

Interactive Questioning in the Classroom (“Peer Instruction” or “Think-Pair-Share”) Sample Questions and Rationales

Much research has been done on the pedagogical effectiveness of interactive questioning in the classroom (sometimes called “peer instruction” or “think-pair-share”) and associated methods of voting (clickers, flash cards, etc.). Such questioning serves many purposes including: (a) pre- lecture/discussion warm-up to introduce a topic; (b) mid-lecture/discussion comprehension check; (c) post- lecture/discussion understanding; (d) integrated reasoning (multiple topics) and top-level assessment; and (e) others as deemed appropriate in your classroom/discipline. The results are clear: proper implementation is the key, regardless of the method of delivery or voting mechanism.

“Conceptually rich” multiple-choice questions are those that require more than one step in reasoning in order to answer correctly. For example, a question that requires only a single step to get to the answer is likely a simple knowledge/recall question (lowest level of Bloom’s taxonomy) and is useful in situations like (a) above. Typically, the more reasoning steps required and/or the more complex those steps are, the more “conceptually rich” the question and the higher the assessment ranks on Bloom’s taxonomy. These questions are more suitable for situations like (b), (c), and (d) above.

I have attached some sample multiple-choice questions, complete with ratings and rationales. Each of the questions is rated on a scale of 1.0 to 4.0 based upon the level of reasoning complexity required in order to provide the most accurate and complete justification of the answer to another person: 1.0 is the easiest, requiring only a single step in reasoning, while 4.0 is the most difficult, requiring the scaffolding of multiple – and sometimes complex – steps to find the solution. (FYI, the ratings are based upon input from multiple experienced astronomy instructors; the rationales are mine alone.)

I would like to receive “conceptually rich” multiple-choice questions from you, ***specific to your discipline***, that can be used to illustrate situations like (b), (c), and (d) above. I would greatly appreciate whatever questions you are willing to share, and would love for you to provide your own ratings and rationales as I’m likely not very well-versed in your discipline. Your contributions will go a long way towards improving the upcoming Flex workshop on “Interactive Questioning in Your Classroom” (in May; announcement to come soon!).

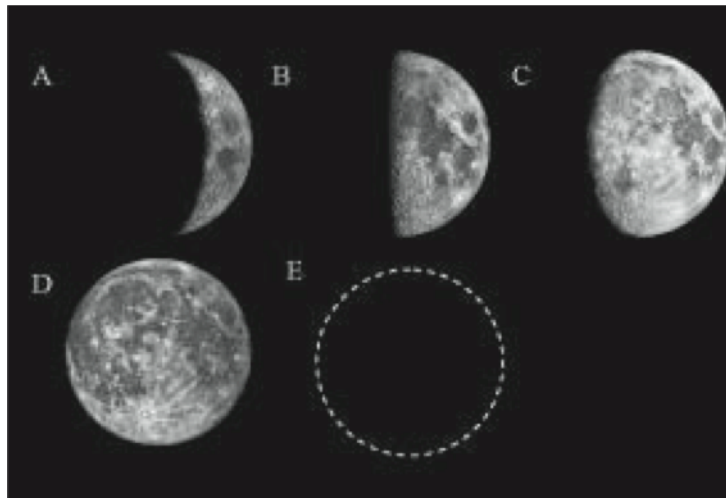
Thank you for your time, consideration, and conceptually rich multiple-choice questions!



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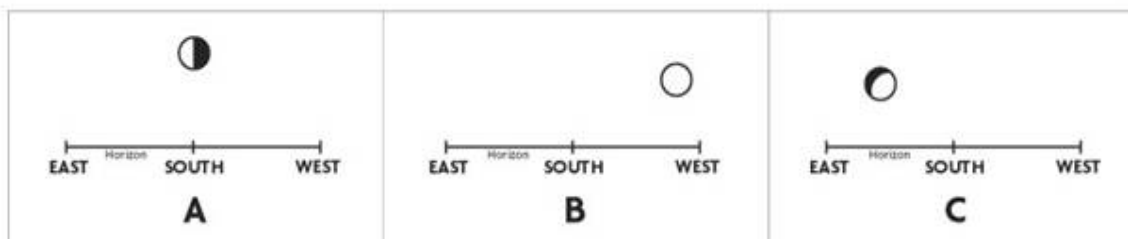
1. The Moon orbits
 - a. Earth.
 - b. the Sun.
 - c. Mars.
 - d. Jupiter.
 - e. Saturn.

2. You look to the western horizon as the Moon is setting and discover that it is in the full moon phase. Earlier that same day when the Moon was first rising, which of the moon phases shown below would the Moon have looked most like?



3. If the Moon is in the waxing gibbous phase today, approximately how long will it be until the Moon is in the waxing crescent phase?
 - a. one day
 - b. one week
 - c. two weeks
 - d. three weeks
 - e. one month

4. Which of the situations shown below occurs at a time closest to sunset?



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5. If the Moon is in the waxing gibbous phase today, how many of the moon phases shown below would the Moon go through during the next 11 days?
- a. none
 - b. one
 - c. two
 - d. three
 - e. more than three



6. In what direction would you look to see the Moon six hours after it rises?
- a. north
 - b. east
 - c. south
 - d. west
7. Which of the following groups of moon phases can be above the horizon at 4pm?
- a. full, waning crescent, and waxing gibbous
 - b. new moon, first quarter, and waxing gibbous
 - c. waxing gibbous, full moon, waning gibbous
 - d. waxing crescent, third quarter, waxing gibbous
 - e. None of the above. The Moon is only above the horizon during the night.

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Ratings are based on both the number and complexity of the required steps.

1.0 = least difficult → 4.0 = most difficult

1. rating = 1.0
Simple recall of knowledge about the Earth-Sun-Moon system.
2. rating = 1.5
Steps required: (a) know how long it takes to cycle through a complete set of lunar phases; (b) know the names of the different lunar phases; (c) determine what the phase would be at the given time; (d) identify the appropriate phase image
3. rating = 2.25
Steps required: (a) know the names of the different lunar phases; (b) know the order of the different lunar phases; (c) know how long it takes to cycle through a complete set of lunar phases; (d) determine time period necessary to go from waxing gibbous to waxing crescent
4. rating = 4.0
Steps required: (a) know the names of the different lunar phases; (b) identify the phases from the images; (c) know the order of the different lunar phases; (d) associate approximate rise and set times with each phase; (e) determine the approximate time in each image based on the position of the phase in the sky; (f) evaluate which image depicts a situation closest to the time of sunset
5. rating = 3.0
Steps required: (a) know the names of the different lunar phases; (b) identify the phases from the images; (c) know the order of the different lunar phases; (d) know how long it takes to cycle through a complete set of lunar phases; (e) determine what the phase would be at the given time; (f) count the phases shown that the Moon passes through from waxing gibbous to the phase determined in step (e)
6. rating = 2.0
Steps required: (a) know the path of the Moon in the sky based upon your latitude; (b) determine where the Moon along that path at the time given
7. rating = 3.25
Steps required: (a) know the names of the different lunar phases; (b) know the order of the different lunar phases; (c) associate approximate rise and set times with each phase; (d) determine which phases fit the criteria (e) select the choice with only phases determined in step (d)

Thank you!