

Appendix A

AP BIOLOGY EQUATIONS AND FORMULAS

STATISTICAL ANALYSIS AND PROBABILITY									
Standard Error		Mean							
$SE_{\bar{x}} = \frac{s}{\sqrt{n}}$		$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$							
Standard Deviation		Chi-Square							
$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n - 1}}$		$\chi^2 = \sum \frac{(o - e)^2}{e}$							
CHI-SQUARE TABLE									
Degrees of Freedom									
p	1	2	3	4	5	6	7	8	
0.05	3.84	5.99	7.82	9.49	11.07	12.59	14.07	15.51	
0.01	6.64	9.32	11.34	13.28	15.09	16.81	18.48	20.09	
LAWS OF PROBABILITY					METRIC PREFIXES				
If A and B are mutually exclusive, then $P(A \text{ or } B) = P(A) + P(B)$					Factor				
If A and B are independent, then $P(A \text{ and } B) = P(A) \times P(B)$					Prefix				
					Symbol				
HARDY-WEINBERG EQUATIONS					10 ⁹				
$p^2 + 2pq + q^2 = 1$		p = frequency of the dominant allele in a population			giga				
$p + q = 1$		q = frequency of the recessive allele in a population			10 ⁶				
					mega				
					10 ³				
					kilo				
					10 ⁻²				
					centi				
					10 ⁻³				
					milli				
					10 ⁻⁶				
					micro				
					10 ⁻⁹				
					nano				
					10 ⁻¹²				
					pico				
Mode = value that occurs most frequently in a data set									
Median = middle value that separates the greater and lesser halves of a data set									
Mean = sum of all data points divided by number of data points									
Range = value obtained by subtracting the smallest observation (sample minimum) from the greatest (sample maximum)									

s = sample standard deviation (i.e., the sample based estimate of the standard deviation of the population)
 \bar{x} = mean
 n = size of the sample
 o = observed individuals with observed genotype
 e = expected individuals with observed genotype

Degrees of freedom equals the number of distinct possible outcomes minus one.

RATE AND GROWTH		Water Potential (Ψ)
Rate dY/dt Population Growth $dN/dt=B-D$ Exponential Growth $\frac{dN}{dt} = r_{\max}N$ Logistic Growth $\frac{dN}{dt} = r_{\max}N\left(\frac{K-N}{K}\right)$	dY = amount of change t = time B = birth rate D = death rate N = population size K = carrying capacity r_{\max} = maximum per capita growth rate of population	$\Psi = \Psi_p + \Psi_s$ Ψ_p = pressure potential Ψ_s = solute potential The water potential will be equal to the solute potential of a solution in an open container, since the pressure potential of the solution in an open container is zero. The Solute Potential of the Solution $\Psi_s = -iCRT$ i = ionization constant (For sucrose this is 1.0 because sucrose does not ionize in water.) C = molar concentration R = pressure constant ($R = 0.0831$ liter bars/mole K) T = temperature in Kelvin ($273 + ^\circ\text{C}$)
Temperature Coefficient Q_{10} $Q_{10} = \left(\frac{k_2}{k_1}\right)^{\frac{10}{t_2-t_1}}$ Primary Productivity Calculation $\text{mg O}_2/\text{L} \times 0.698 = \text{mL O}_2/\text{L}$ $\text{mL O}_2/\text{L} \times 0.536 = \text{mg carbon fixed/L}$	t_2 = higher temperature t_1 = lower temperature k_2 = metabolic rate at t_2 k_1 = metabolic rate at t_1 Q_{10} = the <i>factor</i> by which the reaction rate increases when the temperature is raised by ten degrees	
SURFACE AREA AND VOLUME		Dilution – used to create a dilute solution from a concentrated stock solution
Volume of a Sphere $V = 4/3 \pi r^3$ Volume of a Cube (or Square Column) $V = l w h$ Volume of a Column $V = \pi r^2 h$ Surface Area of a Sphere $A = 4 \pi r^2$ Surface Area of a Cube $A = 6 a$ Surface Area of a Rectangular Solid $A = \Sigma$ (surface area of each side)	r = radius l = length h = height w = width A = surface area V = volume Σ = Sum of all a = surface area of one side of the cube	$C_i V_i = C_f V_f$ i = initial (starting) C = concentration of solute f = final (desired) V = volume of solution Gibbs Free Energy $\Delta G = \Delta H - T\Delta S$ ΔG = change in Gibbs free energy ΔS = change in entropy ΔH = change in enthalpy T = absolute temperature (in Kelvin) pH = $-\log [H^+]$