

Multiple Choice Solutions for Midterm Exam #1:

Cabanela Exam

1. D
2. D
3. C
4. B
5. B
6. A
7. A
8. B
9. D
10. A
11. A
12. B
13. B
14. B
15. C
16. B
17. A
18. C
19. B
20. D
21. A
22. A (This one was difficult and really required a good understanding of Kepler's Third Law)
23. B
24. B

Craig Exam

1. C
2. B
3. C
4. A
5. A
6. B
7. A
8. C
9. D
10. A
11. A
12. C
13. C
14. B
15. A
16. B
17. A
18. D
19. C
20. D
21. C
22. C
23. D
24. A

Short Answer Solutions for Midterm #1:

1. (10 points) In the past decade, planetary systems have been discovered around several dozen other stars.

- a. Assuming that those planetary systems formed in a similar manner to our solar system, what would you expect the distribution and sizes of the rocky, icy, and gaseous worlds to be in those planetary systems?

If these other planetary systems formed in a similar fashion to our solar system, we would expect similar results. That is

- The rocky worlds would be nearest to the star and they would be medium-sized (maybe small too).*
- The gas worlds would be farther from the Sun than the rocky worlds and they would be huge.*
- The icy worlds would be farthest from the Sun and mostly small (and a few medium) worlds.*

*+3 points for placing the distance of kind of world from the Sun accurately
+3 points for getting the sizes right for each kind of world (as seen in our solar system).*

- b. It turns out most of the planetary systems discovered so far have large, gaseous worlds orbiting within 1AU of their star. Does this mean we should expect astronomers, using the ‘scientific method’, should toss out the idea that those planetary systems formed in a manner similar to the solar system? **NOTE:** This question does not have a ‘right’ or ‘wrong’ answer, we are looking at the logic of your explanation of what you think astronomers exploiting the ‘scientific method’ would do.

The answer to this question basically comes down to “what should a scientist do when there is evidence in contradiction of the predictions of the hypothesis they are testing?” In other words, we expected other planetary systems to have their gas giant worlds far from their star (like in our solar system) and we discovered this is not the case. The scientist now has to consider if the entire theory of star and planet formation needs to be tossed out or if it just needs to be “tweaked.” The truth is that since the theories for star and planet formation before the discovery of these exoplanetary systems was fairly good at making predictions of what we would see around forming stars, astronomers felt comfortable keeping those theories mostly intact and started just adding additional features to those theories. This new generation of theories makes predictions that are not being followed up observationally.

+4 points for any reasonable argument about how scientists deal with observations conflicting with their predictions.

1. When Newton proposed the law of gravitation it was rapidly realized that the orbits of the planets might be unstable. The pull of the large outer planets could, unless the orbits were just right, disturb the orbits of the inner planets like Earth. One explanation given at the time was:

The only way the solar system could have ended up with stable orbits is if the planets were placed in those orbits by someone or something.

Is this a scientific explanation or not? Explain why you chose the answer you did. (10 points)

This explanation is not scientific because there is no way to test it. The explanation doesn't make any predictions about what might happen in the future, only a story about what happened in the past that would be impossible to verify.

It could conceivably be argued that the argument is almost scientific if it were interpreted to mean that there is some sort of "placement" of planets in every solar system. Then, maybe, the "placement" could be detected by looking at other planets, though it is hard to see how any patterns seen in other solar systems could only be explained in terms of "placement" by someone or something.

+2 points for noting this explanation is not scientific.

+4 points for providing a correct reason for why this explanation is not scientific (e.g. - not testable, makes no predictions, invokes the supernatural, not falsifiable).

+4 points for clarity.

2. Describe two of the observations Galileo made with a telescope that undermined the geocentric view of the universe. Also explain in what way those observations undermined the geocentric view. (10 points)

There are four of Galileo's telescopic discoveries that you could say undermined the geocentric view:

Sunspots: *Because it challenged the idea of the perfect heavens. Furthermore, while not mentioned in class, Galileo used them to show the Sun rotated on its axis and was thus not "immutable".*

The Mountains on the Moon: *Similar to sunspots in that they were used to argue against the perfection of the heavens. Also led to the moon being considered just another world like Earth.*

The Moons of Jupiter: *Galileo realized that the moons of Jupiter orbit around Jupiter. This was important in establishing that the Earth was **not** the center of all motion in the heavens. The key assumption of the geocentric model was that everything moved around the Earth.*

The Phases of Venus: *The changing phases of Venus, notably the presence of a "full (small) Venus", strongly suggested that Venus had to be going around the Sun instead of orbiting in an epicycle between the Earth and Sun as demanded by the geocentric model.*

There was a fifth telescopic discovery of faint stars that had not previously been seen. While these suggested a much vaster universe than previously known, but this didn't really argue against the geocentric model directly. These observations alone did not prove a heliocentric theory correct, only that the geocentric theory is clearly incorrect.

+3 points for correctly describing two telescopic observations by Galileo (2 points for first, 1 point for the second).

+4 points for correctly explaining how each of those observations undermined the geocentric view of the solar system.

+3 points for Clarity