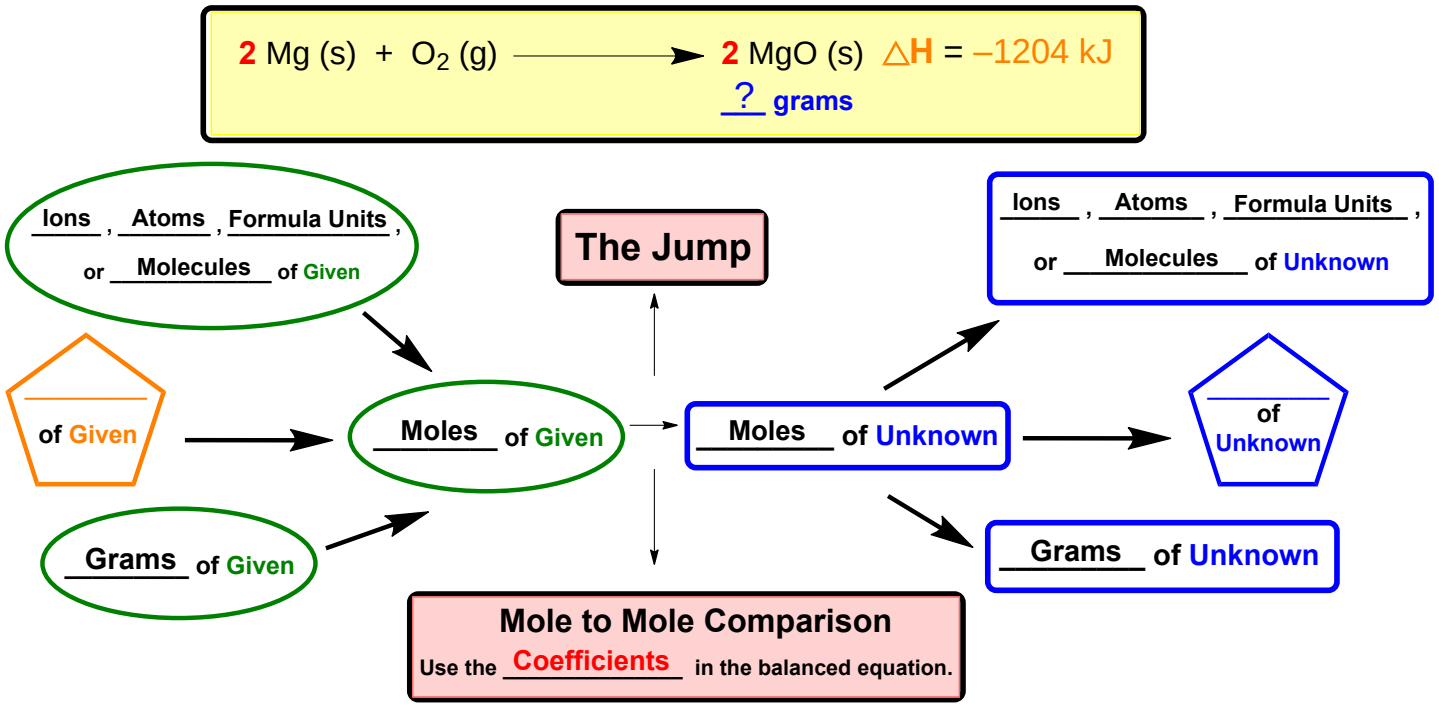
CONCEPT: THERMOCHEMICAL EQUATIONS

- Recall, stoichiometry deals with the numerical relationship between compounds in a *balanced chemical equation*.
  - □ **Thermochemical Equations** deal with chemical equations that include an enthalpy of reaction (ΔH_{rxn}).

Thermochemical Stoichiometric Chart

- The chart uses the Given quantity of a compound to determine the Unknown quantity of another compound.



EXAMPLE: Consider the following thermochemical reaction:

2 Mg (s) + **1** O_2 (g) → **2** MgO (s) ΔH_{rxn} = –1204 kJ

How many grams of MgO are produced during an enthalpy change of –375 kJ?

STEP 1: Convert the **given** quantity into moles of **given**.

STEP 2: Do a **mole to mole comparison** to convert moles of **given** into moles of **unknown**.

STEP 3: If necessary, convert the moles of **unknown** into the final desired units.

STEP 4: If you calculate more than one final amount then you must compare them to determine the theoretical yield.

CONCEPT: THERMOCHEMICAL EQUATIONS

PRACTICE: Nitromethane (CH_3NO_2), sometimes used as a fuel for drag racing, burns according to the following reaction:

$$4\ CH_3NO_2\ (l) + 7\ O_2\ (g) \longrightarrow 4\ CO_2\ (g) + 6\ H_2O\ (g) + 4\ NO_2\ (g) \qquad \Delta H^\circ = -2441.6\ kJ$$

How much heat is released by burning 125.0 g of nitromethane (MW: 61.044 g/mol)?

PRACTICE: Consider the following reaction:

$$2\ C_6H_6\ (l) + 15\ O_2\ (g) \longrightarrow 12\ CO_2\ (g) + 6\ H_2O\ (g) \qquad \Delta H^\circ = -6278\ kJ$$

What volume of benzene (C_6H_6, d = 0.880 g/mL, molar mass = 78.11 g/mol) is necessary to evolve 5.19×10^9 kJ of heat?

PRACTICE: The creation of liquid methanol is accomplished by the hydrogenation of carbon monoxide:

$$CO\ (g) + 2\ H_2\ (g) \longrightarrow CH_3OH\ (l) \qquad \Delta H^\circ = -128.1\ kJ$$

How much heat (in kJ) is released when 125.0 g CO reacts with 2.32×10^2 g H_2?