

University of Victoria  
Department of Physics and Astronomy  
Astronomy 101 - Exploring the Night Sky

## Multiple-Choice Question Assignment

Writing a multiple-choice style question can be challenging. This document is meant to explain what is expected of you for this assignment, and the criteria under which you will be graded. Your assignment will be graded out of 3 marks. One mark is effectively a participation mark, while the other two are for assessing the quality of the submission.

The reason why this assignment is used in this course is that it provides insight into how students conceptualize the material and conceptualize testing. Creating a good exam question requires the creator to synthesize ideas, which is the ultimate skill being taught in this course. The primary skill is synthesis of ideas (critical thinking), while the topic is Astronomy. Synthesis is when multiple separate ideas are brought together to form a better understanding of the whole. Synthesis is common in Physics and Astronomy: for example, our understanding of greenhouse gases in the lab is combined with our understanding of Earth's atmospheric changes over the past 200 years to come to the conclusion that climate change is caused by human activity. The conclusion is synthesized from two separate pieces of information.

### The Basics

To be eligible for full marks, your question must meet the following criteria:

- Your question must be directly related to the topic(s) of the assignment. Each assignment will be based on two topics from the course material. Be sure to double check which topics are due for the submitted assignment. **Submitting a question on the wrong topic will result in a grade of zero for the assignment.**
- Your question must consist of the question text, along with FOUR OR FIVE choice options. **Questions with 1, 2, 3 or more than 5 options will receive a maximum of 1 mark, depending on other factors.**
- Only ONE of the choice options must correctly answer the question text. In the case where there is an option that incorporates multiple of the other options, your question should include the text "Select the BEST answer." **Questions with multiple correct answers or no correct answers will receive a maximum of 1 mark, depending on other factors.**
- Your question should address material covered in the lecture slides or verbally in the lecture itself. **Questions that require research online will receive a maximum of 1 mark, depending on other factors.**
- Your question should be non-trivial. A trivial question is one that asks for the reader to identify something provided directly out of the notes. Examples of trivial questions is provided in the examples section below. **Trivial questions will not be assigned full marks.**
- Your question should clearly indicate which of the answers you believe to be correct. **Questions that do not indicate the correct answer or indicate an incorrect answer as correct will not be assigned full marks.**

## How to Write a Good MC Question

Writing a good MC question can be difficult. The following is meant to help guide you to create a good multiple choice question. A good question generally takes about 30-60 minutes to create, which includes time reading through material to double check you understand it correctly, double checking ideas, and re-reading/editing.

- Simple MC questions ask for the test-taker to recall information. This could be asking to select the correct definition of a word, or providing the definition of a word and asking to select the word that meets that definition.
- In contrast, good MC questions ask the test-taker to synthesize understanding. If the focus of the question is on an important term or concept, instead of asking for the definition, you could provide a question and options that require the test-taker to apply the knowledge or understand the implications.
- While one (and only one) of the options must be the correct, best answer, at least one other option should be plausible for someone who did not study. A good rule of thumb is to distribute your options as: 1 correct answer, 1-2 plausible but incorrect options(s), 1-2 incorrect options that are at least topically related, and no more than 1 humorous or ridiculous or complicated/technical-sounding-but-misleading options.

## Grading

Each assignment submission will be graded out of 3 total marks. In general, the following criteria will be used for assessing grades on the assignment. For situations not covered below, the marker will assess the grade as they see fit and may or may not provide feedback explaining the reasoning.

Assignment submissions will be graded 1/3 if there is a submission but does not meet the Basic criteria listed above.

Assignment submissions will be graded 2/3 if the submission is non-trivial, but is either simplistic or has other significant problems.

Assignment submissions will be graded 3/3 if the submission meets the criteria for an Good MC question listed above.

Assignment submissions that are sufficiently good quality to be used in the course question bank will result in the question creator receiving an extra bonus percentage towards their final course grade. Questions that receive this extra bonus mark are typically both Excellent and Novel.

## Examples

The following are actual examples of questions submitted assignments.

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*The following question would receive a maximum mark of 2/3. The reason for this is that none of the answers are correct. The question creator has indicated that they believe that the last option is correct, but this results from a misunderstanding about what is prograde and retrograde. However, this question is non-trivial and asks for the test-taker to understand the difference between two terms.*

What is the difference between retrograde and prograde motion in astronomy?

- a) Retrograde motion is when a planet moves in the same direction as Earth, while prograde motion is when a planet moves in the opposite direction of Earth.
- b) Prograde motion is when a planet moves in the same direction as Earth, while retrograde motion is when a planet moves in the opposite direction of Earth.
- c) Retrograde motion is when a planet moves in a clockwise direction, while prograde motion is when a planet moves in a counterclockwise direction.
- d) Prograde motion is when a planet moves in a clockwise direction, while retrograde motion is when a planet moves in a counterclockwise direction. (Correct)

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*The following question would receive a maximum mark of 1/3. The reason for this is that the correct answer is not discussed in this course. The term “barycentre” and its derivatives are correct terms, but are not part of the course, and so this question isn’t something that can be asked in class.*

Which of the following frames of reference in astronomy is considered the most difficult to define and measure accurately due to its constantly changing position and orientation relative to other celestial objects?

- a) Heliocentric frame of reference
- b) Geocentric frame of reference
- c) Barycentric frame of reference (Correct)
- d) Galactic frame of reference

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*The following question would receive a maximum mark of 1/3, as multiple of the options provided are correct and it is a simplistic question. Both size and temperature influence the intensity of blackbody radiation.*

The intensity of a radiation emitted from a blackbody depends on:

- a) composition
- b) shape
- c) size
- d) temperature
- e) texture

*The following question would receive a maximum grade of 1/3, as it is a true-false question rather than a MC question.*

The sky should appear violet (the shortest visible wavelength) instead of blue, however we see it as blue because our eyes are worse at perceiving violet.

- a) True
  - b) False (Correct)
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*This question would receive a maximum mark of 2/3. The question is interesting and non-trivial, but the creator did not do sufficient research on the topic to understand that purple is not actually a colour of light. Purple is the absence of green. There are other misunderstandings with the demonstration of understanding in the options provided.*

You notice that an object is purple. How are you able to observe the colour?

- a) Purple wavelengths are absorbed by the object. All other wavelengths are reflected back to your eye.
  - b) A purple corpuscle is sent to your eye from the object.
  - c) The object colours air molecules that are touching it purple. The air that touches your eyes has been 'dyed' purple due to its proximity to the purple object.
  - d) All wavelengths of light are absorbed by the object except purple which is reflected and reaches your eye. (Correct)
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*This question would likely be assigned a grade of 1/3, as it is a trivial question.*

What is the order of the following wavelengths of light, from shortest to longest?

- a) Gamma Rays, X-Rays, Ultraviolet, Visible light, Infrared, Radio
- b) Radio, Infrared, Visible light, Ultraviolet, X-Rays, Gamma Rays
- c) Infrared, X-Rays, Ultraviolet, Visible light, Radio, Gamma Rays
- d) Gamma Rays, Radio, Visible light, Ultraviolet, X-Rays, Infrared,
- e) Visible light, Infrared, Ultraviolet, Radio, Gamma Rays, X-Rays

*The following question would receive a maximum mark of 3/3. The reason for this is that it explores a deeper understanding of the material and tests multiple topics simultaneously.*

A company that makes energy drinks wants to market the drinks as being able to improve the test scores of students. The research team conduct an experiment on two separate occasions using a group of twenty students. Ten students are given an energy drink before taking a test, while the other ten receive a placebo that they are told is an energy drink. In the first round, the average test scores of the ten students who consume the energy drink are 25% higher than those who do not. In the second round of the experiment, the group which receives the placebo achieve average test scores of 5% higher than the group that consumes the energy drink.

How do the results of this experiment reflect on the theory the company is attempting to market?

- a) The theory is not sound because the experiments are not repeatable. (Correct)
  - b) The theory is sound because the theory is falsifiable, and the experiment is repeatable.
  - c) This is not a theory, so the scientific method cannot be applied.
  - d) The theory is not sound because it is not falsifiable.
  - e) The theory is not sound because it makes unnecessary claims (it is not simple).
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*The following question would receive a maximum mark of 3/3. The reason for this is that it tests multiple ideas simultaneously with distractors that require someone to think about what the concepts mean.*

What best describes the difference between conjunction and opposition in planetary alignment?

- a) Conjunction refers to the alignment of the inferior planets (Venus/Mercury) in a line connecting Earth and the Sun. Opposition refers to the alignment of the superior planets (Mars, Jupiter, Saturn, Uranus, Neptune) along the same line.
- b) Conjunction refers to when planets are aligned with a line connecting the Earth and the Sun. Opposition refers to when planets are aligned on the opposite side of the Earth from the Sun. (Correct)
- c) Conjunction refers to when the plane of the ecliptic aligns with the plane of the lunar orbit, allowing for eclipses to occur. Opposition refers to when they are out of alignment.
- d) Conjunction refers to the time when the axis of Earth's rotation, the celestial poles, point in the line connecting the Earth and the Sun. Opposition refers to the time when the axis of Earth's rotation points perpendicular to the line connecting the Earth and the Sun.
- e) Conjunction refers to a form of measurement of the celestial sphere using azimuth and altitude. Opposition refers to a form of measurement of the celestial sphere using angles measured from the first point of Ares.