

# Pre-Lecture Reading Questions

## ASTR/PHYS 109

### 1. Introduction

It is important to learn how to both ask science questions, tell if it is a well-asked question, and to be well prepared for lecture. For these reasons we will have a number of Pre-Lecture Reading Question (PLRQ) assignments. In particular, there will be seven assignments: In six you will be evaluating the scientific quality of questions in quizzes (one for each Unit of the reading) and one, for Unit 2 only, where you will be writing down your own and turning in those questions in TurnItIn on eCampus. Each of these assignments will be part of your grade as discussed in the Syllabus.

In this Section we will give an overview of what we are looking for. In Section 2 we will describe the standards we will be using in the class for determining the quality of the question. In Section 3 we will give example questions and how each is evaluated according to the class standards. Finally, in Section 4, we will talk about the writing assignment you will do for Unit 2.

Excellent scientific questions are interesting and fun, and can break down a complex topic into smaller, more tangible sets of goals. Perhaps most importantly, they are well set up for useful answers. In short, excellent questions can help keep you focused, and have the added benefit of bringing rigor to a complex and open-ended discipline. Excellent scientific questions take many forms, but they all have many similarities between them. For this course we consider two different types of questions:

1. Questions about anything in the reading that a typical student might find unclear or need help understanding.
2. Questions related to the science of the reading that go beyond what is in the text. Something in the reading that made you think of a science question you really want to know the answer to.

While there are many interesting questions that can be asked, in this assignment we are only interested in questions that are related to the reading and about the science of the course. Said differently, we are not considering questions that are only tangentially related, or interesting but not about the science. For example, questions should not be about the history, philosophy or biology/life. While those ARE interesting, they are outside the the confines of this assignment and you can ask them privately or we can spend a little time on them in class. These questions in these need to be clearly tied to the reading, or go beyond the reading. Touching on issues outside the scope of the chapter, like in a later chapter, often produces excellent questions. Since this is hard, we'll make it more explicit below, and give examples after that.

***The bulk of these assignments are done in quizzes in eCampus. You will be given 10 questions to evaluate to help sharpen your skills. Perhaps the most important part of this assignment is the feedback on each question in each quiz. It is designed to both help you evaluate quality for questions in future quizzes, and provide some of the answers to the question (especially if it was interesting!)*** You need to get a 100% on the first quiz (to ensure you are excellent at the style) but you do not need a 100% on the later quizzes. You will get as many attempts as you need and your highest score will always be used.

## 2. What makes for an Excellent PLRQ question

There are five factors you should keep in mind for evaluating these questions:

- 1) *Is it obvious the question-asker read the Unit (or rather, is it not obvious that they didn't read)?*
- 2) *Is the question relevant to this unit's reading?*
- 3) *Is the question clear and well-phrased?*
- 4) *Does it reflect critical thinking?*
- 5) *Is it relevant to the science of the reading?*

Since the way we will be learning is by taking quizzes (you will be given 10 different questions) your job will be to evaluate the quality of each question and indicate where it is between "Excellent" and "Not Acceptable" according to the standards of the course.

To try and turn the five criteria into a judgement call, we describe the criteria here, and give examples in the next Section. We note that since there is some subjectivity in assessing the question quality, we will assign partial credit for some questions. The quiz answer options are:

- **Excellent:** Question meets all the criteria
- **Good:** Question is fine overall, but doesn't fully satisfy all the requirements
- **Borderline:** Question might be ok, but it has definite flaws. Maybe it was written quickly.
- **Bad:** Question is barely acceptable. It doesn't satisfy several criteria or it's almost answered in the book except for some wording technicality.
- **Not Acceptable:** Question is nonsense or is directly answered in the reading

**Excellent** questions are clear, well phrased, and thoughtful. It shows that the reader was thinking critically about the material in the reading and asking for clarification about something that is unclear, or asking for more information. It is ok to ask a question that may well be answered in a later chapter. In addition, topics that are closely related to the reading, even if they are not explicitly mentioned in the reading, are fine. These are questions that scientists have found worth answering, or are currently under investigation by scientists. Said differently, if an experiment would be needed (or was needed) to answer the question, that is usually a good indication that it is an excellent question. It does not need to be about a central topic of the chapter.

**Good** questions indicate that the reading has been done, but are typically not excellent because unclarities, vagueness or being too broad. To be a good question, they must still show critical thinking. Questions about definitions or simple facts that can be looked up in a dictionary are typically Bad or Borderline. However, just because it can be looked up these days, doesn't necessarily mean it is a bad question; a scientist might have had to do the experiment to learn the answer. That's an excellent question that someone already knows the answer to.

**Bad** questions typically indicate that the reading was not done, that no thought was given to the subject material, or the student did not understand the assignment. There is sometimes the case that the question is so poorly worded that they did not make any sense.

**Borderline** questions still show that the reading has been done, but are not excellent (or good) questions due to lack of critical thinking or being unrelated to the science of the unit. Historical questions and questions that are not "science" questions are Borderline instead of Bad if they are clear, show critical thinking, and show that the reading has been done. Questions that are not clearly enough worded to understand what was asking, but look like there might have been a good question in there somewhere are Borderline. If the question doesn't make sense then it is Not Acceptable.

**Not Acceptable** questions are the worst kind of questions. For example, they are already directly answered in the textbook or show that the reader didn't read the text or just didn't understand the assignment. It is VERY important to be careful about what is *directly* answered in the book. Sometimes a related question is answered which in fact makes this an excellent question. A good check to see if a question is Not Acceptable is to be able to point to exactly where the text, for example a page number, it is answered.

### 3. Example Questions and Feedback

Note: In the quiz itself there will typically be feedback on both the question quality AND on the answer. Here we will just comment on the question quality to help you be prepared for the quiz itself.

- *How many known quarks are there?*  
**Feedback on question quality:** This is a NOT ACCEPTABLE question because it is directly answered in the chapter (the answer is 6, on page 21, Table 3.1).
- *What is the difference between up quarks and the top quarks?*  
**Feedback on question quality:** This is an EXCELLENT question because it is asking for important information that goes beyond what is in the chapter. The answer is not directly in the text itself. It takes scientists to actually determine what the differences are.
- *How many quarks are there?*  
**Feedback on question quality:** This one is hard to evaluate. At first glance, it is similar to the first question that is not acceptable. However, this is in fact an EXCELLENT question as it asks a question that scientists are currently working on. What is there to say that the 6 known quarks are the only quarks? It really would have been better if it were more explicit what the reader is asking. For example, *We know of six quarks, but are there reasons to think there are others out there to be discovered?*
- *What is the mass of the Sun?*  
**Feedback on question quality:** This is a BORDERLINE question. Superficially, this could be seen as an Excellent question, with an experiment. It's not such a good question because it does not show any real thinking, and can be easily looked up. If the question made it clear why this is interesting, that would help. For example, *If a whole bunch of new mass were to fall into the Sun, would that have an impact on the speed of the Earth around it?*
- *Do all stars have the same mass?*  
**Feedback on question quality:** This is an EXCELLENT question because it goes beyond the simple fact, and asks about new information. While many people already know the answer to this question, that doesn't make it a bad question. It is true that this question is answered in later units (and would thus not be a good question for them), it is not answered directly in the text, and is a good question for the first unit.
- *What is the evidence that a big bang occurred?*  
**Feedback on question quality:** This is an EXCELLENT question for the first unit. While it is answered in later chapters (and would thus not be a good question for them), it is not answered directly in the text.
- *Should I be worried about black holes?*  
**Feedback on question quality:** This surely not an excellent question since it's not really about the science, it is about you and your worries. This would get credit both as a GOOD or a BORDERLINE question for the first unit.

- *If we have only sent objects to the edges of our solar system, how can we know the true distances of stars beyond our solar system?*  
**Feedback on question quality:** This is an EXCELLENT question because it is asking about the solar system as well as about how much we know about it using scientific methods. It is focused, easy to understand, and interesting. While one could say this is more about how we measure things rather than about the science, we would also give full credit for GOOD.
- *Why do we believe there is no edge of the universe?*  
**Feedback on question quality:** This is an EXCELLENT question because it is clearly based on the reading, and goes beyond what is covered in Chapter 3 to something interesting. The fact that we will talk about it in a later chapter which also indicates it's likely to be an excellent question.
- *How does the universe exist?*  
**Feedback on question quality:** It's hard to evaluate this question because it's not clear what the writer means when they use the word "exist." It is not clear if it's thoughtful or reflects critical thinking. For this reason we say this is a BAD question. A better question would be "How was the universe created?" or "What made the universe come into existence?" At the moment, it's too broad and nonspecific. Then again, since it takes a fair amount of knowledge to know just how problematic this question is we also give full credit for BORDERLINE.
- *Where did everything come from, how did it all come to be?*  
**Feedback on question quality:** This is a BORDERLINE question in some ways, and potentially excellent in others. The question of where did everything come from IS a scientific question. It would be a better question if it were more specific, and/or more clear what the question is that is being asked.
- *Are the anti-matter guns on Star Trek real?*  
**Feedback on question quality:** This is a BORDERLINE question as it has lots of borderline qualities. It is only barely relevant to the reading, but then again, anti-matter *is* mentioned in Chapter 3 and it is interesting to know more. The question is certainly clear, but it isn't clear if it is important or critical. It could be excellent if rephrased to not sound so frivolous.
- *What is reality as it really is?*  
**Feedback on question quality:** There is no chapter for which this could be a relevant question. It is not really thoughtful or nor does it reflect critical thinking. It is not really asking for clarification. This is a BAD question.
- *Is there anything smaller than an atom?*  
**Feedback on question quality:** This is directly answered in Chapter 3. Thus, this is a NOT ACCEPTABLE question.
- *What is the difference between astronomy and cosmology?*  
**Feedback on question quality:** This is directly answered in the book and therefore a NOT ACCEPTABLE question.

## 4. Unit 2 Writing Assignment

For Unit 2 only, you will submit four questions relating to the reading into TurnItIn in eCampus<sup>1</sup>. Please number and format your questions as follows:

1. *First question*
2. *Second question*
3. *Third question*
4. *Fourth question*

Your set of questions will be reviewed on a Pass/Revise basis. If all of your questions are considered Excellent and you will receive full credit (pass). If not, you will be provided feedback and you will need to resubmit. You can re-use the questions that were already Excellent. Multi-part questions should be avoided. Extra questions submitted in the same assignment will be ignored. The goal here is not to create enough questions that some of them are Excellent, the goal is for you to ONLY submit Excellent questions; in other words not submit any that are not Excellent.

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<sup>1</sup> Instructions can be found at <http://people.physics.tamu.edu/toback/109/WritingAssignments/InstructionsforTurnitin.shtml>