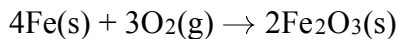Base your answers to questions **1** through **3** on the information below.

Rust on an automobile door contains $Fe_2O_3(s)$. The balanced equation representing one of the reactions between iron in the door of the automobile and oxygen in the atmosphere is given below.

$4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$

1. Write the IUPAC name for Fe_2O_3.

2. Determine the gram-formula mass of the product of this reaction.

3. Identify the type of chemical reaction represented by this equation.

4. Base your answer to the following question on the information below.

A student is instructed to make 0.250 liter of a 0.200 M aqueous solution of $Ca(NO_3)_2$.

What is the gram-formula mass of $Ca(NO_3)_2$?

5. Base your answer to the following question on the information below.

    The decomposition of sodium azide, $NaN_3(s)$, is used to inflate airbags. On impact, the $NaN_3(s)$ is ignited by an electrical spark, producing $N_2(g)$ and $Na(s)$. The $N_2(g)$ inflates the airbag.

Balance the equation using the smallest whole-number coefficients.

6. Show a correct numerical setup for calculating the formula mass of glucose, $C_6H_{12}O_6$.

7. Base your answer to the following question on the passage below.

    Acid rain is a problem in industrialized countries around the world. Oxides of sulfur and nitrogen are formed when various fuels are burned. These oxides dissolve in atmospheric water droplets that fall to earth as acid rain or acid snow.

    While normal rain has a pH between 5.0 and 6.0 due to the presence of dissolved carbon dioxide, acid rain often has a pH of 4.0 or lower. This level of acidity can damage trees and plants, leach minerals from the soil, and cause the death of aquatic animals and plants.

    If the pH of the soil is too low, then quicklime, CaO, can be added to the soil to increase the pH. Quicklime produces calcium hydroxide when it dissolves in water.

Balance the neutralization equation below, using the smallest whole number coefficients.

$$\underline{\quad} HNO_3 + \underline{\quad} Ca(OH)_2 \rightarrow \underline{\quad} Ca(NO_3)_2 + \underline{\quad} H_2O$$
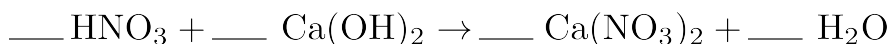
8. Show a correct numerical setup for calculating the number of moles of CO_2 (gram-formula mass = 44 g/mol) present in 11 grams of CO_2.

9. Given the equation:

$$2 H_2(g) + O_2(g) \rightarrow 2 H_2O(g)$$
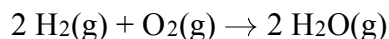
If 8.0 moles of O_2 are completely consumed, what is the total number of moles of H_2O produced?

10. Base your answer to the following question on
    the information below.

    Gypsum is a mineral that is used in the construction industry to make drywall (sheetrock). The chemical formula for this hydrated compound is $CaSO_4 \cdot 2\,H_2O$. A hydrated compound contains water molecules within its crystalline structure. Gypsum contains 2 moles of water for each 1 mole of calcium sulfate.

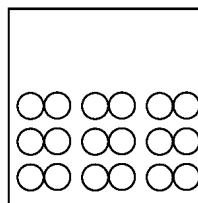   What is the gram formula mass of $CaSO_4 \cdot 2\,H_2O$?

11. Base your answer to the following question on the particle diagrams below, which show atoms and/or molecules in three different samples of matter at STP.
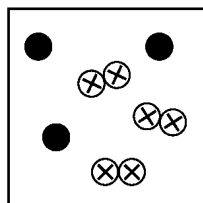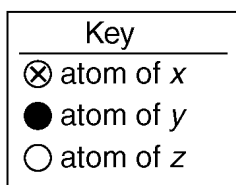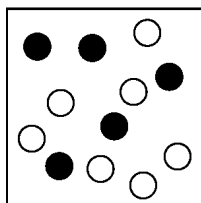
Sample 1   Sample 2   Sample 3

Explain why (x)(x) does *not* represent a compound.

12. The following procedures are carried out during a laboratory activity to determine the mass in grams of $CuSO_4$ in a hydrated sample of $CuSO_4 \bullet 5H_2O$.

Step 1 Determine the mass in grams of the crucible and $CuSO_4 \bullet 5H_2O$.
Step 2 Determine the mass in grams of the crucible and $CuSO_4$
Step 3 Determine the mass in grams of $CuSO_4 \bullet 5H_2O$.
Step 4 Determine the mass in grams of the empty crucible.
Step 5 Determine the mass in grams of $CuSO_4$

Arrange the steps above in the order that the student should use to determine the mass of $CuSO_4$ in the sample.

_____, _____, _____, _____, _____

13. Base your answer to the following question on the information below.

A scientist in a chemistry laboratory determined the molecular formulas for two compounds containing nitrogen and oxygen to be NO_2 and N_2O_5

Write an IUPAC name for the compound N_2O_5.

Base your answers to questions **14** and **15** on the information and equation below.

Antacids can be used to neutralize excess stomach acid. Brand Antacid contains the acid-neutralizing agent magnesium hydroxide, $Mg(OH)_2$. It reacts with $HCl(aq)$ in the stomach, according to the following balanced equation:

$2 \text{ HCl(aq)} + Mg(OH)_2(s) \rightarrow MgCl_2(aq) + 2 \text{ H}_2O(\ell)$
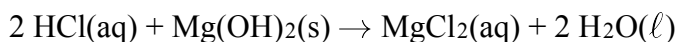
14. Brand *B* antacid contains the acid-neutralizing agent sodium hydrogen carbonate. Write the chemical formula for sodium hydrogen carbonate.

15. Show a correct numerical setup for calculating the number of moles of Mg(OH)$_2$ (gram-formula mass = 58.3 grams/mole) in an 8.40-gram sample.

1.   iron(III) oxide

2.   160.g/mol.

3.   *Examples:* – synthesis
      – redox – oxidation

4.   164 g/mol

5.   <u>2</u> NaN$_3$(s) → <u>2</u>
      Na(s) + <u>3</u> N$_2$(g).

6.   6(12.0) + 12(1.0) +
      6(16.0)
                or
         6(12) + 12(1) +
      6(16)

7.   2 HNO$_3$ + 1 Ca(OH)$_2$
      → 1 Ca(NO$_3$)$_2$ + 2 H$_2$
      O

8.   11 g × $\frac{1 mole}{44 g}$ *or* $\frac{11}{44}$

9.   16 *or* 16.0

10.   Acceptable responses:
      172, 172.2.

11.   Acceptable responses:
      A compound must
      contain two or more
      different elements,
      only 1 kind of atom
      present.

12.   4,1,3,2,5

13.   Responses include,
      but are not limited to,
      these examples:
      dinitrogen pentoxide
      • nitrogen(V) oxide

14.   NaHCO$_3$

15.   Acceptable responses:
      8.40g × $\frac{1 mole}{58.3 g}$. $\frac{8.4}{58.3}$