MATH APPLICATION ACTIVITY:
UNDERSTANDING PPM AND PPB

OBJECTIVE: **Students will:**
- Compute ppm and ppb concentration levels;
- Correlate those concentrations to the amount of greenhouse gases in the atmosphere;
- Create a visual representation of the composition of the atmosphere in ppm.

MATERIALS:
- ✓ 7 clear plastic cups
- ✓ Dark colored sugar free drink mix (Kool Aid)
- ✓ 10mL and 100 mL graduated cylinders
- ✓ markers, paper/pencil
- ✓ **Student Sheets**

PROCEDURE:
- ✓ Read and discuss the background information on pages 3-4.
- ✓ Divide students into groups of 2-3.
- ✓ Post the following instructions for the class or make copies for each group.

1. Measure exactly 100 mL of water and add the contents of one drink mix packet of Kool Aid into a clear plastic cup. This concentration will be called **1/1** or **one part per one**.
2. Label the cups 1-7 with # 1 being the cup with the drink mix.
3. Measure exactly 90 mL of water into each of the other six clear plastic cups.
4. Measure exactly 10 mL of the liquid from cup #1 and stir it in to cup #2. This concentration is **1/10** or **one part per ten**.

5. Measure exactly 10 mL of the liquid from cup #2 and stir it in to cup #3. This concentration is **1/100** or **one part per hundred**.

6. Measure exactly 10 mL of the liquid from cup #3 and stir it in to cup #4. This concentration is **1/1000** or **one part per thousand**.

7. Measure exactly 10 mL of the liquid from cup #4 and stir it in to cup #5. This concentration is **1/10,000** this is **one part per ten thousand**.

8. Measure exactly 10 mL of the liquid from cup #5 and stir it in to cup #6. This concentration is **1/100,000** or **one part per hundred thousand**.

9. Measure exactly 10 mL of the liquid from cup #6 and stir it in to cup #7. This concentration is **1/1,000,000** or **one part per million**.

10. Complete the activities in **ANALYSIS/COMPREHENSION.**

   ***Note: Student can use a calculator, an online ppm/percent convertor or simply do the math to complete the activities.**

   ***NOTE: Percentage is parts per 100. 1 part per hundreds is 10 parts per thousand or 10,000 parts per million. To get from percent to ppm MULTIPLY by 10,000. To get from ppm to percent DIVIDE BY 10,000**

   EXAMPLE 1: 780,000ppm of X = _____%
   780,000ppm ÷ 10,000 = 78%

   EXAMPLE 2: 78% of X = _____ppm
   .78   ÷ 10,000 = 780,000 ppm

DATA TABLE 4: CONCENTRATIONS OF ATMOSPHERIC GASES

Gas	Decimal Fraction	Percent	PPM	PPB
Nitrogen	0.78	78.0	780,000	780,000,000
Oxygen	.2095	20.95	209,500	209,500,000
Argon	.0093	0.93	9300	9,300,000
Neon	.000018	0.0018	18	18,000
Helium	.0000052	0.00052	5.2	5200
Hydrogen	.0000005	0.00005	.5	500
*Water vapor	.0004	0.04	400	400,000
*Ozone	.00000003	0.000003	.3	300
*Methane	.00000175	0.000175	1.75	1750
*Carbon dioxide	.0004	0.0400	400	400,000
*Nitrous oxide	.0000003	0.00003	.326	326
*CFCs (Total)	.000000035	0.0000035	.035	35