Worksheet 6.2
Calculation of enthalpy changes

NAME: **CLASS:**

INTRODUCTION

Thermochemical equations are those that include an enthalpy value. The calculation of ΔH for these equations from thermochemical data is an important skill.

No	Question	Answer
1	State which of the following reactions are exothermic and which are endothermic. **a** $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$ $\Delta H = -1204$ kJ mol^{-1} **b** $CaCl_2.6H_2O(s) \xrightarrow{H_2O} CaCl_2(aq)$ $\Delta H = +18.0$ kJ mol^{-1} **c** $4NH_3(g) + 3O_2(g) \rightarrow N_2(g) + 6H_2O(g)$ $\Delta H = -1250$ kJ mol^{-1} **d** $CH_4(g) \rightarrow C(s) + 2H_2(g)$ $\Delta H = +412.0$ kJ mol^{-1}	
2	Although these reactions do not have a ΔH value, they are still either exothermic or endothermic. Classify each reaction as either exothermic or endothermic: **a** $Na(g) \rightarrow Na^+(g) + e^-$ **b** $H_2O(l) \rightarrow H_2O(g)$ **c** $Cl_2(g) \rightarrow 2Cl(g)$ **d** $I_2(g) \rightarrow I_2(s)$	
3	Given the thermochemical equation: $2NO_2(g) \rightarrow N_2(g) + 2O_2(g)$ $\Delta H = -67.4$ kJ mol^{-1} determine ΔH for the following. **a** $4NO_2(g) \rightarrow 2N_2(g) + 4O_2(g)$ **b** $\frac{1}{2}N_2(g) + O_2(g) \rightarrow NO_2(g)$ **c** $\frac{3}{2}N_2(g) + 3O_2(g) \rightarrow 3NO_2(g)$	

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4	Consider the equation $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ $\Delta H = -92.3$ kJ mol^{-1} Calculate the amount of energy that would be given off when 5.00 mol of hydrogen gas reacts completely with an excess amount of nitrogen gas.	
5	Ethyne, C_2H_2 (known industrially as acetylene), undergoes combustion with oxygen to produce a very high temperature flame, hot enough to cut steel. Calculate the amount of heat energy released by the complete combustion of 2.50 dm^3 of ethyne at STP according to the equation: $2C_2H_2(g) + 5O_2(g) \rightarrow 4CO_2(g) + 2H_2O(g)$ $\Delta H = -2600$ kJ mol^{-1}	
6	Tungsten carbide reacts with oxygen according to the equation $2WC(s) + 5O_2(g) \rightarrow 2WO_3(g) + 2CO_2(g)$ $\Delta H = -2388$ kJ mol^{-1} Calculate the amount of heat that would be given off by the complete reaction of 1.125 kg of tungsten carbide.	
7	Tristearin, $(CH_3(CH_2)_{16}COO)_3C_3H_5$, is a saturated fat widely found in beef and is the chief constituent of lard. The heat of combustion of tristearin is 38 kJ g^{-1}. **a** Determine the molecular formula of tristearin. **b** Calculate the energy released by the combustion of 1 mol of this fat.	
8	Propane burns readily in air according to the thermochemical equation $C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$ $\Delta H = -2220$ kJ mol^{-1} Calculate the mass of propane required to produce 15.30 MJ of energy.	

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9	In the production of iron in a blast furnace, haematite, Fe_2O_3, is reduced by carbon monoxide according to the equation $Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(l) + 3CO_2(g)$ Determine ΔH for this reaction, given that the complete reduction of 719 g of haematite yields 88.2 kJ of energy.	
10	Sodium metal reacts vigorously with magnesium chloride to displace magnesium metal according to the equation $MgCl_2(s) + 2Na(l) \rightarrow 2NaCl(s) + Mg(s)$ Determine ΔH for this reaction, given that the complete reaction of 7.92 g of sodium metal generates 31.0 kJ of energy.	