Chem Honors - WKS Dr. Casagrande
Unit 9: Chemical Reactions Review

Be able to answer the following:
1. What are the four state symbols and what do they indicate?
2. What are some indications of the occurrence of a chemical reaction?
3. What do the coefficients in a chemical equation represent?
4. What must you Never, Never, Ever change when balancing a chemical equation?
5. What are the seven elements that exist as diatomic molecules when by themselves?
6. What are oxidation and reduction? Be able to identify the element that is oxidized and the element that is reduced in a chemical reaction and what their products are.
7. What is an aqueous solution?
8. What is a precipitate?

Balance each of the following reactions and indicate the reaction type in the blank at right.

Reaction Type

1. ___ Li_2O (s) + ___ H_2O (ℓ) ⟶ 2 LiOH (aq) — Synthesis

2. ___ $Ca(ClO_3)_2$ (s) $\xrightarrow{\Delta}$ ___ $CaCl_2$ (s) + 3 O_2 (g) — Decomposition

3. 2 NaBr (aq) + ___ F_2 (g) ⟶ 2 NaF (aq) + ___ Br_2 (ℓ) — Single Replacement

4. ___ C_5H_{12} (ℓ) + 8 O_2 (g) ⟶ 5 CO_2 (g) + 6 H_2O (g) — Combustion

5. ___ Au_2S_3 (aq) + 3 H_2 (g) ⟶ 2 Au (s) + 3 H_2S (g) — Single Replacement

6. 4 Fe (s) + 3 O_2 (g) ⟶ 2 Fe_2O_3 (s) — Synthesis/Combustion

Reaction — Type(s)

7. Aqueous barium chloride mixes with aqueous aluminum sulfate to form solid barium sulfate and aqueous aluminum chloride. — Double Replacement

$3\ BaCl_2\ (aq) + Al_2(SO_4)_3\ (aq) \longrightarrow 3\ BaSO_4\ (s) + 2\ AlCl_3\ (aq)$

8. Solid antimony reacts in oxygen gas to form solid tetraantimony hexoxide. — Synthesis/Combustion

$4\ Sb\ (s) + 3\ O_2\ (g) \longrightarrow Sb_4O_6\ (s)$

9. Solid potassium chlorate is heated in a test tube and produces solid potassium chloride and oxygen gas. — Decomposition

$2\ KClO_3\ (s) \xrightarrow{\Delta} 2\ KCl\ (s) + 3\ O_2\ (g)$

10. Liquid isopropanol (C_3H_7OH) reacts with oxygen gas to form gaseous carbon dioxide and water vapor. — Combustion

$2\ C_3H_7OH\ (\ell) + 9\ O_2\ (g) \longrightarrow 6\ CO_2\ (g) + 8\ H_2O\ (g)$

DETERMINE the products and write the BALANCED EQUATION for each for each of these single-replacement reactions as if the reaction occurs. Determine whether the reaction would occur. Then write the Net Ionic Equations

11. __2__ Li (s) + ___ $ZnCl_2$ (aq) → 2 LiCl (aq) + Zn (s)

Reaction occurs
Zn^{2+} → Zn is above Li → Li^+

$2\ Li^0\ (s) + Zn^{2+}\ (aq) + 2\ Cl^-\ (aq) \rightarrow 2\ Li^+\ (aq) + 2\ Cl^-\ (aq) + Zn^0\ (s)$

$2\ Li^0\ (s) + Zn^{2+}\ (aq) \rightarrow 2\ Li^+\ (aq) + Zn^0\ (s)$

12. ___ Cu + ___ Na_2SO_4 (aq) → $CuSO_4$ (aq) + 2 Na (s) NR

Reaction does not occur
Na^+ → Na is below Cu → Cu^{2+}

$Cu^0\ (s) + 2\ Na^+\ (aq) + SO_4^{2-}\ (aq) \rightarrow Cu^{2+}\ (aq) + SO_4^{2-}\ (aq) + 2\ Na^0\ (s)$

$Cu^0\ (s) + 2\ Na^+\ (aq) \rightarrow Cu^{2+}\ (aq) + 2\ Na^0\ (s)$

Determine the reactant formulas for the following scenarios, then complete the reactions as above.

13. Solid iron wire is placed into a solution of copper(II) chloride.

$Fe\ (s) + CuCl_2\ (aq) \rightarrow FeCl_2\ (aq) + Cu\ (s)$

$Fe^0\ (s) + Cu^{2+}\ (aq) + 2\ Cl^-\ (aq) \rightarrow Fe^{2+}\ (aq) + 2\ Cl^-\ (aq) + Cu^0\ (s)$

$Fe^0\ (s) + Cu^{2+}\ (aq) \rightarrow Fe^{2+}\ (aq) + Cu^0\ (s)$

14. Fluorine gas is bubbled through a solution of gallium(III) iodide.

$3\ F_2\ (g) + 2\ GaI_3\ (aq) \rightarrow 2\ GaF_3\ (aq) + 3\ I_2\ (s)$

$3\ F_2\ (g) + 2\ Ga^{3+}(aq) + 6\ I^-\ (aq) \rightarrow 2\ Ga^{3+}(aq) + 6\ F^-\ (aq) + 3\ I_2\ (s)$

$3\ F_2\ (g) + 6\ I^-\ (aq) \rightarrow 6\ F^-\ (aq) + 3\ I_2\ (s)$ REDUCE: $F_2\ (g) + 2\ I^-\ (aq) \rightarrow 2\ F^-\ (aq) + I_2\ (s)$

15. Label these changes as either oxidation or reduction:

a) $F^-\ (aq) \rightarrow F_2\ (g)$ oxidation

b) $Al^0\ (s) \rightarrow Al^{3+}\ (aq)$ oxidation

c) $Zn^{2+}\ (aq) \rightarrow Zn^0\ (s)$ reduction

d) $I_2^0\ (s) \rightarrow I^-\ (aq)$ reduction

16. Put in all charges (oxidation numbers) in the following substances.

a) $\overset{2+\ 1-}{NiBr_2}$ b) $\overset{0}{Co}$ c) $\overset{3+\ 1-}{AuCl_3}$ d) $\overset{0}{F_2}$ e) $\overset{1+\ 1-}{HBr}$ f) $\overset{0}{Mg}$ g) $\overset{1+\ 1-}{KF}$

17. Complete these reactions, put in all oxidation numbers and then write the net ionic equation. *(Only write substances whose charges change, not spectator ions.)* Then indicate which substance is being oxidized, which is being reduced, and what their products are. [Remember LEO-GER!]

a) __3__ $\overset{0}{Mg}\ (s) +$ __2__ $\overset{3+\ 1-}{AuCl_3}\ (aq) \rightarrow 3\ \overset{2+\ 1-}{MgCl_2}\ (aq) + 2\ \overset{0}{Au}\ (s)$

Net Ionic Eq:

$3\ Mg\ (s) + 2\ Au^{3+}\ (aq) + 6\ Cl^-\ (aq) \rightarrow 3\ Mg^{2+}\ (aq) + 6\ Cl^-\ (aq) + 2\ Au\ (s)$

$3\ Mg\ (s) + 2\ Au^{3+}\ (aq) \rightarrow 3\ Mg^{2+}\ (aq) + 2\ Au\ (s)$

Oxidized: Mg Product: Mg^{2+}

Reduced: Au^{3+} Product: Au

b) 3 $\overset{0}{Cl_2}$ (g) + 2 $\overset{3+\ 1-}{AlBr_3}$ (aq) → 2 $\overset{3+\ 1-}{AlCl_3}$ (aq) + 3 $\overset{0}{Br_2}$ (ℓ)

Net Ionic Eq:

$3\ Cl_2\ (g) + 2\ Al^{3+}\ (aq) + 6\ Br^-\ (aq) \rightarrow 2\ Al^{3+}(aq) + 6\ Cl^-\ (aq) + 3\ Br_2\ (\ell)$

$3\ Cl_2\ (g) + 6\ Br^-\ (aq) \rightarrow 6\ Cl^-\ (aq) + 3\ Br_2\ (\ell)$ REDUCE: $Cl_2\ (g) + 2\ Br^-\ (aq) \rightarrow 2\ Cl^-\ (aq) + Br_2\ (\ell)$

Oxidized: Br^- Product: Br_2

Reduced: Cl_2 Product: Cl^-

For the following skeleton equations, determine the correct product formulas & states, then balance. Then write complete ionic and net ionic equations.

18. ___ K_2S (aq) + ___ $CoCl_2$ (aq) → 2 KCl (aq) + CoS (s)

$2\ K^+\ (aq) + S^{2-}\ (aq) + Co^{2+}\ (aq) + 2\ Cl^-\ (aq) \rightarrow 2\ K^+\ (aq) + 2\ Cl^-\ (aq) + CoS\ (s)$

$S^{2-}\ (aq) + Co^{2+}\ (aq) \rightarrow CoS\ (s)$

19. ___ RbI (aq) + ___ $AgNO_3$ (aq) → $RbNO_3$ (aq) + AgI (s)

$Rb^+\ (aq) + I^-\ (aq) + Ag^+\ (aq) + NO_3^-\ (aq) \rightarrow Rb^+\ (aq) + NO_3^-\ (aq) + AgI\ (s)$

$I^-\ (aq) + Ag^+\ (aq) \rightarrow AgI\ (s)$

20. Lithium carbonate solution reacts with molybdenum(VI) bromide solution.

$3\ Li_2CO_3\ (aq) + MoBr_6\ (aq) \rightarrow 6\ LiBr\ (aq) + Mo(CO_3)_3\ (s)$

$6\ Li^+\ (aq) + 3\ CO_3^{2-}\ (aq) + Mo^{6+}\ (aq) + 6\ Br^-\ (aq) \rightarrow 6\ Li^+\ (aq) + 6\ Br^-\ (aq) + Mo(CO_3)_3\ (s)$

$3\ CO_3^{2-}\ (aq) + Mo^{6+}\ (aq) \rightarrow Mo(CO_3)_3\ (s)$

21. Sodium chloride solution reacts with lead(II) chlorate solution.

$2\ NaCl\ (aq) + Pb(ClO_3)_2\ (aq) \rightarrow 2\ NaClO_3\ (aq) + PbCl_2\ (s)$

$2\ Na^+\ (aq) + 2\ Cl^-\ (aq) + Pb^{2+}\ (aq) + 2\ ClO_3^-\ (aq) \rightarrow 2\ Na^+\ (aq) + 2\ ClO_3^-\ (aq) + PbCl_2\ (s)$

$2\ Cl^-\ (aq) + Pb^{2+}\ (aq) \rightarrow PbCl_2\ (s)$