Thermochemical equations and Hess Law
Lesson 2a

<u>Read</u> before attempting these questions.

A few rules apply to manipulating balanced thermochemical equations
1) When reversing an equation change the sign of the ΔH
For example
=> 2CO(g) + O_2(g) => 2CO_2(g) ΔH = - 566 kJ/mol
=> 2CO_2(g) => 2CO(g) + O_2(g) ΔH = +566 kJ/mol

2) When multiplying the equation also multiply the ΔH

For example
=> 2CO(g) + O_2(g) => 2CO_2(g) ΔH = - 566 kJ/mol
=> CO(g) + ½ O_2(g) => CO_2(g) ΔH = - 283 kJ/mol

3) When adding equations also add the ΔH
For example
1) ----- C(s) + O_2(g) => CO_2(g) ΔH = - 393 kJ/mol
2) ----- 2C(s) + O_2(g) => 2CO(g) ΔH = - 221 kJ/mol

3C(s) + 2O_2(g) => 2CO(g) + CO_2(g) ΔH = (- 393 kJ/mol + - 221 kJ/mol) = - 614 kJ/mol

1) ----- $2CH_3OH$ (g) + 3O_2(g) => $4H_2O$(g) + 2CO_2 (g) *ΔH* = - 1352 kJ/mol
2) ----- C(s) + O_2(g) => CO_2(g) *ΔH* = - 393 kJ/mol
3) ----- $2H_2$(g) + O_2 => $2H_2O$(g) *ΔH* = - 484 kJ/mol

1) *Consider the thermochemical equations shown above. Calculate the ΔH of the following thermochemical equations.*
   a) 3C(s) + 3O_2(g) => 3CO_2(g)
   b) 2H_2O(g) => 2H_2(g) + O_2(g)
   c) 2H_2O(g) + CO_2 (g) => CH_3OH (g) +1½ O_2(g)

   d) Find the ΔH of the thermochemical equation below
   2CH_3OH (g) + O_2(g) => 4H_2O(g) + 2C(s) ΔH =

   e) Find the ΔH of the thermochemical equation below
   2C(s) + O_2(g) + 4H_2(g) => 2CH_3OH (g)

2) Given the equations below find the *ΔH* of C(s) + O_2(g)→ CO_2(g)

   1-------- C(s)+ ½O_2(g) → CO(g) ΔH = -110.5 kJ mol^{-1}

   2-------- CO(g) + ½O_2(g) → CO_2(g) ΔH = -283 kJ mol^{-1}