**Name:** _____ **Class:** _____ **Date:** _____ **ID: A**

# Chem Semester 1 Review 08 - 09

## Short Answer

1. Balance the following equation for the reaction.
_____$Cr(s)$ + _____$H_3PO_4(aq)$ → _____$H_2(g)$ + _____$CrPO_4(s)$

2. Balance the following equation for the reaction.
_____$SiO_2(s)$ + _____ $C(s)$ → _____$SiC(s)$ + _____ $CO(g)$

Write a balanced equation for each of the following reactions, substituting symbols and formulas for names. Include the state of each reactant and product. Then identify the reaction type for each. If more than one reaction type applies, list all that apply.

3. When aluminum nitrate and sodium hydroxide solutions are mixed, solid aluminum hydroxide forms. The other product is sodium nitrate.
4. When magnesium is heated in the presence of nitrogen gas, solid magnesium nitride forms.
5. When solid copper(II) oxide and hydrogen react, metallic copper and water form.
6. Most industrial production of metallic sodium is accomplished by passing an electric current through molten sodium chloride. Chlorine gas also is produced.
7. Liquid pentane ($C_5H_{12}$) burns, producing water vapor and carbon dioxide.

Predict the products in each of the following reactions. If no reaction occurs, write NR. You may use Figure 10-10 for the relative activities of common metals and halogens.

8. $Rb(s) + CaCl_2(aq)$
9. $Pt(s) + MnBr_2(aq)$
10. $F_2(g) + NaI(aq)$

Balance the following chemical equations.

11. $SnS_2(s) + O_2(g) \rightarrow SnO_2(s) + SO_2(g)$
12. $Al(s) + HCl(aq) \rightarrow AlCl_3(aq) + H_2(g)$

Write a complete ionic equation and a net ionic equation for each of the following double-displacement reactions.

13. $Ba(NO_3)_2(aq) + H_2SO_4(aq) \rightarrow$
$BaSO_4(s) + 2HNO_3(aq)$
14. $FeCl_3(aq) + (NH_4)_3PO_4(aq) \rightarrow$
$FePO_4(s) + 3NH_4Cl(aq)$
15. KCl(aq) 1 AgC2H3O2(aq) →
AgCl(s) 1 KC2H3O2(aq)

16. Define a chemical reaction.
17. Define reactants in a chemical reaction.
18. Define products in a chemical reaction.
19. What are spectator ions?
20. Define a skeleton equation.
21. What are net ionic equations?
22. Define a decomposition reaction.
23. Go back and review how to draw Lewis structures. There are a couple of lewis structure problems on the test.

**Problem**

Identify and calculate the number of representative particles in each of the following quantities.

24. 2.15 moles of gold
25. 11.5 moles of potassium bromide

Calculate the number of moles of the substance that contains the following number of representative particles.

26. $8.92 \times 10^{23}$ atoms of barium
27. $5.50 \times 10^{25}$ molecules of carbon monoxide

Determine the mass in grams of each of the following quantities.

28. 1.24 moles of beryllium

Calculate the number of moles in each of the following samples.

29. 6.35 g lithium
30. 3.75 g calcium carbide ($CaC_2$)

How many atoms are in the following samples?

31. 1.24 g cobalt

Which quantity has the greatest mass?

32. $1.33 \times 10^{24}$ atoms of argon

33. Solve the following problem. Show your work. A 2.00-g sample of a hydrate of iron(II) chloride produces 1.27 g of anhydrous iron(II) chloride ($FeCl_2$) after heating. Determine the empirical formula and the name of the hydrate.

Fill in the following table with the type of reaction that the reactants and products describe.

34. Fill in the following table with the type of reaction that the reactants and products describe.

| Reaction Classifications | | |
|---|---|---|
| **Reaction type** | **Reactants** | **Products** |
| | One plus oxygen | One or more oxides |
| | One | Two or more |
| | Two compounds | Two compounds |
| | Two or more | One |
| | An element and a compound | An element and a compound |

Use the following table to determine whether or not a precipitate forms when the solutions listed below are mixed. Write the formula for the precipitate if one is formed. Write NP if no precipitate is formed. Use examples 1 and 2 as guides.

| Solubility Rules for Some Common Compounds |
|---|
| **1. Compounds that contain these ions will not form precipitates.**<br>All Ions from Group 1A metals<br>Ammonium, nitrate, and acetate polyatomic ions<br>Chloride, bromide, and iodide ions, unless combined with silver, mercury(l), or lead |
| **2. Compounds that contain these ions usually will form precipitates.**<br>Oxide and sulfide ions<br>Carbonate, hydroxide, and phosphate polyatomic ions |
| **3. If a compound contains an ion mentioned in Rule 1, it will not form a precipitate, even if it contains an ion mentioned in Rule 2.**<br>For example, ammonium sulfide will dissolve in water. Although sulfides usually don't dissolve in water, all ammonium compounds will dissolve. |

**Example 1**: sodium hydroxide and lead(II) nitrate
If a reaction were to occur, lead(II) hydroxide and sodium nitrate would form. According to the table, lead(II) hydroxide forms a precipitate. The formula for the precipitate is Pb(OH)2.

**Example 2**: ammonium acetate and potassium phosphate
If a reaction were to occur, ammonium phosphate and potassium acetate would form. According to the table, neither forms a precipitate. No reaction occurs.

35. potassium chloride and mercury(I) nitrate

36. ammonium carbonate and potassium nitrate

37. sodium phosphate and tin(II) bromide

38. lithium nitrate and silver acetate

# Chem Semester 1 Review 08 - 09
# Answer Section

## SHORT ANSWER

1. ANS:
   __2___Cr(s) + __2___$H_3PO_4$(aq) → __3___$H_2$(g) + __2___$CrPO_4$(s)
2. ANS:
   __1___$SiO_2$(s) + __2___ C(s) → __1___SiC(s) + __2___ CO(g)
3. ANS:
   $Al(NO_3)_3$(aq) + 3NaOH(aq) → $Al(OH)_3$(s) +3$NaNO_3$(aq)
   double-replacement
4. ANS:
   4Mg(s) + 3$N_2$(g) → 2$Mg_2N_3$(s)
   synthesis
5. ANS:
   CuO(s) + $H_2$(g) → Cu(s) + $H_2O$(l)
   single-replacement
6. ANS:
   2NaCl(l) → 2Na(s) + $Cl_2$(g)
   decomposition
7. ANS:
   $C_5H_{12}$(l) + 8$O_2$(g) → 6$H_2O$(g) + 5$CO_2$(g)
   combustion
8. ANS:
   RbCl(aq) + Ca(s)
9. ANS:
   NR
10. ANS:
    NaF(aq) + $I_2$(s)
11. ANS:
    $SnS_2$(s) + 3$O_2$(g) → $SnO_2$(s) + 2$SO_2$(g)
12. ANS:
    2Al(s) + 6HCl(aq) → 2$AlCl_3$(aq) + 3$H_2$(g)
13. ANS:
    $Ba^{2+}$(aq) + 2$NO_3^-$(aq) + 2$H^+$(aq) + $SO4^{2-}$(aq)→
    $BaSO_4$(s) + 2$H^+$(aq) + 2$NO_3^-$(aq)
    $Ba^{2+}$(aq) + $SO_4^{2-}$(aq) → $BaSO_4$(s)
14. ANS:
    $Fe^{3+}$(aq) + 3$Cl^-$(aq) + 3$NH_4^+$(aq) + $PO_4^{3-}$(aq) →
    $FePO_4$(s) + 3$NH_4^+$(aq) + 3$Cl^-$(aq)
    $Fe3^+$(aq) + $PO_4^{3-}$(aq) → $FePO_4$(s)
15. ANS:
    K+(aq) + $Cl^-$(aq) + $Ag^+$(aq) + $C_2H_3O_2^-$(aq)→
    AgCl(s) + $K^+$(aq) + $C_2H_3O_2^-$(aq)
    $Cl^-$(aq) + $Ag^+$(aq) → AgCl(s)

16. ANS:
The process by which the atoms of one or more substances are rearranged to form different substances is called a chemical reaction.

DIF: 1 REF: Page 277 OBJ: 10.1.1 Recognize evidence of chemical change.
STO: B.3 TOP: Recognize evidence of chemical change.
KEY: Chemical reactions MSC: 1

17. ANS:
The starting substances of a chemical reaction are called reactants.

DIF: 1 REF: Page 278 OBJ: 10.1.2 Represent chemical reactions with equations.
STO: UCP.1, UCP.2, B.3 TOP: Represent chemical reactions with equations.
KEY: Chemical reactions MSC: 1

18. ANS:
The substances formed in a chemical reaction are called products.

DIF: 1 REF: Page 278 OBJ: 10.1.2 Represent chemical reactions with equations.
STO: UCP.1, UCP.2, B.3 TOP: Represent chemical reactions with equations.
KEY: Chemical reactions MSC: 1

19. ANS:
Ions that do not participate in a reaction are called spectator ions.

DIF: 1 REF: Page 293 OBJ: 10.3.1 Describe aqueous solutions.
STO: B.2, B.3 TOP: Describe aqueous solutions. KEY: Ionic equation
MSC: 1

20. ANS:
The equation that uses chemical formulas to identify the reactants and the products is called a skeleton equation.

DIF: 1 REF: Page 279 OBJ: 10.1.2 Represent chemical reactions with equations.
STO: UCP.1, UCP.2, B.3 TOP: Represent chemical reactions with equations.
KEY: Skeleton equation MSC: 1

21. ANS:
Ionic equations that include only the particles that participate in the reaction are called net ionic equations.

DIF: 1 REF: Page 293 OBJ: 10.3.1 Describe aqueous solutions.
STO: B.2, B.3 TOP: Describe aqueous solutions. KEY: Net ionic equation
MSC: 1

22. ANS:
A chemical reaction in which a single compound breaks down into two or more elements or new compounds is called a decomposition reaction.

DIF: 1 REF: Page 286 OBJ: 10.2.1 Classify chemical reactions.
STO: UCP.1, B.3 TOP: Classify chemical reactions. KEY: Decomposition reactions
MSC: 1

23. ANS:
in the text in CH 9

**PROBLEM**

24. ANS:

$$2.15 \text{ mol Au} \times \frac{6.02 \times 10^{23} \text{ atoms Au}}{1 \text{ mol Au}}$$

$$= 1.29 \times 10^{24} \text{ atoms Au}$$

25. ANS:

$$11.5 \text{ mol KBr} \times \frac{6.02 \times 10^{23} \text{ formula units KBr}}{1 \text{ mol KBr}}$$

$$= 6.92 \times 10^{24} \text{ formula units KBr}$$

26. ANS:

$$8.92 \times 10^{23} \text{ atoms Ba} \times \frac{1 \text{ mol Ba}}{6.02 \times 10^{23} \text{ atoms Ba}}$$

$$= 1.48 \text{ mol Ba}$$

27. ANS:

$$5.50 \times 10^{25} \text{ molecules CO} \times \frac{1 \text{ mol CO}}{6.02 \times 10^{23} \text{ molecules CO}}$$

$$= 91.4 \text{ mol CO}$$

28. ANS:

$$1.24 \text{ mol Be} \times \frac{9.01 \text{ g Be}}{1 \text{ mol Be}}$$

$$= 11.2 \text{ g Be}$$

29. ANS:

$$6.35 \text{ g Li} \times \frac{1 \text{ mol Li}}{6.94 \text{ g Li}}$$

$$= 0.915 \text{ mol Li}$$

30. ANS:

$$1 \text{ mol } CaC_2 \times \frac{2 \text{ mol C}}{1 \text{ mol } CaC_2} \times \frac{12.01 \text{ g C}}{1 \text{ mol C}}$$
$$= 24.02 \text{ g C}$$

$$1 \text{ mol } CaC_2 \times \frac{1 \text{ mol Ca}}{1 \text{ mol } CaC_2} \times \frac{40.08 \text{ g Ca}}{1 \text{ mol Ca}}$$
$$= 40.08 \text{ g Ca}$$

$(24.02 \text{ g} + 40.08 \text{ g}) = 64.10 \text{ g}$

The molar mass of calcium carbide is 64.10 g/mol.

$$3.75 \text{ g } CaC_2 \times \frac{1 \text{ mol } CaC_2}{64.10 \text{ g } CaC_2}$$
$$= 0.0585 \text{ mol } CaC_2$$

31. ANS:

$$1.24 \text{ g Co} \times \frac{1 \text{ mol Co}}{58.93 \text{ g Co}} \times$$
$$\frac{6.02 \times 10^{23} \text{ atoms Co}}{1 \text{ mol Co}}$$
$$= 1.27 \times 10^{22} \text{ atoms Co}$$

32. ANS:

$$1.33 \times 10^{24} \text{ atoms Ar} \times \frac{1 \text{ mol Ar}}{6.02 \times 10^{23} \text{ atoms Ar}} \times$$
$$\frac{39.95 \text{ g Ar}}{1 \text{ mol Ar}}$$
$$= 88.3 \text{ g Ar}$$

The quantity $4.16 \times 10^{23}$ atoms of radium has the greatest mass.

33. ANS:

2.00 g $FeCl_2 \cdot xH_2O$ – 1.27 g $FeCl_2$ = →.73 g $H_2O$
0.73 g $H_2O \times 1$ mol $H_2O$/18.02 g $H_2O$ = 0.040 mol $H_2O$
1.27 g $FeCl_2 \times 1$ mol $FeCl_2$/126.75 g $FeCl_2$ = 0.0100 mol $FeCl_2$
0.040 mol $H_2O$/0.0100 mol $FeCl_2$ = 4 mol $H_2O$/1 mol $FeCl_2$
4 mol $H_2O$ : 1 mol $FeCl_2$
$FeCl_2 \cdot 4H_2O$
iron(II) chloride tetrahydrate

34. ANS:

| Reaction Classifications | | |
|---|---|---|
| **Reaction type** | **Reactants** | **Products** |
| **combustion** | One plus oxygen | One or more oxides |
| **decomposition** | One | Two or more |
| **double-replacement** | Two compounds | Two compounds |
| **synthesis** | Two or more | One |
| **single-replacement** | An element and a compound | An element and a compound |

35. ANS:
HgCl

36. ANS:
NP

37. ANS:
$SN_3(PO_4)_2$

38. ANS:
NP