

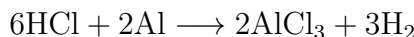
Chemistry Honors Study Guide

Test 3 S2

Test date: TBD

1 Gasses and Heat in Stoichiometry

Gasses



At STP, how many *ml* of H_2 gas are produced from 12 *g* of solid Al? (1 *mol* = 22.4 *L* at STP)

Using stoichiometry:

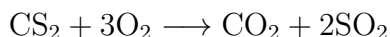
$$\begin{aligned} (12 \text{ g Al}) \times \left(\frac{1 \text{ mol Al}}{26.98 \text{ g Al}} \right) \times \left(\frac{3 \text{ mol H}_2}{2 \text{ mol Al}} \right) \times \left(\frac{22.4 \text{ L H}_2}{1 \text{ mol H}_2} \right) \times \left(\frac{1000 \text{ ml}}{1 \text{ L}} \right) \\ = \boxed{14944.4 \text{ ml}} \end{aligned}$$

Heats of Formation

ΔH_f is the heat absorbed/released when compounds are formed from elemental units. The ΔH_f of elements, including diatomic elements, is always 0.

Heats of formation equation:

$$\Delta H_{\text{rxn}} = \sum \Delta H_{\text{f(products)}} - \Delta H_{\text{f(reactants)}} \quad (1)$$



Find the heat of formation given the following:

$$\Delta H_f(\text{CO}_2) = -393.5 \frac{\text{kJ}}{\text{mol}}$$

$$\Delta H_f(\text{SO}_2) = -296.8 \frac{\text{kJ}}{\text{mol}}$$

$$\Delta H_f(\text{CS}_2) = 87.9 \frac{\text{kJ}}{\text{mol}}$$

Solution: Using 1:

$$\begin{aligned} & [-393.5 + 2(-296.8)] - [3(0) + 87.9] \\ &= \boxed{1075 \frac{kJ}{mol}} \end{aligned}$$

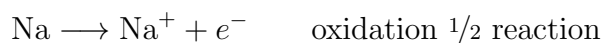
2 Redox

Definitions

- **redox reaction**: Short for *oxidation/reduction reaction*.
- **oxidation**: Losing electrons (becoming more positive).
- **reduction**: Gaining electrons (becoming more negative).

Reactions

LEO the lion says GER (Losing Electrons = Oxidation, Gaining Electrons = Reduction)



Assigning Oxidation Numbers

Rules

1. An element in its elemental state is neutral.
2. H in a compound is always +1.
3. O in a compound is -2 except for H_2O_2 ; in that case, the oxidation number of O is -1.
4. Monatomic ions are whatever ionic charge they would normally form.
5. All oxidation numbers must add to the overall charge of the molecule or ion.

Example: What is the oxidation number of I in $\text{Mg}(\text{IO}_3)_2$?

Solution: By looking at the charge on Mg, the charge on $(\text{IO}_3)_2$ can be found to be 2-, so the charge on one ion is 1-, making the ion $(\text{IO}_3)^-$. The oxidation number of O in this compound is 2- by rule 3. There are 3 oxygen atoms, so:

$$3(-2) + \text{I} = -1$$

Solving for I:

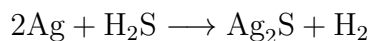
$$-6 + \text{I} = -1$$

$$I = -1 + 6$$

$$I = 5$$

The charge on I is +5.

Writing Half-Reactions

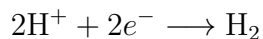


To write half-reactions, look at the oxidation numbers on each element. If the oxidation number has increased, it has been oxidised. If the number has decreased, it has been reduced.

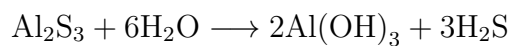
Oxidation $1/2$ reaction:



Reduction $1/2$ reaction:



If *none* of the oxidation numbers change, the reaction is *not* a redox reaction. For example,



is not a redox reaction.