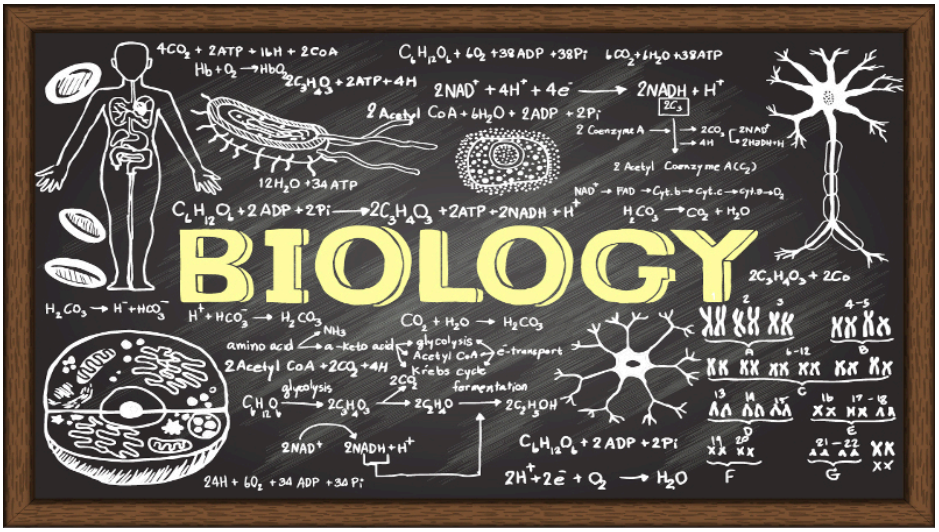


The Big AP Bio Review Guide

There are MANY ways you can best review for the AP Bio Exam. In this book (and on Canvas) I will provide you with MANY different resources for review; the only rule is that you MUST be doing some type of review ***each day***!

Content by J. Castle, T. Jones, L. Fergeson, K. Phillipe, K. Schertz, K. Shapiro, K. Riedell, Fiveable, The College Board, Compiled & Modified R. Holt 2025

Test Overview - The AP Bio Exam

Will take place on the secure application Bluebook - test it out on your chromebook!

DIGITAL TESTING

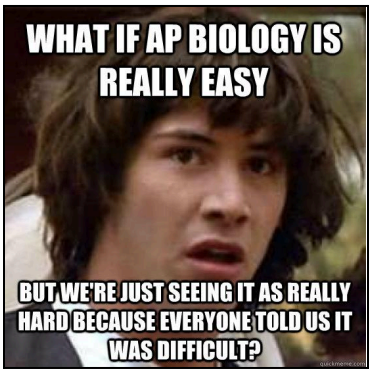
Bluebook

Section I: Multiple Choice

60 Questions | 1 Hour 30 Minutes | 50% of Exam Score

- Individual Questions
- Set-based Questions (4-5 questions/set)

Questions will include quantitative data (*charts, data tables, graphs*), qualitative data (*models, maps, representations*), and text-based sources/reading.



Section II: Free Response

6 Questions | 1 Hour 30 Minutes | 50% of Exam Score

*The free-response section includes**:***

- ***2 long FRQs (Questions 1 & 2; 18 pts total)***
- ***4 short questions. (Questions 3-6; 16 pts total)***

The 2 long FRQs ask students to:

1. **Question 1: Interpreting and Evaluating Experimental Results**

   An 8 to 10-point question that presents you with an authentic scenario accompanied by data in a table and/or graph. This question assesses your ability to do the following:

   (a) (1-2 points): **Describe** and **explain** biological concepts, processes, effects, or models.
   (b) (3-4 points): **Identify** experimental design variables and **justify** procedures.
   (c) (c) (1-3 points): Analyze data and **describe** an effect or relationship; sometimes **calculate**!
   (d) (2-4 points): **Predict** effects of a change, **justify** your predictions, **explain** a process.

2. **Question 2: Interpreting and Evaluating Experimental Results with Graphing**

   An 8 to 10-point question that presents you with an authentic scenario accompanied by data in a table. This question assesses students' ability to do the following in four question parts.

   (a) (1-2 points): **Describe** and **explain** biological concepts, processes, effects, or models.
   (b) (4 points): **Construct** a graph, plot, or chart and use confidence intervals or error bars to **determine** differences in data.
   (c) (1 to 3 points): Analyze data and **describe** an effect or relationship.
   (d) (1 to 3 points): **Predict** effects of a change, **justify** your predictions, **explain** a process.

The short FRQs assess students' understanding of the following:

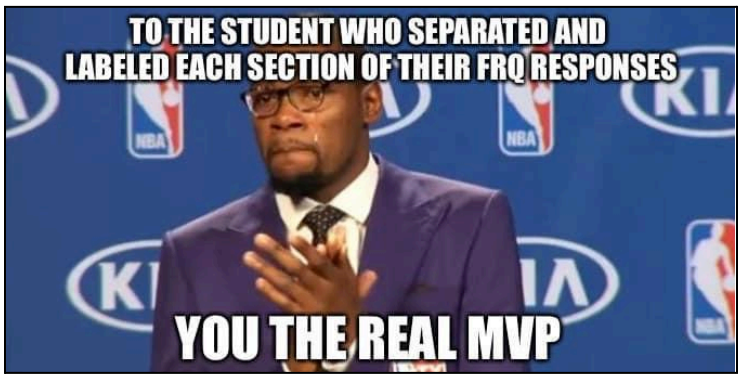
Scientific investigation, conceptual analysis, analysis of a model/visual representation, and data analysis.

3. **Question 3: Scientific Investigation** is a 4-point question that presents you with a description of a lab investigation scenario. This question assesses students' ability to do the following in four question parts:
   (a) (1 point): **Describe** biological concepts or processes.
   (b) (1 point): **Identify** variables or **justify** experimental procedures.
   (c) (1 point): **Predict** results or **state** a null or alternative hypothesis.
   (d) (1 point): **Justify** predictions or provide **support** for a claim.

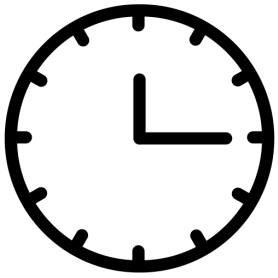
4. **Question 4: Conceptual Analysis** is a 4-point question that presents students with an authentic scenario describing a biological phenomenon with a disruption. This question assesses students' ability to do the following in four question parts:
   (a) (1 point): **Describe** biological concepts or processes.
   (b) (1 point): **Explain** how/why something occurs in biological concepts or processes.
   (c) (1 point): **Predict** the causes or effects of a change in a biological system.
   (d) (1 point): **Justify** your prediction.

5. **Question 5: : Analyze Model or Visual Representation** is a 4-point question that presents students with a description of an authentic scenario accompanied by a visual model or representation. This question assesses students' ability to do the following in four question parts:
   (a) (1 point): **Describe** characteristics of a biological concept, process, or model represented visually.
   (b) (1 point): **Explain** relationships between different characteristics of a biological concept or process represented visually.
   (c) (1 point): **Represent** relationships within a biological model (by drawing).
   (d) (1 point): **Explain** how/why a biological concept or process represented visually relates to a larger biological principle, concept, process, or theory.

6. **Question 6: : Analyze Data** is a 4-point question that presents students with data in a graph, table, or other visual representation. This question assesses students' ability to do the following in four question parts:
   (a) (1 point): Use the data to **identify** a trend/rate/data point.
   (b) (1 point): **Identify** or **describe** relationships/variation in data.
   (c) (1 point): Use data to **evaluate** or **support** a hypothesis or prediction.
   (d) (1 point): **Explain** how experimental results relate to biological principles, concepts, processes, or theories.



General Test Reminders



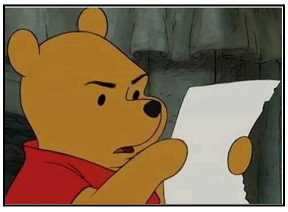
- **No blank answers - at least guess on everything!** There's NO penalty for guessing. Make a note of your guesses *(flag them)* so you can come back to them later if needed.
- **Answer the things you know first** and don't get *stuck* on a tough question! Make your best guess and move on if needed. **Otherwise you may run out of time and not get to answering some questions that you may know the answers to!** If you need to, *look for the answer in other questions, then come back later.*
- Read prompts or questions **TWICE!** Give your brain a chance to *really* process it.
- As you read, **make a note of words** in the question that **help you focus on what's really being asked**. Students often read too superficially and make assumptions about what the question is, rather than really understanding what is being asked. Jot down notes if you need to!
- You may use a calculator, and a formula sheet is provided to you . You do *NOT* have to clear your calculator beforehand.
- Remember that many questions will ask for the **BEST answer/explanation**. Do not choose the first correct answer you read, as it may *NOT* be the actual best explanation! ***Slow down and read each option first.***
- Think about how questions **relate to other domains of biology.** Remember, this test encompasses *EVERYTHING* we have learned throughout the year. Ex. A question about genes is most likely related to evolution so search for an answer option that is related to evolution.
- **Don't let anxiety talk you out of correct answers!** Always go with your first instinct - don't change your answers UNLESS you happen to find the correct answer somewhere else in the test. You're often right the first time - DON'T GO BACK and change your answer unless you *definitely* found the correct answer somewhere else in the test.
- Pay attention to **diagrams & graphs**! Often just looking at the picture/graph/diagram can give you the answer to the question!
- ***START STUDYING EARLY****!* This is NOT a test where cramming the day before works magic! You WILL do better if you study a little over time! MAKE A STUDY PLAN IF YOU ARE TAKING MULTIPLE AP EXAMS!
- Understand that the exam is written to be **difficult** – the average score is about ~50% correct (3). It is very likely that you will not know everything, ***so relax and do your best.***

MCQ Reminders

- These will be answered on your **computer** this year.
- **Eliminate wrong things** on the MCQ first and then pick the answer you think is best.
- Again, don't leave these blank! Always ***at least guess!***
- Keep an eye on your **time!** You have 60 questions in 90 minutes! That's 1.5 mins/question. (10 questions/15 mins)
- Skip and come back to questions if needed, but guess on them before you do!
- If you don't understand the question, look in the ***answer choices for clues*** for what the question is about.

FRQ Reminders

1. Read the question completely. **Then read it again!**
2. **Watch your time: Take ~10 mins to read all of the questions and decide the order you will answer them in, then take 20 min/long FRQ, 8 min/short FRQ.**
3. **ALWAYS separate and label your responses with the letter and task verb,** for example (a) Identify - , (b) Explain - , (c) Describe, etc. *Don't just write one giant paragraph.* Again, the goal is to make it easy for the reader to find and award you your points!
    a. You can answer the prompts in any order you want as long as they are labeled!
4. **DO NOT RESTATE THE QUESTION OR QUESTION STEM**, it's a ***waste of your time!*** You are NOT writing an essay! If you write your answer to an FRQ on the wrong page, JUST LEAVE A NOTE on the correct page telling the grader where to find it. *Don't waste time rewriting the whole thing!*
5. Make sure your answer is a **complete thought** unless the prompt asks you to do something simple like identify/determine/calculate.
    a. DON'T be vague in an attempt to trick the grader! **Clearly and concisely state what you know.**



6. Write as **legibly** as possible! Make it EASY for the graders to give you points! You must use a **pen with navy blue or black ink on FRQs**, so anything you don't want graded must be ~~crossed out~~ with a single line. Graphs may be completed in pencil.
7. While you don't need to be "wordy", you DO need to write like a college student. Write using the verbage/language your teacher would use - you have to convince the reader that you know this stuff at a COLLEGE level. Use AP Level vocab. **Points are given for content, not intent.** If a 4th grader could say it, it is too vague/simple. Use appropriate vocab, NOT SLANG!
8. Don't be vague! DO NOT *just* say something "changes/is affected." ***BE SPECIFIC & CONCISE.*** Indicate *what* changed, *direction* of change **(increase/decrease/remained constant)** and tell us *why*! Also, don't use "**it**" when describing something; tell us what "**it**" is! **AGAIN, BE SPECIFIC**.

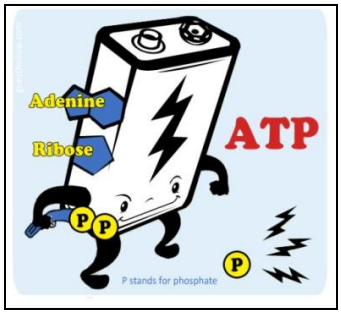
9. **Be careful with absolutes as well**; will it *really* kill ALL the bacteria? Will the ENTIRE ecosystem actually be destroyed? Be realistic. Avoid "maybes" and "mights" as well, however, as that is *too vague* and makes you seem unsure.

10. On the free-response questions, keep in mind that the national average is earning about half of the possible points, so not everyone is expected to earn *every* point, but do *everything* in your power to earn *every point you can!* **NO BLANKS** if you can help it!

11. When it comes down to it, remember… **ATP: Answer the prompt, THEN STOP!** ***Don't write more than the question asks for!*** Know the task verbs and what they are asking you to do!

    a. Answer what the prompt is asking, and then *NO MORE THAN THAT!* **Graders will read EVERY word you write unless you cross it out**. If you answer correctly, then ***contradict*** *your answer later*, you LOSE that earned point. **Don't word vomit and contradict yourself.**

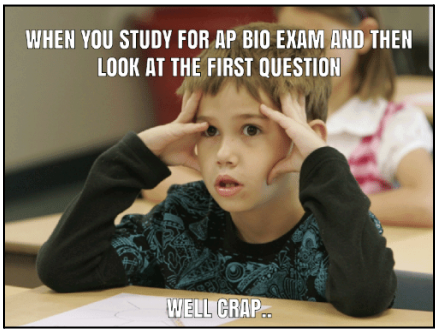
        i. For example, if the FRQ asks for two examples, only the first two examples that you write are graded. HOWEVER, if you put a third response, and it **contradicts** the first two, you will lose the points for the first two!



12. Many FRQs may at first seem *complicated* or contain things you have not learned, but **DON'T PANIC.**

    a. You don't need to know how to cure cancer or to understand bee psychology, you just need to know the common **METHODS OF SCIENCE.**

    b. ***Be calm, look closer*:** They really ***ARE*** asking you about things you have learned such as cell structure, communication, ecosystems, genetics, evolutionary processes, homeostasis, metabolism, water potential, etc…you just need to apply scientific reasoning to the question.



    c. Remember, you aren't just being tested on content knowledge. You are also being tested on **scientific practices/skills**. Can you *read and interpret diagrams, can you design/interpret scientific experiments, can you perform data analysis, can you propose scientific explanations, can you justify scientific arguments, etc.*

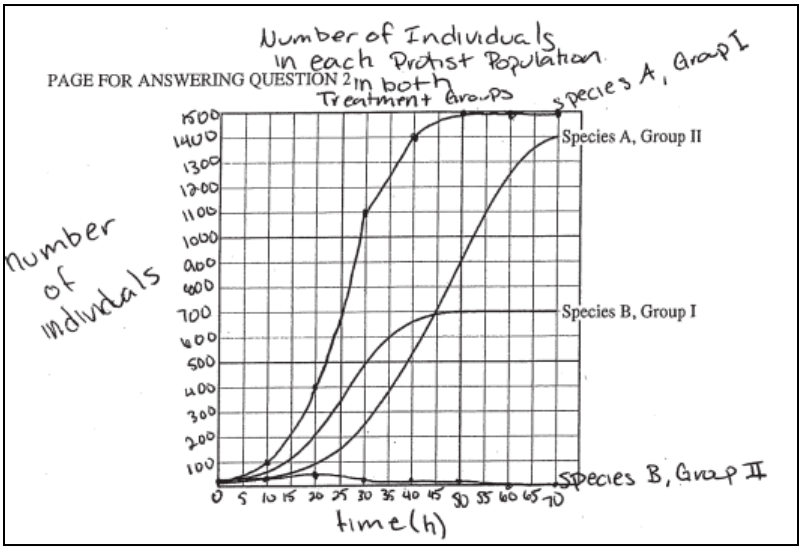
FRQ Task Verbs

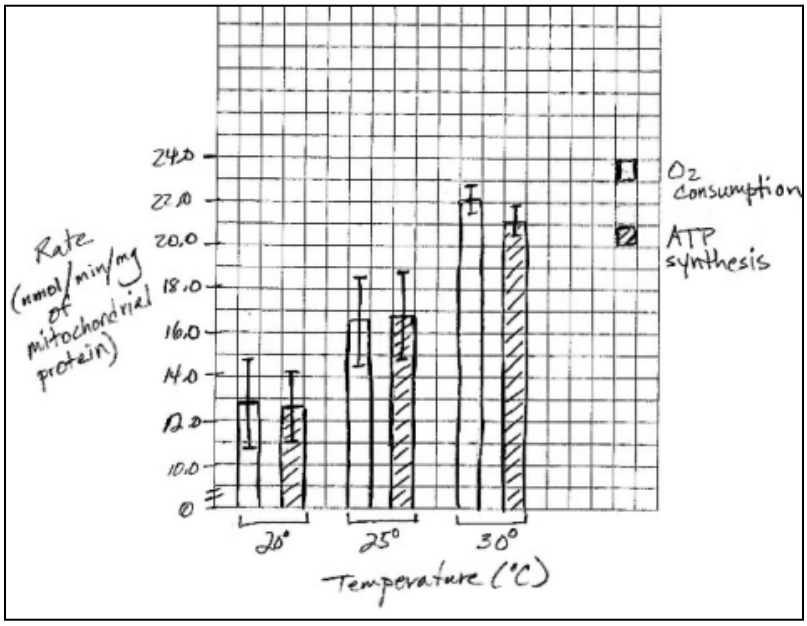
Term	What it means for FRQ	Example prompt
Identify/ Provide	Indicate or provide information answering the question without elaboration or explanation. **~1 word/simple sentence**	***Identify*** *the most likely ecological relationship between plants and rhizobacteria*
Describe	Provide relevant characteristics, make a statement/definition with additional information and give an example . ~**1-2 complex sentences.**	***Describe*** *the role of carbon in biological system*
Explain	Tell HOW or WHY something occurs. Make connections. Ex. "A" happens, therefore this leads to "B". This causes "C" to occur, therefore "A" and "C" have this relationship/connection. This is typically 2-3 sentences. Use evidence and/or reasoning. • Sometimes, it is a process requiring steps in order. • Use "<u>because</u>" for "why" questions.	***Explain*** *how the addition of the common wild oat affects the number of native bunchgrass plants that can be supported by the California grasslands ecosystem.* *Ex. Because wild oat competes with native plants for resources, the native bunchgrass population will decrease.*
Make a Claim	Make an assertion based on evidence or knowledge. If also asked to **justify** your claim, make sure you add "Because" or "Which leads to" in your answer to get full points!	***Make a claim*** *about the role of the inner mitochondrial membrane in ATP synthesis.*
Support a Claim	Provide reasoning to explain how evidence supports a claim.	*A scientist claims that the presence of aquaporins in chloroplast membranes supports the endosymbiotic theory.* ***Support the claim*** *with evidence from biological concepts.*
Justify	Provide data/evidence to support, qualify, or defend a claim and/or provide reasoning to explain HOW that evidence supports the claim.	*Using the data,* ***provide reasoning for/justify*** *the claim that antibiotic resistance may arise in bacterial species.*
Calculate	A math problem to solve. Perform mathematical steps to arrive at the final answer. Does not need complete sentences, just the math! **ALWAYS WITH UNITS; NO NAKED NUMBERS!** For APES: Must show set-up and answer as well! **No work shown = no credit!**	***Calculate*** *the surface area to volume ratio of the cell.*
Determine	Decide or conclude after reasoning/observation, or mathematical calculation.	***Determine*** *whether the concentration of Chlorella on day 15 is statistically different from the concentration on day 30.*
Construct/ Draw	Create a diagram/graph/representation/model that illustrates or explains relationships or phenomena.	***Construct*** *a graph to represent the data found in Table 1.*
Predict	Predict the causes or effects of a change in, or disruption to, one or more components in a relationship, pattern, process, or system.	***Predict*** *which treatment group will have the smallest amount of accessible nutrients in the soil.*
State	State the null or alternative hypothesis to support or defend a claim about a scientifically testable question.	***State*** *the null hypothesis of this experiment OR* ***State*** *the alternative hypothesis for this experiment.*

Graphing

At least one of the two long FRQs may ask you to graph! If you are asked to create a graph:

- If asked to make a *specific type of graph*, **do it!** Otherwise, YOU must determine the appropriate type of graph.
  - **Lines** are best for *change over time/rates/spectrum.*
  - **Bars** are best for *comparison of distinct categories.*
- **Label** your x and y axis, and don't forget the **UNITS**!
- Usually, you will be plotting the **means/averages** of data. *Pay close attention!* Include **error bars** if SEM **(+/- 2SEM)** if provided! BE CAREFUL not to *accidently shade over error bars!*
- Include a key/label for your graph!





DRY MIX is an acronym to help you remember how variables are plotted on a graph.

D = dependent variable
R = responding variable
Y = graph information on the vertical axis

M = manipulated variable
I = independent variable
X = graph information on the horizontal axis

HHMI - Types of Graphs ← Make sure you review AND understand the different types of graphs and when to use them!

Experimental Design

- **Hypothesis/Alternative hypothesis**
  Clearly defined prediction that states how the IV will affect the DV.
  Ex. Increasing the **amount of light (IV)** will increase the **growth rate of the plant (DV)**.

- **Null hypothesis**
  Clearly defined statements describe a "no effect" scenario of the lab.
  Ex. "Increasing the amount of light (IV) will have no effect on the growth rate of the plant (DV)"
  "There will be no difference between the different experimental groups."
  "All experimental groups will have the same results."
  Can be used for statistical analysis - reject vs. fail to reject the null to determine significance of results.

- **Independent Variable AKA Manipulated Variable**
  What you are testing. It is what *causes* things to change as you make changes to it. Some people nickname it the I-do variable.

- **Dependent Variable AKA the Responding Variable**
  The *effect* you are measuring, and it may or may not change. It can be observed during and/or at the end of the experiment. Basically the "results" or "data" of your experiment.

- **The Control or Control Group**
  Group free of any change of the independent variable. It is to make sure that your results were a result of the independent variable instead of another factor.
  - **Negative Control** - what you would traditionally think of as the control group because it receives NO independent variable treatment.
    - *Ex.* How do different colors/wavelengths of light impact the rate of photosynthesis? IV is the different colors of light (red, green, blue), then the Negative control group would be NO light.
  - **Positive Control** - a control group treated with a known outcome - used to ensure the experimental setup works as intended.
    - *Ex.* How do different colors of light impact the rate of photosynthesis? Positive control group would be one with white light (all colors combined - because we already know plants WOULD do photosynthesis with this light).

- **Experimental Groups**
  All groups exposed to the independent variable.

- **Constants/Controlled Variables**
  The things that you keep the same for each test group. They are sometimes called "controlled variables" -- NOT to be confused with the control.

- **Extraneous Variables**
  Unanticipated, unwanted events, which may cause incorrect experimental results and wrong conclusions.

Good Experiments Have

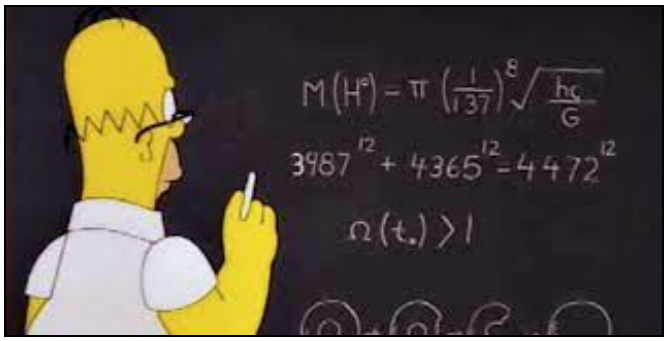
- A large sample size--the more data you can gather, the better.
    - 20 fish in each pond
    - 5 seeds in each petri dish
- A lot of constants--the things you keep the same in every sample or test group.
- A control or control group--not exposed to the independent variable, but has the same constants.
    - A pond without pesticide added (but has the same number of fish as experimental ponds)
    - A petri dish with pure water, but no salt added (but has the same number of seeds as experimental dishes)
    - A sample not exposed to a pollutant
- Experimental (test) groups that have increasing levels of a substance - for ex:
    - 4 ponds with **increasing** levels of pesticide (one without pesticide)
    - 6 dishes with seeds and **increasing** levels of salt (one without salt)
- Only one independent variable
    - OR, multiple independent variables, but designed in such a way that each variable is tested against a control
- Appropriate graphs
    - Line graph for change over time, concentration, or measurement (length, etc)
    - Bar graph to compare different groups, locations, etc.
    - Scatter Plot for data points that are varied, random, or do not make a pattern
- Small standard error
- Research is done beforehand to develop a good question and hypothesis
- Is repeated or can be repeated by others

Flawed Experiments Have

- A small sample size--not enough data to draw a true conclusion
    - Only 2 fish in each pond
    - Only 1 seed in each petri dish
- Too many independent variables--can't isolate which variable caused the change or gave the results
- No control—if the experiment needs one.
- Extraneous variables (outside, unwanted factors) may have influenced the data.
- Large standard error

AP Bio Scientific Practices ← Science skills you are expected to be able to demonstrate.

Math Reminders



- Calculators ARE allowed, but you MUST know how to apply math to the correct formulas from the **formula sheet.**
- NO NAKED NUMBERS! **Always** include your units!
- While you don't need to know *specific* conversion factors, you DO need to know **basic metric conversions** as well as things like 7 days/week, 24 hours/per, 60 mins/hour, etc.

Multiplication Factor	Prefix	Symbol
$1,000,000,000 = 10^9$	giga	G
$1,000,000 = 10^6$	mega	M
$1,000 = 10^3$	kilo	k
$100 = 10^2$	hecto	h
$1 = 1$		
$0.01 = 10^{-2}$	centi	c
$0.001 = 10^{-3}$	milli	m
$0.000001 = 10^{-6}$	micro	μ
$0.000000001 = 10^{-9}$	nano	n

- Math Hack - If you don't know how to solve A, but know that you need A to solve B, make up an answer for A (for example 1 or 10), and plug into B!
- Clearly identify your final answer so there is no guessing on the part of the reader.

- **AP Bio Penguins - Math Monday Videos**
- **Math Skills Review Slideshow**
- **Math Skill Drills Practice Worksheets**
- **Hardy-Weinberg Otter Page**

Common Concepts, Phrases, Misconceptions

Unit 1	How changes in structure affect function, elements/composition of the 4 macromolecules, polar vs. nonpolar properties, functional groups, monomers → polymers..
Unit 2	Cell membrane & transport, water potential, hypertonic/hypotonic solutions, what types of molecules can move across the membrane or not and WHY.
Unit 3	Enzymes enzymes enzymes! How do enzymes affect the rate of reactions? How can enzymatic reactions be affected by the environment? Interplay between photosynthesis & cellular respiration.
Unit 4	Interpreting diagrams is VERY popular with cell communication pathways - be sure you can read and interpret! How can mutations in a cell signaling pathway alter it? Changes in ligands vs. changes in receptors.
Unit 5	Reading pedigrees, punnett squares to determine patterns of inheritance, chi-square, etc. Chi-square is popular with genetics questions!
Unit 6	DNA → RNA → Protein pathway, how changes in one affect the other, biotechnology. This is a big but essential unit! How is DNA replicated? How are proteins synthesized? How do changes in one part of the pathways affect another part?
Unit 7	Evolution, evolution, evolution! Be sure you understand the concept of natural selection, speciation, etc. *Drawing/interpreting cladograms/phylogenetic trees shows up basically EVERY YEAR!*
Unit 8	Ecological relationships, graphs, human impacts on environment, ecological niches, measuring biodiversity and the benefits of a biodiverse ecosystem!
Basic Science Stuff	Changes in structure affecting function! (change in molecule shape/form such as changes in DNA affecting protein shape, temperature denaturing a protein, loss of function OR no change in function of a protein, etc...) Describing the effect of "..." on the rate of "..." (Increase, decrease, stay constant) Basic science practices! Comparing experimental to control groups, supporting claims with evidence, identifying trends, identifying variables, repetition of trials to increase validity of data, supporting/not supporting alternative hypotheses, rejecting/failing to reject null hypotheses!

- **AP Biology - Common Misconceptions Review**

Other Super Helpful Stuff

- AP Bio Exam CED Topics - 2024 ← **A list of all of the topics from each Unit, with links to specific pages in the CED.**
- AP Bio Vocabulary by Unit ← **All of the vocab I could think of from each unit!**
- Pictionary AP Biology ← **Like playing pictionary? AP Bio themed is best!**
- AP Bio Penguins Review Page ← **Incredible resources from Mrs. Jones including practice questions/tests/etc. - AP Bio Penguins**
- Top AP Bio Quizizz Activities ← **List of Quizizz Activities from Mrs. Jones and other teachers.**
- Video - Everything you'll learn in AP Bio in 25 minutes: AP® Biology Review // Full Course Overview
- Video - AP Biology Free Response: 5 Steps to Writing FRQs in 2022 | Albert

After the test:

Know you worked hard all year and this is just ONE test. I know you have learned a lot and I am proud of all the work you have done!

Don't worry about scores; not posted until at least mid-July!

Know that you will live happily and have a productive life no matter what this score is. Again, *I'm proud of you!*

After your exam, feel proud for having done it!

From another teacher - Mrs. Lee Fergeson:

AP scores represent a snapshot of what happens on a single day in your life, and are not fully representative of what you know and can do!

They are not PASS/FAIL, they simply indicate whether you have demonstrated *enough* mastery of the content and skills to earn college credit or not. Just because you may not demonstrate enough mastery now doesn't mean you never will! It's about placement and readiness for specific college level work, and that changes over time as you continue to learn and practice skills.

These tests do not measure your capacity for empathy, creativity, kindness, love, or compassion!

These exams DO NOT determine the trajectory of your life or even your eventual degree/career! You will continue to learn and grow throughout your life and increase your ability to apply scientific practices and content knowledge. Be proud that you are brave enough to challenge yourself! **Go you!**