Big Idea #3

# Chemical Reactions, Energy Changes, Redox Reactions

## types of reactions

synthesis elements/compounds combine to a more complex compound
decomposition single compound split into 2+ elements/compounds
acid-base acid ($H^+$) reacts w/ base ($OH^-$) to form water & salt
oxidation-reduction results in change in oxidation state of participating species
combustion hydrocarbon reacts with oxygen in atmosphere, forms $CO_2$ and $H_2O$
precipitation mixing of aqueous solutions results in insolvable salts

## combustion analysis

all of the carbon ends up in $CO_2$ ] convert g to mol
all of the hydrogen ends up in $H_2O$ ] use to find empirical formula

## enthalpy

bonds are formed energy is released
bonds are broken energy is absorbed
enthalpy change $\Delta H = H_{products} - H_{reactants}$
↳ exothermic $-\Delta H$, energy released to surroundings
↳ endothermic $+\Delta H$, energy absorbed from surroundings

## oxidation states

neutral atom not bonded to other elements 0
any ion (even in compound) equal to ion charge
oxygen -2
hydrogen (bonded to nonmetal) +1
most electronegative element most common charge
combined oxidation states add to:
0 for neutral compound
compound charge for polyatomic ion

## oxidation-reduction reactions

Oxidation Is Loss of $e^-$ ] oxidation number increases

Reduction Is Gaining $e^-$ ] oxidation number decreases

## redox titrations

color-changing compounds reduced/oxidized

## reduction potentials

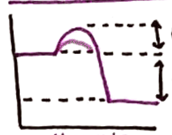
larger $E°$ → more likely to occur
larger oxid. pot. → more likely to be oxidized
(lower reduc. pot.)
larger reduct. pot. → more likely to be reduced
(lower oxid. pot.)
$E = E_{oxidation} + E_{reduction}$ (never multiply by coefficient)
reverse reaction → reverse sign

## important solubility rules

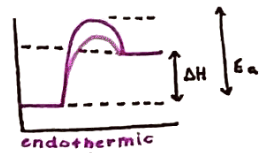
alkali metals (group I) or ammonium always soluble

nitrate ($NO_3^-$) always soluble

## energy diagrams

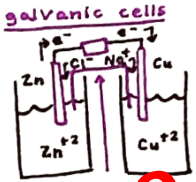



exothermic reactions
— = w/ catalyst



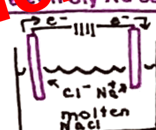

endothermic reactions
— = w/ catalyst

## galvanic cells




oxidation happens @ anode
reduction happens @ cathode
salt bridge maintains neutral charge
$Y \rightarrow Y^+ + e^-$ anode
$Z^+ + e^- \rightarrow Z$ cathode

## electrolytic cells




$2Cl^- \rightarrow Cl_2 + 2e^-$ anode
$Na^+ + e^- \rightarrow Na$ cathode

## electroplating

$I = \frac{q}{t}$
I = current (A)
q = charge (C)
t = time (s)

$\boxed{96{,}500\ C/mol}$