



Flipping Physics Lecture Notes:

Short Answer for AP Physics Explained

<http://www.flippingphysics.com/short-answer.html>

I already have videos for Qualitative/Quantitative Translation, Paragraph Argument Short Answer, and Experimental Design Questions.¹ This is about the generic “Short Answer” type of question for AP Physics exams. According to the AP Physics 1 Course and Exam Description, 2 out of the 5 free response questions on the exam will be this generic “Short Answer” question. And, even though 40% of the free response questions will be “Short Answer”, the Course and Exam Description only has the following to say about “Short Answer” questions:

“The two short answer questions focus on practices and learning objectives not focused on in the other question types.”²

So, yeah. “Short Answer” questions cover everything not covered in the Qualitative/Quantitative Translation, Paragraph Argument Short Answer, and Experimental Design Questions.

In order to figure out what “Short Answer” questions are, let’s look at the 10 “Short Answer” questions which are in the publicly released AP Physics 1 exams from 2015 to 2019. But, when you go through those 10 “Short Answer” questions, you will discover that a full 5 of them are about topics which, in December of 2020, were removed from the AP Physics 1 curriculum. That’s right, 50% of the publicly released AP Physics 1 “Short Answer” questions are about physics topics which are no longer a part of the AP Physics 1 curriculum. So, we have 5 “Short Answer” free response questions to analyze to understand what “Short Answer” questions are. There is one from each year. While I do understand that I have detailed solution videos for each of these free response questions, I think it will be useful to look at all 5 of them in a general sense to find out what “Short Answer” questions are.

The five free response questions we are going to analyze are 2015 #1, 2016 #1, 2017 #4, 2018 #1, and 2019 #1. Each short answer question is worth 7 points. That means there are a total of 35 points represented by these free response questions.

3 out of the 5 free response questions, 2015 #1, 2016 #1, and 2018 #1, each have a free body diagram which is worth 2 points. That means, 6 out of 35 points, or roughly 17% of all the points on these 5 free response questions come from simply drawing free body diagrams correctly. And one of these free body diagrams, 2018 #1, only had 1 force in it, even though it was worth 2 points. Please take your free body diagrams seriously.

Once you have drawn a free body diagram, often you will need to use Newton’s Second Law to sum the forces, manipulate equations, and solve for a variable. A total of 8 points from the same 3 free response questions require you to do that. That’s roughly 23% of all the points.

But the largest category of points is where they present you with a situation, ask you to answer a multiple-choice question, and then justify or explain your answer. 15 out of 35 points, or roughly 43% of all the points fit in this category. Every one of the 5 free response questions has at least 2 out of 7 points for a multiple-choice question and answer justification. In fact, all 7 points of 2017 #4 fit in this category. Several have a 1 point question which fits in this category, which means what really matters for these is where you justify or explain your answer, not the multiple-choice answer itself. Many of these questions present you with a change to the situation presented at first, and then ask you the multiple-choice question, and ask you to justify your answer.

¹ <https://www.flippingphysics.com/ap-physics-1-review.html>

² From page 206 of the 2020 AP Physics 1 Course and Exam Description (CED).
<https://apstudents.collegeboard.org/ap/pdf/ap-physics-1-course-and-exam-description.pdf>

The last category is the 5 points from part (a) of 2019 #1. Here they present you with a situation of 2 objects which collide and ask you to graph the speed of the center of mass of the system as a function of time. Your entire answer, worth 5 points, is simply drawing lines on the 5 parts of the graph. No explanation necessary. 5 out of 35 points, or roughly 14% of all the points are drawing a graph with no explanation necessary. So realize, the College Board may throw something completely different at you and you need to be prepared for that.

Also, notice the complete lack of numbers in all 5 of these free response questions. Everything is free body diagrams, setting up equations, variable manipulation, graphs, and understanding and explaining how variables will be affected by changes to the physical situations presented. As I have said so many times before, you need to let go of your numbers dependency.

Free Response Question #1 from 2015.

Part (a) – 2 points – Free Body Diagram

Part (b) – 3 Points – 2 Newton's Second Law, manipulate equations to solve for variables.

Part (c) - 2 points – Situation changes. How does a variable change? Multiple-choice. Explain.

Free Response Question #1 from 2016.

Part (a i) – 2 Points – Free Body Diagram

Part (a ii) – 1 point – Pick a force (multiple-choice). Explain why something happens.

- This is the one point I did not categorize in the video.
 - Perhaps it belongs with “Multiple Choice → Explain/Justify”, however, if you read it carefully, it is a *bit* different than the others.

Part (b) – 2 points – Newton's Second Law, manipulate equations, solve for variable.

Part (c i) – 1 point - Situation changes. How does a variable change? Multiple-choice. Explain.

Part (c ii) – 1 point – Explain using different physics.

Free Response Question #4 from 2017.

Part (a) – 3 points – Given 2 situations. Yes/No. Explain.

Part (b i) – 2 points – Same situations. Different multiple-choice question. Explain.

Part (b ii) – 2 points – Same situations. Different multiple-choice question. Explain.

Free Response Question #1 from 2018.

Part (a) – 2 points – Free Body Diagram (Only 1 force.)

Part (b i) – 3 points – Newton's Second Law, manipulate equations, solve for variable.

Part (b ii) – 1 point - Situation changes. How does a variable change? Multiple-choice. Explain.

Part (c) – 1 point - Situation changes. How does a variable change? Multiple-choice. Explain.

Free Response Question #1 from 2019.

Part (a) – 5 points – Draw lines on a graph. No explanation necessary.

Part (b) – 2 points – Situation changes. How does a variable change? Multiple-choice. Explain.