AP ENVIRONMENTAL SCIENCE MATH AND EQUATION REVIEW

1) **Show all *work*.** No work, no credit. This is critically important for every calculation, even if it seems trivial.

2) **Show all *units*.** Units provide valuable information.

3) **Develop good *"math sense"* or *"math literacy."*** The answers should make sense. If you calculate a cost of $50 billion per gallon of water, does this seem right?

4) **Know *simple conversion factors*** such as the number of days in a year or hours in a day. Other good numbers to know:
U.S. population = approx. 300 million (300,000,000 or 3×10^8)
World population = approx. 6.8 billion (6,800,000,000 or 6.8×10^9)

5) **Know and convert *metric prefixes*.**

- T tera- 10^{12} (trillion 1,000,000,000,000)
- G giga- 10^9 (billion 1,000,000,000)
- M mega- 10^6 (million 1,000,000)
- k kilo- 10^3 (1000)
- h hecto- 10^2 (100)
- da deka- 10^1 (10)
- d deci- 10^{-1} (0.1)
- c centi- 10^{-2} (0.01)
- m milli- 10^{-3} (0.001)
- μ micro- 10^{-6} (one-millionth 0.000001)
- n nano- 10^{-9} (one-billionth 0.000000001)

6) **Be comfortable working with *negative numbers*.** Going from -8 ºC to +2ºC is a 10º change.

7) **Use dimensional analysis.** Conversions should show units of measurement and conversion factors.
Example: If water has a density of 62 pounds per cubic foot, how many tons of water are contained in a 4000 cubic foot tank?
4000 cubic foot tank x (62 pounds/cubic foot) x (1 ton/2000 pounds) = 132 tons

Example: If electricity costs $0.20 per kilowatt hour, calculate the cost to run a 1500 watt appliance for two hours.
1500 watts x (1 kilowatt/1000 watts) x 2 hours x ($0.20/kilowatt hour) = $0.60

8) **Work *scientific notation problems* without a calculator.** Multiplication and division will be common. Multiplying numbers in scientific notation requires the exponents to be added. Dividing numbers in scientific notation requires exponents to be subtracted.
Examples: 10^6 TIMES $10^3 = 10^9$
10^8 DIVIDED BY $10^1 = 10^7$

9) **Calculate percent change**. Percent change can be calculated by finding the difference between the old and new values, and then dividing by the old value. Convert to a percent by multiplying by 100.
Example: old value = $400, new value = $500, percent change = ($100/$400)x 100 = 25% increase

10) **Calculate population growth rate and population density.** Growth rate = [b - d] + [i - e]
Population density = population divided by area

11) **Know the *Rule of 70* to predict doubling time.**
Doubling time = 70 divided by annual growth rate (in %)

12) **Calculate *half-life.***

AMOUNT REMAINING = (ORIGINAL AMOUNT)(0.5)x
where x = number of half-lives

13) **Calculate pH using –log [H+].** Log10 x = y and 10y = x.
Most pH problems are easily solved without a calculator. Remember that for every one-increment change in pH, the ion concentrations change by a factor of 10.

Examples: if pH = 6, then the concentration of hydrogen ions [H+] = 1×10^{-6}
If pH = 2, then the concentration of hydrogen ions [H+] = 1×10^{-2}
If the concentration of hydrogen ions = 1×10^{-13}, then the pH = 13

14) **Be familiar with units of energy and power.**

- Watt = joule/sec = volts x amps
- Calorie = energy to raise one gram of water by one degree C.
- BTU (British thermal unit) = energy to raise one pound of water by one degree F.
- Kilowatts x hours = kilowatt hours
- Efficiency = energy out divided by energy in

15) **AP GRAPHING TIPS**

- Label each axis.
- Set both axes to scale with consistent increments.
- Connect dots.
- Interpolate and extrapolate.
- Be comfortable with doing graphs by hand.
- Include a title and a key.