mol) + (3 mol $\times$ 0 kJ/mol)] = -110.5 kJ	
$\Delta_r H^\circ$	= -110.5 kJ - (-316.4 kJ) = +205.9 kJ			

b.

	Reactants		Products	
Species	CO(g)	H2O(g)	CO2(g)	H2(g)
Coefficient (mol)	1	1	1	1
$\Delta_f H_m^\circ$ (kJ/mol)	-110.5	-241.8	-393.5 kJ	0
$\Sigma n \Delta_f H_m^\circ$	= [(1 mol $\times$ -110.5 kJ/mol) + (1 mol $\times$ -241.8 kJ/mol)] = -352.3 kJ		= [(1 mol $\times$ -393.5 kJ/mol) + (1 mol $\times$ 0 kJ/mol)] = -393.5 kJ	
$\Delta_r H^\circ$	= -393.5 kJ - (-352.3 kJ) = -41.2 kJ			

c.

	Reactants		Products	
Species	N2(g)	H2(g)	NH3(g)	
Coefficient (mol)	1	3	2	
ΔfH_m° (kJ/mol)	0	0	−45.9	
$\Sigma n \Delta fH_m^\circ$	= [(1 mol × 0 kJ/mol) + (3 mol × 0 kJ/mol)] = 0 kJ		= (2 mol × −45.9 kJ/mol) = −91.8 kJ	
$\Delta_r H^\circ$	= −91.8 kJ − (0 kJ) = −91.8 kJ			