Thermochemical equations and Hess Law
Lesson 2a

Read 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
=> $2CO(g) + O_2(g) \Rightarrow 2CO_2(g)$ ΔH = - 566 kJ/mol
=> $2CO_2(g) \Rightarrow 2CO(g) + O_2(g)$ ΔH = +566 kJ/mol

2) When multiplying the equation also multiply the ΔH

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

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

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

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

a) $3C(s) + 3O_2(g) \Rightarrow 3CO_2(g)$ *ΔH = - 393 kJ/mol X 3 = -1179kJ/mol*
b) $2H_2O(g) \Rightarrow 2H_2(g) + O_2(g)$ *ΔH = + 484 kJ/mol*
c) $2H_2O(g) + CO_2 (g) \Rightarrow CH_3OH (g) +1½ O_2(g)$ *ΔH = +676 kJ/mol*
d) Find the ΔH of the following thermochemical equation below
$2CH_3OH (g) + O_2(g) \Rightarrow 4H_2O(g) + 2C(s)$ *ΔH = -1352 + 393 X 2 kJ/mol =-566 kJ/mol*
Flip equation 2 and change the sign of the ΔH to +393 kJ/mol multiply it by 2 and add it to equation 1

e) Find the ΔH of the following thermochemical equation below
$2C(s) + O_2(g) + 4H_2(g) \Rightarrow 2CH_3OH (g)$ *ΔH = +566 kJ/mol*

2) Given the equations below find the ΔH of $C(s) + O2(g) \rightarrow CO2(g)$ *ΔH = -394 kJ mol*
1-------- $C(s)+ ½O2(g) \rightarrow CO(g)$ *ΔH = -110.5 kJ mol^{-1}*
2-------- $CO(g) + ½O2(g) \rightarrow CO2(g)$ ΔH = -283 kJ mol^{-1}