



---

# AP<sup>®</sup> Biology

## 2026 EXAM REFERENCE INFORMATION

Name: \_\_\_\_\_

**NOTE:** You may use any blank space in this booklet for scratch work during the exam. **Proctors** should collect this reference information at the conclusion of the exam.

# AP<sup>®</sup> BIOLOGY EQUATIONS AND FORMULAS

## Statistical Analysis and Probability

### Mean

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

### Standard Deviation

$$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$$

### Standard Error of the Mean

$$SE_{\bar{x}} = \frac{s}{\sqrt{n}}$$

### Chi-Square

$$\chi^2 = \sum \frac{(o-e)^2}{e}$$

### Chi-Square Table

p value	Degrees of Freedom							
	1	2	3	4	5	6	7	8
0.05	3.84	5.99	7.81	9.49	11.07	12.59	14.07	15.51
0.01	6.63	9.21	11.34	13.28	15.09	16.81	18.48	20.09

### Laws of Probability

If A and B are mutually exclusive, then:

$$P(A \text{ or } B) = P(A) + P(B)$$

If A and B are independent, then:

$$P(A \text{ and } B) = P(A) \times P(B)$$

### Hardy-Weinberg Equations

$$p^2 + 2pq + q^2 = 1 \quad p = \text{frequency of allele 1 in a population}$$

$$p + q = 1 \quad q = \text{frequency of allele 2 in a population}$$

$\bar{x}$  = sample mean

$n$  = sample size

$s$  = sample standard deviation (i.e., the sample-based estimate of the standard deviation of the population)

$o$  = observed results

$e$  = expected results

$\Sigma$  = sum of all

Degrees of freedom are equal to the number of distinct possible outcomes minus one.

### Metric Prefixes

<u>Factor</u>	<u>Prefix</u>	<u>Symbol</u>
$10^9$	giga	G
$10^6$	mega	M
$10^3$	kilo	k
$10^{-1}$	deci	d
$10^{-2}$	centi	c
$10^{-3}$	milli	m
$10^{-6}$	micro	$\mu$
$10^{-9}$	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 = value obtained by subtracting the smallest observation (sample minimum) from the greatest (sample maximum)

<b>Rate and Growth</b>		<b>Water Potential (<math>\psi</math>)</b>
<p><b>Rate</b></p> $\frac{dY}{dt}$ <p><b>Population Growth</b></p> $\frac{dN}{dt} = B - D$ <p><b>Exponential Growth</b></p> $\frac{dN}{dt} = r_{\max} N$ <p><b>Logistic Growth</b></p> $\frac{dN}{dt} = r_{\max} N \left( \frac{K - N}{K} \right)$	<p><math>dY</math> = amount of change</p> <p><math>dt</math> = change in time</p> <p><math>dN</math> = change in population size</p> <p><math>B</math> = birth rate</p> <p><math>D</math> = death rate</p> <p><math>N</math> = population size</p> <p><math>K</math> = carrying capacity</p> <p><math>r_{\max}</math> = maximum per capita growth rate of population</p>	<p><math>\Psi = \Psi_p + \Psi_s</math></p> <p><math>\Psi_p</math> = pressure potential</p> <p><math>\Psi_s</math> = solute potential</p> <p>The water potential will be equal to the solute potential of a solution in an open container because the pressure potential of the solution in an open container is zero.</p> <p><b>The Solute Potential of a Solution</b></p> <p><math>\Psi_s = -iCRT</math></p> <p><math>i</math> = ionization constant (1.0 for sucrose because sucrose does not ionize in water)</p> <p><math>C</math> = molar concentration</p> <p><math>R</math> = pressure constant (<math>R = 0.0831</math> liter bars/mole K)</p> <p><math>T</math> = temperature in Kelvin (<math>^{\circ}\text{C} + 273</math>)</p>
<p><b>Simpson's Diversity Index</b></p> <p>Diversity Index = <math>1 - \sum \left( \frac{n}{N} \right)^2</math></p> <p><math>n</math> = total number of organisms of a particular species</p> <p><math>N</math> = total number of organisms of all species</p>		

### Surface Area and Volume

**Surface Area of a Sphere**

$$SA = 4\pi r^2$$

**Surface Area of a Rectangular Solid**

$$SA = 2lh + 2lw + 2wh$$

**Surface Area of a Cylinder**

$$SA = 2\pi rh + 2\pi r^2$$

**Surface Area of a Cube**

$$SA = 6s^2$$

**Volume of a Sphere**

$$V = \frac{4}{3}\pi r^3$$

**Volume of a Rectangular Solid**

$$V = lwh$$

**Volume of a Cylinder**

$$V = \pi r^2 h$$

**Volume of a Cube**

$$V = s^3$$

$r$  = radius

$l$  = length

$h$  = height

$w$  = width

$s$  = length of one side of a cube

$SA$  = surface area

$V$  = volume