Name: ANSWER KEY Period: _____ Date: _____

Introduction to the Mole – ONLINE EDITION!

Today you will use 3 different websites to learn about a central concept in chemistry: THE MOLE! This is a lesson in chemistry and a lesson in **independence**: all of the information you need to answer the questions is in the websites. Check them out!

Website 1: http://antoine.frostburg.edu/chem/senese/101/moles/faq/why-use-moles.shtml (~12 minutes)

1 mole of ANYTHING = 6.02×10^{23} of that thing

1 mole of eggs = 6.02×10^{23} eggs

1 mole of diamonds = 6.02×10^{23} diamonds

1 mole of hydrogen = 6.02×10^{23} atoms of hydrogen

1 mole of water = 6.02×10^{23} molecules of water

1. How many sneakers are in one mole of sneakers? 6.02×10^{23} sneakers
2. How many atoms of carbon are in one mole of carbon? 6.02×10^{23} atoms of carbon
3. You have a mole of substance 1 and a mole of substance 2. Do substance 1 and substance 2 have to have the same mass (number of grams)? Yes (No)

   Explain your answer using an example:

   A dozen elephants and a dozen eggs are both 12 but elephants have a MUCH larger mass

4. Why do we use moles in chemistry?

   counting molecules individually is impractical
   ↳ TOO MANY
   moles solve the problem of counting large numbers of molecules

5. Once we know how many moles we have, we can use moles to count molecules.

6. Complete the following examples:

0.001 moles of water x $\left(\frac{6.02\times10^{23}\text{ water molecules}}{1\text{ mole water}}\right)$ = 6.02×10^{20} molecules of water

units cancel out

100 water molecules x $\left(\frac{1\text{ mole water}}{6.02\times10^{23}\text{ water molecules}}\right)$ = 1.66×10^{-22} moles of water

7. Can you use something's mass (number of grams) to figure out how many moles of it you have? (Yes) No

8. Complete the following examples:

100 grams of water x $\left(\frac{1\text{ mole water}}{18\text{g water}}\right)$ = 5.56 moles of water

6 moles of O_2 x $\left(\frac{32\text{g } O_2}{1\text{ mole } O_2}\right)$ = 192 grams of O_2

Why do we have 32 grams of O2 if the molecular weight (another word for molar mass) of oxygen is 16 grams?

because we have O_2, not O
↳ 2 O's

Website 2: http://chemistry.about.com/od/workedchemistryproblems/a/molegramconvert.htm
(~20 minutes)

PROBLEM 1: How many moles of CO_2 are in 454 grams of CO_2?

Atomic mass of carbon: 12.01 grams

ATOMIC MASS = BOTTOM NUMBER ON PERIODIC TABLE!!! REMEMBER?

Atomic mass of oxygen: 16 grams

Formula mass (molar mass) of CO_2:

12.01 g Carbon + 2(16 g Oxygen) = 44.01 g CO_2

Mass of one mole of CO_2 = 44.01 grams CO_2

454 grams CO_2 x $\left(\frac{1\text{ mol } CO_2}{44.01\text{g } CO_2}\right)$ = 10.3 moles of CO_2

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PROBLEM 2: How many grams of H_2SO_4 are in 3.6 moles of H_2SO_4?

Atomic mass of hydrogen: 1.008 grams

Atomic mass of sulfur: 32.06 grams

Atomic mass of oxygen: 16 grams

Formula mass (molar mass) of H_2SO_4:

2(1.008 g H) + 32.06 g S + 4(16 g O) = 98.08 grams H_2SO_4

Mass of one mole of H_2SO_4 = 98.08 grams H_2SO_4

3.6 moles H_2SO_4 x $\left(\frac{98.08 g\ H_2SO_4}{1\ mol\ H_2SO_4}\right)$ = 353 grams of H_2SO_4

TRY ON YOUR OWN:

3. How many moles of CH_4 are in 64 grams of CH_4?

Atomic mass of carbon: 12.01 grams

Atomic mass of hydrogen: 1.01 grams

Formula mass (molar mass) of CH_4:

12.01 g Carbon + 4(1.01 g Hydrogen) = 16.05 grams CH_4

Mass of one mole of CH_4= 16.05 grams CH_4

64 ~~grams CH_4~~ x $\left(\frac{1\ mol}{16.05 g\ CH_4}\right)$ = 3.99 moles ~~grams~~ of CH_4

4. How many grams are in 4.2 moles of FeO_2?

Atomic mass of iron: 55.85 grams

Atomic mass of oxygen: 16 grams

Formula mass (molar mass) of FeO_2:

55.85 g Iron + 2(16 g Oxygen) = 87.9 grams FeO_2

Mass of one mole of FeO_2= 87.9 grams FeO_2

4.2 ~~moles FeO_2~~ x $\left(\frac{87.9 g\ FeO_2}{1\ ~~mol\ FeO_2~~}\right)$ = 368.97 grams of FeO_2

Website 3 (~30 minutes):

http://www.softschools.com/quizzes/chemistry/counting_particles_and_avogadros_number/quiz1119.html

Directions: Take the "Counting Particles & Avogadro's Number" Quiz. Answer all 10 questions and SHOW YOUR WORK below! Re-do any problems you got wrong, and still show your work.
Include units in every answer.

1. How many atoms are in 2.5 moles of zinc? 1.51×10^{24} atoms

2. How many formula units (molecules) are in 3.25 moles of silver nitrate? 1.96×10^{24} formula units
   - FORMULA UNIT = molecule/particle (for ionic compounds)

3. How many atoms are in 4 moles of hydrogen gas? 2.41×10^{24} atoms

4. How many molecules are in 1.5 moles of water? 9.0×10^{23} molecules

5. How many formula units are in 3.3 moles of NaCl? 1.99 formula units

6. If you have 5.75×10^{24} aluminum atoms, how many moles is that? 10 moles

7. If you have 3.58×10^{24} molecules of carbon dioxide gas, how many moles do you have? 6 moles

8. If there are 3.58×10^{23} formula units of zinc chloride, how many moles are there? 0.5
   (real answer is 0.59)

9. How many moles are in 2.5×10^{20} iron atoms? 0.000415 moles
   (4.15×10^{-4} moles)

10. How many moles are in 4.50×10^{24} oxygen atoms? 7.5 moles