Types of Reactions
Review Packet

Name Key
Block _____ Date _____

1) A complete chemical equation should include what 3 components?

Formulas, Phases, Balancing

2) How are physical changes different from chemical reactions? Support your answer by listing some common physical changes and by listing what must be created for a reaction to have occurred.

Chemical Reaction - new solid, liquid or gas is formed. Bonds are broken, atoms rearranged, new bonds form.

Physical Change - start/end w/ same chemical substance (mixing, dissolving, phase changes)

3) Write the pattern you would look for to help identify the following types of reactions:

a. Synthesis

$A + B \rightarrow C$

b. Decomposition

$A \rightarrow B + C$

c. Single Displacement

$A + BC \rightarrow AC + B$ (A: metal)

$A + BC \rightarrow BA + C$ (A: Non-Metal)

d. Double Displacement

$AB + CD \rightarrow AD + CB$

e. Combustion

$C_xH_y + O_2 \rightarrow H_2O + CO_2$

$C_xH_yOH + O_2 \rightarrow H_2O + CO_2$

4) For each of the following, identify the type of reaction occurring.

a. $Mn(NO_3)_2\ (aq) + K_2SO_4\ (aq) \rightarrow MnSO_4\ (s) + 2KNO_3\ (aq)$

DD

b. $2C_8H_{18}\ (g) + 25O_2\ (g) \rightarrow 16CO_2\ (g) + 18H_2O\ (g)$

Comb.

c. $2KOH\ (aq) + H_2SO_4\ (aq) \rightarrow K_2SO_4\ (aq) + 2H_2O\ (l)$

DD

d. $2HBr\ (aq) + Cl_2\ (g) \rightarrow Br_2\ (l) + 2HCl\ (aq)$

SD

e. $S(s) + O_2\ (g) \rightarrow SO_2\ (g)$

Synth.

f. $Na_3PO_4\ (aq) + 3Li\ (s) \rightarrow Li_3PO_4\ (aq) + 3Na(s)$

SD

g. $2N_2O_3\ (g) \rightarrow 4NO\ (g) + O_2\ (g)$

Decomp.

5) How can you determine whether or not a single displacement reaction will occur?

Reactivity series → is the pure element reactive enough to displace something in the compound?

6) How can you determine whether or not a double displacement reaction will occur?

Solubility Chart → did you make a new s, l, or g? (both aq = no rxn)

7) What reactant is always present in combustion reactions and which products are always created by the reaction?

- $O_2\ (g)$
- $CO_2\ (g)$ & $H_2O\ (g)$

8) For each of the following: **A)** Predict whether or not the reaction will occur (if necessary) **B)** Write out a ***complete*** chemical equation if it will occur, if not write "***No Reaction***"

a. A magnesium hydroxide solution is combined with a solution of copper (II) nitrate.

$$Mg(OH)_2\,(aq) + 2CuNO_3\,(aq) \longrightarrow 2CuOH\,(s) + Mg(NO_3)_2\,(aq)$$

b. A lead (II) nitrate solution is poured over a piece of aluminum.

$$3Pb(NO_3)_2\,(aq) + 2Al\,(s) \longrightarrow 2Al(NO_3)_3\,(aq) + 3Pb\,(s)$$

c. Solutions of aluminum chlorate and sodium bromide are mixed.

No Rxn ($AlBr_3$ & $NaClO_3$ are aq)

d. Propane (C_3H_8) vapor is combusted.

$$C_3H_8\,(g) + 5O_2\,(g) \longrightarrow 3CO_2\,(g) + 4H_2O\,(g)$$

e. Iodine crystals are dumped into hydrobromic acid (HBr).

No Rxn (I is not more reactive than Br)

f. Silver fluoride solution is stored in a tin can.
↳ can be +2 or +4

$$Sn\,(s) + AgF\,(aq) \longrightarrow SnF_2\,(aq) + Ag\,(s)$$

g. Ammonium sulfide solution is combined with calcium chloride solution.

$$(NH_4)_2S\,(aq) + CaCl_2\,(aq) \longrightarrow CaS\,(s) + 2NH_4Cl\,(aq)$$

h. Chlorine gas is bubbled through hydriodic acid (HI).

$$Cl_2\,(g) + 2HI\,(aq) \longrightarrow 2HCl\,(aq) + I_2\,(s)$$

9) Reference your answers for 8a and 8c. Support these answers by writing out the complete chemical equation, total ionic equation and net ionic equation for 8a and 8c.

8a.

Chemical Equation: $Mg(OH)_2\,(aq) + 2CuNO_3\,(aq) \rightarrow 2CuOH\,(s) + Mg(NO_3)_2\,(aq)$

Total Ionic: $Mg^{2+}\,(aq) + 2OH^-\,(aq) + 2Cu^{1+}\,(aq) + 2NO_3^-\,(aq) \rightarrow 2CuOH\,(s) + Mg^{2+}\,(aq) + 2NO_3^-\,(aq)$

Net Ionic: $2Cu^{1+}\,(aq) + 2OH^-\,(aq) \rightarrow 2CuOH\,(s)$

A reaction has occurred as evidenced by the formation of a new solid, CuOH.

8c.

Chemical Equation: $Al(ClO_3)_3\,(aq) + 3NaBr\,(aq) \rightarrow AlBr_3\,(aq) + 3NaClO_3\,(aq)$

Total Ionic: $Al^{3+}\,(aq) + 3ClO_3^-\,(aq) + 3Na^+\,(aq) + 3Br^-\,(aq) \rightarrow Al^{3+}\,(aq) + 3Br^-\,(aq) + 3Na^+\,(aq) + 3ClO_3^-\,(aq)$

Net Ionic: No Reaction

No reaction has occurred as evidenced by no formation of a new solid, liquid or gas.

Lab Skills

In addition to the conceptual understanding of types of reactions, make sure you are confident in properly performing common laboratory skills. Concepts that are fair game for your assessment include, but are not limited to:

- Showing an understanding of the labs performed in this unit (SD, DD, Combustion)
- Showing an understanding of when/how to use instrumentation properly and the ability to safely execute procedures such as weighing, liquid measurement, pipetting, solution preparation, etc.
- Forming a conclusion supported by data/observations (evidence) and proper reasoning.

10) Summarize your understanding of these concepts below.

Big Ideas from the Single Displacement Lab:

- Metals displace metals, non-metals displace non-metals.
- Reactivity series predicts whether the displacement will happen.
- Being in the compound (bonded) is the preferred state (stable e⁻ configuration)

$A + BC \rightarrow AC + B$ (A: metal) . $A + BC \rightarrow BA + C$ (A: non-metal)

Big Ideas from the Double Displacement Lab:

- Ions switch partners
- Solubility chart predicts whether a reaction will occur (new s, l, g must be made). 2 aq products = no rxn (mixture of ions).
- Net Ionic equations show who was involved in the reaction

$AB + CD \rightarrow AD + CB$

Big Ideas from the Combustion Lab:

- Hydrocarbons & alcohols combust in the presence of oxygen
- Water & carbon dioxide are the products
- Water is a gas due to heat energy released

General Safety Procedures for Lab:

- Personal safety (goggles & apron)
- Chemical safety (MSDS reports & NFPA symbols)
- Rinsing / Contamination / Disposal

How to weigh a substance and transfer it:

- Place weigh boat on scale & tare/zero
- Use scoopula to add desired amount of solid reagent to the weigh boat
- Do not return excess reagent to the original container.
- Quantitatively transfer into proper glassware using dH_2O.

How to measure a volume accurately:

- Measure from the bottom of the meniscus
- Last digit reported for data is your best estimate b/w the lines

How to pipette:

- Clean/dry pipette (prime w/ your solution if needed)
- Use pipette bulb to draw solution into pipette, above grad. mark.
- Release pressure until fluid level is at grad. mark (bottom of meniscus)
- Allow fluid to drain into glassware of ~~choice~~ choice.

How to prepare a solution:

- Quantitatively transfer desired amount of chemical into the appropriate size volumetric flask.
- Fill ½ way with dH_2O, swirl to mix until chemical is dissolved.
- Fill to grad. mark, cap, invert/flip to mix

H ↑ transfer pipette

When to use beakers, graduated cylinders, volumetric flasks, volumetric pipettes, transfer pipettes, weigh boats, etc.

Beakers – hold/transfer/mix in/pipette out of

Grad. Cyl./vol pipette – Measure fluid volume

Vol. Flask – Make solutions in

Trans. Pipette – Add (slowly) to get fluid level to grad. mark in vol. flask or grad. cyl.

Weigh Boat – Weigh solid reagents