Formulas and Math Concepts Needed for The AP Exam and the Final Exam

Percent Change

$$\frac{\text{Ending amount - starting amount}}{\text{Starting amount}} \times 100$$

Productivity

Gross Primary Production - Cellular Respiration = Net Primary Productivity

Or GPP - Resp = NPP

Sometimes NPP is just called "productivity"

Trophic Levels

90% loss of energy/biomass as you go up a trophic level

OR 10% of energy/biomass passed onto the next trophic level

Population Density

$$\frac{\text{Population}}{\text{Area}} = \text{Population Density}$$

Population Density: $\frac{\text{total population}}{\text{total area}}$	**Population Change:** $\frac{\text{(births + immigration) - (deaths + emigration)}}{\text{total population}}$
Birth Rate (as a %): $\frac{\text{total births}}{\text{total population}} \times 100$	**Population Growth Rate:** $\frac{\text{(births + immigration) - (deaths + emigration)}}{\text{total population}} \times 100$
Birth Rate (per 1000): $\frac{\text{total births}}{\text{total population}} \times 1000$	**Doubling Time:** $\frac{70}{\text{\% growth rate}}$ = years to double
Death Rate (as a %): $\frac{\text{total deaths}}{\text{total population}} \times 100$	**Rate of Change:** $\frac{\text{(new-old)}}{\text{old}}$
Death Rate (per 1000): $\frac{\text{total deaths}}{\text{total population}} \times 1000$	**Percent Change:** $\frac{\text{(new-old)}}{\text{old}} \times 100$
Crude Birth Rate: $\frac{\text{total \# births}}{\text{total population}} \times 1000$	**Natural Rate of Population Increase:** births-deaths
Crude Death Rate: $\frac{\text{total \# death}}{\text{Total population}} \times 1000$	
Population Growth Rate: $\frac{\text{CBR-CDR}}{10}$	

Finding Doubling Time of a Population (Called the Rule of 70)

70% (r is growth rate in a percentage)
r

Density: Mass/volume

Metric System Conversions: Memorize these conversions

To convert to a larger unit, move the decimal point to the left or divide <----------

To convert to a smaller unit, move the decimal point to the right or multiply ---------->

Giga (G) 10^9	**Mega (M) 10^6**	**Kilo (k) 10^3**	**Basic Unit (gram g, liter l, meter m, Joule J, Watt W)**	**Centi (c) 10^{-2}**	**milli (m) 10^{-3}**	**micro or micro n (μ) 10^{-6}**	**nano (n) 10^{-9}**	**pico (p) 10^{-12}**

When you convert to a SMALLER unit, the answer must be a LARGER number
When you convert to a LARGER unit, the answer must be a SMALLER number

Video help can be found here: https://youtu.be/0LfR_yms49w

pH Scale
1 # decrease on scale = 10x H^+ (acidity)
Its exponential and logarithmic.
Example: A solution with pH of 2 has 1000 times more H^+ ions than a solution with a pH of 5.
This is because 5-2 = 3. So three tens multiplied = 10 x 10 x 10 = 1000

Energy
1000J = 1 KJ

Power: Power is the rate at which energy is used. **(P = E/t)**

- Unit: Watt
- 1 horsepower = 746 watts

1W = 1J/s (1 Watt = 1 Joule per second)

The Kilowatt Hour, or kWh, is not a unit of power but of energy. Kilowatt x hour = kWh

1 kWh = 3600 kJ
Your electricity bill is in kWh.

Example: A TV uses 200 watts and runs for 6 hours. This is 1200Wh OR 1.2kWh.

We also use Therms (for natural gas) or Joules or BTU (for total energy use), but you do not need to memorize any special conversions for these units.

Half Life: Review how to sketch out and solve: