
Understanding the AP Biology Examination

The AP Biology Exam takes three hours and includes both a 90-minute multiple-choice section and a 90-minute free-response (essay) section that begins with a 10-minute reading period. The multiple-choice section will be one-half of your exam grade, and the free-response section will account for the other half. Both sections include questions that assess students' understanding of the Big Ideas, Enduring Understandings, and Essential Knowledge statements. The exam probably looks like many other tests you've taken. At the core of the examination are questions designed to measure your knowledge and understanding of modern biology. You should be prepared to recall basic facts and concepts, to apply scientific facts and concepts to particular problems, to synthesize facts and concepts, and to demonstrate reasoning and analytical skills by organizing written answers to broad questions.

The AP Biology Exam is very challenging. When you sit down to take the test, you are expected not only to be fluent in the areas of biology that you find fascinating (the ones that probably inspired you to take a special interest in the subject originally), but also to have an intimate knowledge of topics you don't find interesting at all. Whatever those topics might be—DNA replication, the dizzying details of gene expression or the immune system—you need to be comfortable with and knowledgeable about all of the AP Biology topics.

Section I, Part A: Multiple-Choice Questions

The College Board has finalized the exam for 2013. There will be 63 standard multiple-choice questions and 6 questions that involve mathematical calculation for which you will grid in a response. You will have 90 minutes to complete Section I. Each of the multiple-choice questions will be directly paired with a Learning Objective from the Curriculum Framework. The questions will require both an understanding of important concepts and biological processes, and then the ability to apply information that is given to you in the question. Because of this, the stem of the questions may be longer than many multiple-choice questions you have seen before. Read the stem carefully, study the accompanying charts and figures, and then work methodically through the possible responses. Because each question may require a deep conceptual understanding, rather than the recall of facts, it will take you longer to answer this type of question. Compared to AP exam questions prior to 2013, the questions are more involved, so the number of questions has been reduced from 100 to 63 multiple-choice and 6 grid-in questions. This portion of the exam is followed by a 5–10 minute break—the only official break during the examination.

The directions for the multiple-choice section of the test are straightforward and similar to the following:

Directions: Each of the questions or incomplete statements below is followed by four suggested answers or completions. Select the answer that is best in each case.

Here is a sample item from page 152 of the College Board’s *Course and Exam Description 2012*.

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A human kidney filters about 200 liters of blood each day. Approximately two liters of liquid and nutrient waste are excreted as urine. The remaining fluid and dissolved substances are reabsorbed and continue to circulate throughout the body. Antidiuretic hormone (ADH) is secreted in response to reduced plasma volume. ADH targets the collecting ducts in the kidney, stimulating the insertion of aquaporins into their plasma membranes and an increased reabsorption of water.

If ADH secretion is inhibited, which of the following would initially result?

- (A) The number of aquaporins would increase in response to the inhibition of ADH.
- (B) The person would decrease oral water intake to compensate for the inhibition of ADH.
- (C) Blood filtration would increase to compensate for the lack of aquaporins.
- (D) The person would produce greater amounts of dilute urine.

Essential Knowledge	3.D.3: Signal transduction pathways link signal reception with cellular response.
Science Practice	1.5: The student can re-express key elements of natural phenomena across multiple representations in the domain.
Learning Objective	3.36: The student is able to describe a model that expresses the key elements of signal transduction pathways by which a signal is converted to a cellular response.

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Your course may not have included a study of kidney function, but all the information you need to answer this item is given in the stem. You are told what ADH does and how it is controlled, and given the role of aquaporins. It is expected that you can use this information to select the correct answer. If you are certain you know the answer, fill in the corresponding oval on the answer sheet. However, what if you’re not certain? The next step is to see if you can eliminate one or more of the choices.

TIP FROM THE READERS

In the past, there was a penalty for guessing, but that has been eliminated.
Answer every question!

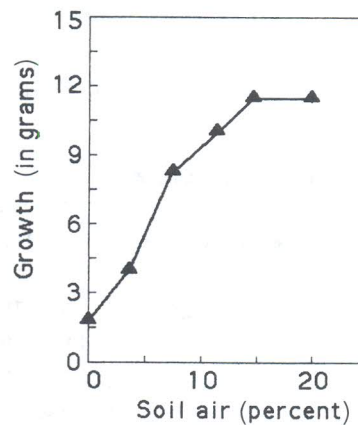
Let’s look again at the question. Choice A suggests a response when ADH is inhibited. You must know that this means there is less ADH. The stem tells you that ADH “stimulates the insertion of aquaporins” so you will eliminate

this choice. Continue to methodically analyze the other choices, and try to eliminate another choice based on your understanding of the information that is given in the stem. Confidently mark your answer sheet and continue. Remember, answer *every* question!

Lab-Based or Experimental Questions

Another type of question you will see in Section I is the lab-based or experimental question. These questions either present you with a set of data in graph (or other) form, or they describe an experiment and ask you to make predictions, select appropriate data, form hypotheses, analyze data mathematically, and perform other science practices. These questions often occur in groups that use the same data set.

It is known that plant cells require oxygen in order to obtain ATP. Those who work with plants have long known that it is possible to quickly kill a plant by overwatering. The graph below shows the results of a study of the effect of soil air spaces on plant growth.



- The data from the above graph show that the plant
 - grows fastest when the soil is 5–10% air.
 - grows fastest when the soil is 15–20% air.
 - grows at the same rate regardless of the soil air percentage.
 - grows most slowly when the soil is 5–10% air.

The correct choice is A. The graph shows the line with the greatest slope (the highest degree of change over the shortest amount of time) between the percentages 5 and 10. During this time, the plant grows by about $9 - 5 = 4$ grams. Just to be sure, check the amount this plant grows when the soil is 15–20% air. At the start, when the air was 15% air, the plant weighed 12 grams. At the end, when the soil is 20% air, the plant weight is the same—12 grams. Virtually no growth occurred during this time.

Clearly this question requires you to be able to interpret a graph, but at this point in your biology education you should be quite capable of doing that. In order to brush up on the various ways that graphs present information, you might review Appendix B of the AP Biology Investigation Manual.

2. It is seen from the graph that plant growth is negatively affected by decreased soil oxygen. Which of the following statements best justifies the reason for this effect?
- (A) Plant root cells require oxygen because no photosynthesis occurs underground.
 - (B) Plant stem and leaf cells are able to do photosynthesis at a higher rate when there is more oxygen in the soil.
 - (C) Water in the soil eliminates oxygen from the soil spaces, so the root cells are unable to produce ATP
 - (D) The rate of cellular respiration is decreased under conditions of high soil moisture.

The correct choice is C. This question requires you to recall the reactants and products of photosynthesis and cellular respiration. *All* plant cells do cellular respiration, consuming O_2 in order to produce ATP. Choice C justifies (explains) why plant growth is low when there is low soil O_2 . Choice D restates the information from the graph. While it is a true statement, it does not justify the reason for this correlation.

Section I, Part B: Grid-In Questions

These questions will require you to calculate an answer for the question, and enter it in a grid in that section on your answer sheet, as shown on the next page. Be sure to practice gridding responses correctly prior to the exam. By the way, you will be able to use a four-function calculator during the exam, as well as a formula sheet (Appendix B of the Investigation Manual), because the emphasis here is on your ability to apply mathematical techniques. To set your mind at ease, the electronic scoring for these responses is set so there is a range of correct scores, to allow for variations in rounding.

The acceptable answer is in the range of 6030–6156, depending on rounding. This question requires that you be able to use the Hardy-Weinberg equation to calculate allelic frequencies. Be sure to remember to carefully follow any instructions that are given for rounding, such as “round to the nearest tenth.” Study the grid pattern on the next page, and you will see that you are able to indicate negative numbers, fractions, and the location of decimal points.

Grid-In Question Requiring Calculator Use

The data below demonstrate the frequency of tasters and non-tasters in an isolated population at Hardy-Weinberg equilibrium. The allele for non-tasters is recessive

Tasters	Non-tasters
8235	4328

		/	/	/	
-
1	0	0	0	0	0
2	1	1	1	1	1
3	2	2	2	2	2
4	3	3	3	3	3
5	4	4	4	4	4
6	5	5	5	5	5
7	6	6	6	6	6
8	7	7	7	7	7
9	8	8	8	8	8
	9	9	9	9	9

How many of the tasters in the population are heterozygous for tasting?



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Integer answer 502	Integer answer 502	Decimal answer -4.13	Fraction answer -2/10
5 0 2	5 0 2	- 4 . 1 3	- 2 / 1 0
-	-	.	.
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

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Section II: Free-Response Questions

At the beginning of Section II of the AP Biology Exam, you will be given a 10-minute time period where you may read the questions and plan and outline your responses before you may begin writing. You should use this time to carefully consider each question. Underline key words or phrases such as “Select two” or “Explain and predict” or “Using an example from each domain.” Begin an outline of your response; include key words. If a graph will be required, decide what type is appropriate, and what will go on each axis. After the reading period, you will be given a response booklet in which to write your essays.

Section II of the AP Biology Exam will have 6 free-response questions. This section contains two types of free-response questions, 2 long and 4 short. The long questions will consist of several sections or related tasks, and be evaluated on a 10-point scale. You should allow approximately 20 minutes for a long free-response question. This is the format that was used on AP Biology exams prior to 2013.

There will be 4 short-response questions that call for brief responses. The instructions may say something like “In a sentence or two. . . .” Heed these parameters to use your time wisely. The short free-response questions should be completed in about 6 minutes or so. For all free-response questions, you must write your answers out, and cannot use an outline form.

BIOLOGY

Section II

Time—80 minutes

Directions: Answer all questions.

Answers must be in essay form. Outline form is NOT acceptable. Labeled diagrams may be used to supplement discussion, but in no case will a diagram alone suffice. It is important that you read each question completely before you begin to write.

1. Water comprises roughly 70% of the human body; cells are roughly 70–95% water, and water covers about three-quarters of the Earth’s surface.
 - (a) **Describe** the major physical properties of water that make it unique from other liquids.
 - (b) **Explain** the properties of water that enable it to travel up through the roots and stems of plants to reach the leaves.
 - (c) **Explain** why the temperature of the oceans can remain relatively stable and support vast quantities of both plant and animal life, when air temperature fluctuates so significantly throughout the year.

Like many free-response questions on the AP Biology Exam, this sample is broken into three distinct parts. Each contains a clear directive. In fact, they are printed in boldface to help you focus on exactly how you should answer the question. First you will need to explain the uniqueness of water by describing its major physical properties. (In your response to this first part of the question, you might wish to include a labeled diagram of the structure of water, complete with electrons and bonds.) Then you must explain the properties of water that allow it to travel from root to leaf. Finally, you should explain the reason(s) why ocean water temperature remains stable and supports plant and animal life—even in the face of great air temperature variations. Of course, limiting your answer by addressing exactly what the question asks will make writing the essay easier for you and earn you a higher score. Always take the time to determine precisely what is being asked before you begin to formulate a concrete thesis and focus on writing your relevant supporting paragraphs.