

To receive credit, you must explicitly address both of the following phases for each question or problem for which you did not receive full credit.

1. Diagnosis Phase – identify precisely what went wrong and why you did it that way
2. Generalization Phase – learn from your mistakes by generalizing beyond the specific problem, i.e. how do the specific difficulties you encountered relate to the general principles or procedures of the science?

Detailed Description of the Diagnosis Phase

In this phase, you must correctly identify your errors and diagnose the nature of your difficulties as they relate to specific content principles or concepts, a problem-solving procedure, or beliefs about the nature of science and learning science.

Note that an incorrect diagnosis or a merely descriptive work (such as simply noting the places where you made mistakes) is unacceptable. You must analyze your thinking behind your mistakes and explain the nature of these difficulties. In this phase **you must identify why you answered the way you did (not just what you did)**, where your understanding might have been weak, what you found difficult, what knowledge or skills you were missing that prevented you from answering correctly, etc. Even “guesses” are not truly random! THINK!

<i>Poor Diagnosis</i>	<i>Good Diagnosis</i>
<p><i>No description of thinking behind difficulty</i></p> <ul style="list-style-type: none"> • I was confused; I just guessed; I don’t know. • I didn’t consider all the options. • I didn’t think long enough. • I didn’t fully understand the question. • I picked the wrong equation. • I thought it would be two times stronger. • I didn’t remember to use $F=ma$. 	<p><i>Focuses on specific reasons for actions</i></p> <ul style="list-style-type: none"> • I thought that a large velocity means that a large force is required. • I knew it was the law of gravity, but I didn’t apply it correctly – I neglected the gravitational force between the central and left-side objects and only included that between the central and right-side objects.

Detailed Description of the Generalization Phase

In this phase you must correctly identify what deeper scientific content understanding you have gained from your diagnosis. By carefully thinking about the particular aspects that were problematic to you in approaching the question or problem and correlating them with the correct solution, you should develop a better understanding of the basic principles. In your writing you should identify this new understanding and describe how it will prevent you from having similar problems in the future. Note that merely stating the correct solution, by copying or paraphrasing it from a book, your notes, etc. does not satisfy the criteria. You must generalize beyond the specific problem to discuss the appropriate general principles of astronomy, physics, etc., i.e. laws, relationships, etc.

In your writing you are more than welcome to identify not only your understanding of your mistakes, but also your acknowledgment of any aspects of your thinking that were already correct and successful in your original attempt. It is hoped that, by doing these reworks, you will hold on to the good elements you already possess as well as add new good ones.

<i>Poor Generalization</i>	<i>Good Generalization</i>
<p><i>Focuses on generic activity</i></p> <ul style="list-style-type: none"> • I learned to read the question carefully. • I learned to pick the right equations. • I learned the right way to think about it. <p><i>Focuses only on the specific problem</i></p> <ul style="list-style-type: none"> • I learned that the strength of the gravitational force between A and B is the same as the strength of the gravitational force between B and C. 	<p><i>Generalizes beyond the specific problem</i></p> <ul style="list-style-type: none"> • I learned that the acceleration does come from the object’s velocity. This is consistent with Newton’s second law, which says that the acceleration depends on the net force and the total mass. • I learned that the expansion of the universe is just that – the “fabric” of spacetime is expanding – not the objects in the universe getting larger.