Title:	Balancing Chemical Equations
Standard:	*5.a I can balance chemical reactions and explain them conceptually using the concept of conservation of mass.*

1) What is the law of conversation of mass and how does it connect to chemical reactions?

2) Which option obeys the law of conservation of mass?
   a) $2Li + O_2 \rightarrow 1Li_2O$
   b) $4Li + O_2 \rightarrow 2Li_2O$
   c) $5Li + O_2 \rightarrow Li_2O$
   d) $Li + O_2 \rightarrow Li_2O$

3) Which option shows that no mass is created or destroyed in a chemical reaction?
   a) $Mn + O_2 \rightarrow MnO_7$
   b) $7Mn + 2O_2 \rightarrow 2MnO_7$
   c) $1Mn + 7O_2 \rightarrow 2MnO_7$
   d) $2Mn + 7O_2 \rightarrow 2MnO_7$

4) Balance the equations below.

$$\_\_\_Pb(s) + \_\_\_NaNO_3(aq) \rightarrow \_\_\_Pb(NO_3)_2(aq) + \_\_\_Na(s)$$

$$\_\_\_C_2H_6(g) + \_\_\_O_2(g) \rightarrow \_\_\_CO_2(g) + \_\_\_H_2O(l)$$

$$\_\_\_Te_8(s) + \_\_\_F_2(g) \rightarrow \_\_\_TeF_6(l)$$

Title:	Relating reactants and products
Standard:	*5.b I can relate reactants to products using a chemical reaction and can convert from molecules A to molecules B or moles A to moles B.*

Use the reaction below for questions 1-3

$$2Mn(s) + 7O_2(g) \rightarrow 2MnO_7(s)$$

1) What will occur to the amount of reactants and products as the reaction proceeds?

2) How many moles of oxygen gas are needed to react completely with 4 moles of manganese?

3) If you react one mole of manganese with one mole of oxygen, will they both be used up completely? Explain.

Use the reaction below for questions 4-6

$$4Li(s) + O_2(g) \rightarrow 2Li_2O(s)$$

4) How many molecules of oxygen are required to completely react with 16×10^8 atoms of lithium?

5) Imagine there are originally 100 molecules of oxygen. If 40 atoms of lithium react, how many molecules of oxygen are left?

6) If 5 moles of lithium oxide reacted backwards to produce reactants, how many total moles of reactants would be produced?

Title:	The mole
Standard:	*5.c I can define a mole and Avogadro's number and can use it to convert from molecules to moles.*

1) Are 1 dozen and 1 mole equal to each other or is one bigger than the other? Explain.

2) How was the mole defined?

3) Rank the following amounts from the least numerous to the most numerous.
   a. 3 moles
   b. 3 dozen
   c. 150,000,000,000
   d. 1
   e. 1×10^{30}
   f. ½ a mole
   g. 6.02×10^{23}

4) How many molecules are contained in a sample of gas that has 3.5 moles of krypton gas?

5) Magnesium burns extremely brightly in air and is often used in fireworks. If there are 1.2×10^{23} atoms of magnesium in a firework, and for proper functioning the device needs at least 2 moles of magnesium, will the firework work? Justify your answer with a complete sentence and show all work.

5) Given the reaction below, how many molecules of oxygen would be required to produce 4 moles of MnO_7?

$$2Mn(s) + 7O_2(g) \rightarrow 2MnO_7(s)$$

Title:	Molar mass
Standard:	*5.d I can calculate the number of grams in one mole of any compound based on the formula.*

1) Calculate the molar masses for the follow chemicals. Include units.
   a. Caffeine: $C_8H_{10}N_4O_2$
   b. Water: H_2O
   c. Table sugar (sucrose): $C_{12}H_{22}O_{11}$
   d. Iron (III) oxide (rust): Fe_2O_3
   e. Oxygen: O_2
   f. Carbon Dioxide: CO_2

2) How many atoms are in 31g of phosphorous?

3) Rank the following from high to low gram molecular mass (molar mass).
   a. Hf
   b. HF
   c. $Sr(OH)_2$
   d. AgOH
   e. PH_3

4) How many grams of chromium are present in a can that contains 2.5 moles of chromium?

5) Ms. Chen is thirsty and asks Mr. Itow to go get her 5 moles of H_2O. Mr. Itow uses his scale to measure out 100g of H_2O. Has he given her too much, too little, or just the right amount of water? Justify your answer with a complete sentence and show all work.

Title:	Converting from grams of one chemical to grams of another chemical
Standard:	*5.e Students know how to covert from grams A to grams B, or any other two step conversion in a reaction.*

Use the following reaction for problems 1-4

$$ZnS(s) + 2O_2(g) \rightarrow 2ZnO(s) + SO_2(g)$$

1) How many moles of sulfur dioxide are produced when 194g of zinc sulfide react completely with oxygen?

2) If 32g of O_2 react fully, how many grams of zinc sulfide must have also been used up?

3) How many molecules of sulfur dioxide can be produced from 16g of oxygen gas?

4) If more than 40g of sulfur dioxide are produced in an unvented area, a monkey in the room will die of acid burns to the lungs. When Dante reacts 48.5g of zinc sulfide completely, does the monkey die?

Read the scenario and answer the remaining questions in complete sentences, using academic language.

The production of nitric acid (HNO_3) often begins with the unbalanced reaction shown below. Often times in industrial processes, the chemical reaction does not proceed perfectly. There are usually other side reactions which use up the reactants instead. Chemists often calculate a percent yield, which is a quick way of expressing how well a reaction is occurring according to plan. The equation for percent yield is shown below.

__$NH_3(g)$ + __$O_2(g)$ → __$NO(g)$ + __$H_2O(g)$

$$\text{percent yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100\%$$

A) Balance the reaction and explain why it is important to balance reaction equations.

B) If 3 moles of NH_3 are used in the process, how many molecules of NH_3 were used?

C) If 34g of NH_3 and 64g of O_2 are combined in a reaction chamber, is there enough NH_3 to react with all of the O_2?

D) What is the percent yield of the reaction if only 30g of NO is produced after 68g of NH_3 reacts fully?