RICE

AP BIOLOGY
EQUATIONS AND FORMULAS

STATISTICAL ANALYSIS AND PROBABILITY

Standard Error	Mean
$SE_X = \frac{s}{\sqrt{n}}$	$\bar{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$

Standard Deviation	Chi - Square
$s = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n-1}}$	$X^2 = \sum \frac{(o-e)^2}{e}$

s = sample standard deviation (i.e. the sample-based estimate of the standard devation 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 = (# of distinct possible outcomes) - 1

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

If A and B are mutually exclusive, then P (A or B) = P (A) + P (B)

If A and B are independent, then P (A and B) = P(A) x P(B)

HARDY - WEINBERG EQUATIONS

$p^2 + 2pq + q^2 = 1$

$p + q = 1$

p: frequency of the dominant allele in a population

q: frequency of the recessive allele in a population

METRIC PREFIXES

Factor	Prefix	Symbol
10^{9}	*giga*	G
10^{6}	*mega*	M
10^{3}	*kilo*	k
10^{-2}	*centil*	c
10^{-3}	*milli*	m
10^{-6}	*micro*	µ
10^{-9}	*nano*	n
10^{-12}	*pico*	p

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: Values obtained by subtracting the smallest observation (sample minimum) from the greatest (sample maximum)

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RATE AND GROWTH

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 date
D = death rate
N = population size
K = carrying capacity
r_{max} = maximum per capita growth rate of population

Temperature Coefficient Q_{10}

$$Q_{10} = \left(\frac{k_2}{k_1}\right)^{\frac{10}{t_2 - t_1}}$$

Primary Productivity Calculation

mg O_2/L x 0.698 = mL O_2/L

mL O_2/L x 0.536 = 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 *factor* by which the reaction rate increases when the temperature is raised by ten degrees

Water Potential (Ψ)

Ψ = Ψp + Ψs

Ψp = pressure potential

Ψs = 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

Ψs = -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 + ^{o}C

SURFACE AREA AND VOLUME

Volume of a Sphere

$V = 4/3 \pi r^3$

Volume of a Rectangular Prism

V = l w h

Volume of a Cylinder

$V = \pi r^2 h$

Surface Area of a Sphere

$V = 4 \pi r^2$

Surface Area of a Cube

A = 6 a

Surface Area of a Rectangular Solid

A = Σ (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

Dilution - used to create a dilute solution from a concentrated stock solution

$C_I V_i = C_f V_f$

I = initial (starting)

C = concentration of solute

f = final (desired)

V = volume of Solution

Gibbs Free Energy

ΔG = ΔH - TΔS

ΔG = change in Gibbs Free Energy

ΔS = change in entropy

ΔH = change in enthalpy

T = absolute temperature (in Kelvin)

pH = - log [H+]