

Name and section: _____

- Failure to follow these directions will cause your grade to be lowered.
- All science tests, including this one, are cumulative by nature.
- Answers must be based on models developed in this course.
- You may not access a computer during the test.
- You may use activities and handouts from your instructor, but you will waste time looking for answers.
- Read each problem or question carefully before attempting a solution.
- Illegible or disorderly responses will be counted as incorrect.
- Responses written anywhere other than the provides space will be ignored.
- Make written responses complete, but concise and to the point.
- You have more than enough space for all your answers, so do not use your own paper.
- Unless otherwise explicitly stated, explanations must consist of complete sentences.
- Unless otherwise explicitly stated, responses must not contain personal opinions.

1. (LCTTA-01HW01) Examine each of the following passages and determine whether or not it is an argument. If it is an argument, specify both its premise(s) and conclusion. If it is not an argument, explicitly state so. You must not let personal agreement or disagreement with any of the premises or conclusions affect your responses. Do not analyze the premises for truth; assume they are true as given.
 - (a) [5 points] Faster-than-light travel is not possible. It would violate the laws of nature.

 - (b) [5 points] The flu epidemic on the east coast is real. Government health officials say so. And I personally have read at least a dozen news stories that characterize the situation as a *flu epidemic*.

 - (c) [5 points] This is an actual letter to the editor of a newspaper.

I am writing about the cost of concert tickets. I am outraged at how much ticket prices are increasing every year. A few years ago, one could attend a popular concert for a decent price. Now some musicians are asking as much as 200 to 300 dollars.

 - (d) [5 points] Witches are mentioned in the Bible. There are many people today who claim to be witches. Historical records reveal that there were witches in Salem. Witches are real.

2. (LCTTA-01HW02) For each of the following sets of premises, construct a conclusion that would be supported by the premises. You must not let personal agreement or disagreement with any of the premises or conclusions affect your responses. Do not analyze the premises for truth; assume they are true as given. All scientists should reach the same conclusion when given the same set of premises.
- (a) [5 points] Premise 1: All married people are happier than unmarried people.
Premise 2: You are married.
- (b) [5 points] Premise 1: You are afraid of heights.
Premise 2: Anyone who is afraid of heights will fall if he or she climbs a tree.
- (c) [5 points] Premise 1: If stem-cell research is banned, John and Sara will be happy.
Premise 2: Stem-cell research is banned.
- (d) [5 points] Premise 1: This course is very different from what I expected.
Premise 2: Courses that deviate from my expectations make me uneasy.
Premise 3: I tend to equate uneasiness over a course with the course being difficult.

3. (LCTTA-01HW03) Consider the following claim: We may eventually discover life on another planet.
- (a) [3 points] Decide whether or not this claim is testable. If it is testable, explain one possible test. Be careful, though, that you do not use words or descriptions of procedures you know nothing about. In other words, keep the language as simple as possible. If the claim is not testable, state so.
- (b) [3 points] If you decided that the claim is testable, now assess it for falsifiability. State your conclusion in a complete sentence.
- (c) [3 points] Suppose we carry out tests for life on hundreds of target planets. Suppose all these tests gave negative results. Have we proven that life does not exist on another planet?

4. [10 points] (LCTTA-01HW04) You are discussing UFOs with someone who has never taken a science course of any kind. The dialog goes like this, with you making the first statement.

There is no evidence that alien spacecraft exist.

Of course there is! People have seen them! That's proof enough for me.

For a spacecraft to get within sight of Earth's surface, it would surely be seen by some of the hundreds of satellites in orbit around Earth. To date, this hasn't happened.

Oh they probably have some sort of cloaking technology that renders them invisible to our satellites.

It's your turn to reply. What should you say? (NOTE: You're not being asked for your opinions here! Your reply, and there is really only one correct reply, should come from the framework we have established in class.)

LCTTA Test Version
Student

5. (LCTTA-01HW05) Carefully read this letter published on the opinion page of the Hickory Daily Record on Thursday, May 22, 2008.

In one of his most memorable sermons, “Will The Church Forget?” the late Dr. D. James Kennedy, the greatest modern Presbyterian pastor the USA has produced, was discussing those who had served in the Armed Forces. He said, “My question today is will the church forget? I don’t think it will forget you unless it should be taken over by the radical liberals of the ’60s who temporarily took over some of our college campuses and said — at the time when the world was being confronted by an increasing aggressive and hostile communism — that they stood fore-square against all anti-communism.

Believe it or not, those were Americans. Those were the radical liberals of the ’60s. Some people think they went away. They didn’t go away; they simply went underground. Today, they are still in our universities, but they are tenured, and they are teaching in our schools.”

Yes, folks, these are the professors of your children who you pay to belittle your children’s Christian faith, who you pay to teach evolution as fact and who you pay to encourage your children to equate the homosexual lifestyle with the heterosexual lifestyle.

In addition, you parents pay the colleges to provide your children with co-ed dorms and possibly co-ed rooms.

I would hazard a guess that very few colleges teach courses on Western civilization. There are probably a lot of classes on feminism, relativism and homosexual rights, but nothing on Western civilization. How many colleges teach about the Christian foundations of this nation?

How many teach that our Supreme Court in 1892 declared America to be a Christian nation by a 9-0 vote?

Are we growing a nation of pagans?

The writer’s name has been removed, and the letter has not been changed so any grammatical errors are assumed to be the either the writer’s or the newspaper editor’s.

- (a) [5 points] After reading the letter, underline the writer’s ultimate conclusion if there is one. If there isn’t one, explicitly say so.
- (b) [5 points] Strike through any statement that supports the writer’s conclusion. If you decided above that there is no conclusion, then explicitly state that there is no conclusion. Obviously, a writer can’t support a conclusion that doesn’t exist.
- (c) [5 points] Strike through any statement that provides background information or expresses a personal opinion.
- (d) [5 points] Based on whether or not a conclusion exists, state whether the writer is attempting to persuade the reader or just relating personal opinions.
- (e) [5 points] Based on this letter, what is the writer’s attitude toward education?
- (f) [5 points] Based on this letter, what is the writer’s attitude toward science?

- (g) [5 points] If you see any factual errors in this letter, circle them and do some research and correct them. Cite your sources.

LCTTA Test
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6. [10 points] (LCTTA-01HW06) You are having a discussion about science with a friend. Your friend happens to be a *relativist*. If you are not familiar with that term, you need to research it. You may be comforted to know that the term has nothing to do with physics or Einstein. After you understand what a *relativist* is, continue reading this question.

During your conversation, you state that science is a process that attempts to find truthful explanations for natural phenomena. Your friend responds by stating, "There is no absolute truth." How would you rebut this statement?

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7. [20 points] (LCTTA-01HW07) Develop a valid experiment to investigate whether or not prayer plays a role in a medical patient's recovery. You must provide detailed descriptions of your hypothesis, procedures, and analysis.

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8. (LCTTA-01HW08)

(a) [3 points] At what point, if any, in a discussion is it okay to accept someone's assertions because of their credentials?

(b) [3 points] What are the consequences of participating in a "debate" (note the quotes) over something for which there is overwhelming evidence?

(c) [3 points] To what extent should true scientists participate in "debates" as described above? Does doing so constitute the equivalent of medical malpractice?

9. [10 points] (LCTTA-01HW09) Some antiscientists say that science once told us there are only nine planets. If science was wrong about that, then it is also wrong about global warming and climate change. Critique this reasoning. Your response must not contain any personal opinions, especially about global warming or climate change.

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10. (LCTTA-01HW10) Think about the rest of this class period. See if you can come up with three events for each of the following categories.

(a) [3 points] certain to happen

(b) [3 points] likely to happen, but not certain

(c) [3 points] unlikely to happen, but not impossible

(d) [3 points] impossible

(e) [3 points] How did you interpret the meaning of *certain*?

(f) [3 points] How did you interpret the meaning of *likely*?

(g) [3 points] How did you interpret the meaning of *impossible*?

11. (LCTTA-01HW11) This question is not asking for your personal opinions on anything as there is a clear, objective answer to each part.
- (a) [5 points] You are a typical research scientist working in a lab hosted and financed by Screw U. (insert your favorite university there if you wish). Your specific job is oversee a group that test drugs for efficacy and safety. A representative from International Medicines, Inc. approaches you and requests that your group tests their newest product Darnitol, a drug for treating high blood pressure, to show that it is safe and has no dangerous side effects. IM makes no offer to finance your testing. What should your response to IM be?
- (b) [5 points] Suppose the IM representative had instead requested that your group tests their newest product to determine whether it is safe and has no dangerous side effects. Again, IM makes no offer to finance your testing. What should your response to IM be?
- (c) [5 points] Suppose the IM representative had instead requested that your group tests their newest product to show that it is safe and offers to completely fund your testing. What should your response to IM be?
- (d) [5 points] Suppose the IM representative had instead requested that your group tests their newest product to determine whether it is safe and has no dangerous side effects and this time, IM offers to completely fund your testing. What should your response to IM be?

12. (LCTTA-01HW12) This question addresses terminology that frequently confuses laypeople. Unless specifically stated, you must not include any personal opinions in your responses.

(a) [5 points] Consider this statement: *Jupiter is bigger than Earth.* In your personal opinion, what does this statement mean?

(b) [5 points] Consult with classmates and make a list of as many different interpretations of the statement as you can find.

(c) [5 points] Consult mathematics or science textbooks or reputable online sources and define the following terms:

1. radius:
2. volume:
3. mass:

Your definitions must not contain any equations or numbers, and must consist only of simple words. Do not make up your own definitions! Everyone must unanimously agree on your definitions.

(d) [5 points] Note that you were asked to consult *textbooks* and *online sources*; note the plurals. Why were you asked to consult multiple sources?

(e) [5 points] Given your unanimously agreed upon definitions, which of the three terms is most likely meant in the original statement?

- (f) [5 points] For each of the remaining two terms, invent a way of describing that property that does not use confusing terminology such as *bigger*. You need not confine yourself to one word descriptions. Sometimes, using multiple words is better.
- (g) [5 points] In an earlier part of this question, you were asked to consider different *interpretations* of a statement. Do you now see an issue with having to *interpret* a statement or a question? If so, what is the issue.
- (h) [5 points] Consider the term *literal interpretation*. Very briefly explain why this term is oxymoronic.

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13. [10 points] (LCTTA-01HW13) One source's definition of *intelligence* is that intelligent beings can understand the laws of Nature and can invent technology to change the way they live. Critique this definition. Is it universally applicable? Your answer may contain personal opinions.

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14. (LCTTA-01HW14) There is a flower native to Thailand called the parrot flower that looks very much like a colorful parrot. Proponents of intelligent design argue that this flower is just too beautiful to have come about by chance. They claim that it, like every other being, was here since Earth was created.
- (a) [5 points] Is the concept of *beauty* subjective or objective? (If you don't know what those words mean, look them up.)

 - (b) [5 points] Are we born understanding the concept of *beauty* or are we somehow conditioned to it?

 - (c) [5 points] Suppose a flower looks amazingly like a hideous creature or something otherwise grotesque. Would this equally signify the work of an intelligent designer? Put another way, are only things perceived as beautiful worthy of having been intelligently designed?

 - (d) [5 points] Suppose an alien creature from another solar system were shown a parrot flower. Would this alien reach the same conclusion regarding the flower's beauty? Consider both possible outcomes, and comment on the consequences of each.

15. (LCTTA-01HW15) Cindy found mysterious burned tufts of grass, roughly arranged in a geometric pattern, in her back yard. The local paper has been printing stories of UFO sightings in the area. A group of three high school students claims to have made up some of the UFO sightings. They even claim to have left fake alien artifacts at random houses in the neighborhood.

(a) [5 points] Construct a scientifically invalid hypothesis to explain the observations, and describe why the hypothesis is invalid.

(b) [5 points] Construct a scientifically valid hypothesis to explain the observations, and describe why the hypothesis is valid.

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16. (LCTTA-01HW16) In 2007, daylight saving time began in the U.S. about three weeks before it had begun in previous years. I have a radio controlled clock radio that adjusts itself at midnight every night based on time signals broadcast from Boulder, CO. These signals are synchronized with the time given by a master atomic clock at the United States Naval Observatory in Washington, D.C. Among other things, the signals tell my clock (and any other radio controlled clock) whether or not daylight saving time is in effect and the clock sets itself appropriately. The clock has performed perfectly since I bought it in 2003.

About one week after the new daylight saving time rules went into effect, the clock radio woke me up at what I thought was 6:00 am, the time for which the alarm had been set, as usual. However, the time announcement from the radio announcer said the time was actually 7:00 am. I thought the announcer had just made a mistake, but subsequent time announcements indicated the time really was after 7:00 am. I examined the clock and observed that the time had been reset one hour earlier than the correct time so that it read 6:00 am when the correct time was actually 7:00 am. The year had been reset to 2000 and the date and day had been reset to one, two, or three days earlier (I cannot remember which). The alarm was still set to go off at 6:00 am. This concerned me because I had overslept by one hour and could have been late to work. All ended well, though, and I got to work on time. A similar incident happened about a week later, but this time over a weekend so I was not concerned about being late for anything.

- (a) [15 points] List **every possible** explanation you can think of, no matter how far fetched, for how the clock radio got reset to the wrong time and date and year. **Do not attempt to rule out any explanations at this point.** State each explanation with complete sentences.
- (b) [15 points] Of the possible explanations you have listed, list the ones that cannot be tested or are not falsifiable. **List only the ones that cannot be tested.**
- (c) [15 points] Of the remaining explanations, list them in order from *most probable* to *least* probable.
- (d) [15 points] List and discuss the criteria you used to perform the ranking in the previous part.
- (e) [15 points] For **each** remaining explanation, discuss how you would go about testing it. Include consideration of **every** possible outcome of each test. This will take considerable effort and possibly even more paper.

17. (LCTTA-01HW17) In exchange for a generous donation to a worthy organization, you receive two tickets to a concert given by one of your favorite musical groups. A representative from the organization explains that the tickets will be sent to you by certified mail early next week. After one week, the tickets have not arrived. You call the organization and a (different) representative tells you the tickets will actually be sent next week by certified mail.

Now, you know that when you get a letter or package by certified mail, you have to sign for it at the post office. If you are not at home when your mail is delivered, the postal carrier will leave a notice in your mailbox that you must present, along with identification, at the post office to get the letter or package. You also know the postal carrier will make three attempts to deliver the item to you and then may return it to the sender. With just one week to go until the concert, the tickets still have not arrived. You once again call the organization and this time they decide that something has probably gone wrong and promise to look into the situation and get back to you later that day. In the meantime, you call your local post office to see if perhaps the tickets are there, and indeed they are. They have been there for over a week. The postal worker tells you that your carrier left at least two different notices about the package in your mailbox. After a trip to the post office, you finally get the tickets.

- (a) [15 points] List **every possible** explanation you can think of, no matter how far fetched, for how the delivery notices failed to show up in your mailbox. **Do not attempt to rule out any explanations at this point.** State each explanation with complete sentences.
- (b) [15 points] Of the possible explanations you have listed, list the ones that cannot be tested or are not falsifiable. **List only the ones that cannot be tested.**
- (c) [15 points] Of the remaining explanations, list them again here in order from *most probable to least probable*.
- (d) [15 points] List and discuss the criteria you used to perform the ranking in the previous part.
- (e) [15 points] For **each** remaining explanation, discuss how you would go about testing it. Include consideration of **every** possible outcome of each test. This will take considerable effort and possibly even more paper.

18. [10 points] (LCTTA-01SQ01) In one complete, coherent, and correct sentence, explain what is meant by a *scientifically valid claim or argument*.

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19. [10 points] (LCTTA-01SQ02) In one complete, coherent, and correct sentence, articulate the difference between *acceptance* and *belief*.

LCTTA Test
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20. [10 points] (LCTTA-01SQ03) In one complete, coherent, and correct sentence, articulate the meaning of Occam's razor.

LCTTA Test
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21. [10 points] (LCTTA-01SQ04) Arnold Arons, a highly respected expert in science teaching, states that science is a human invention. In one complete, coherent, and correct sentence, articulate in your own words what this means. Use simple language as though you were explaining this to someone who knows nothing about science. There may be more than one way to articulate the correct answer.

LCTTA Test
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22. (LCTTA-01TQ01) Each of the following examples may contain a fallacy. If an example does, simply state the name of the fallacy. If an example does not, state that there is no fallacy. There is no need for complete sentences here.
- (a) [5 points] I didn't do well on my astronomy test because my Internet access was interrupted by the big thunderstorm that came through yesterday and I couldn't get into WebAssign to review my homework. Then when the power came back on this morning, I couldn't find my calculator so I had to go out and buy one. On the way to Wal-Mart, I had a flat tire and had to call AAA. That made me late to class. I only had five minutes left to take the test after I got there. Besides, it's a dumb course. It's not like I want to be a professional astronomer anyway.
 - (b) [5 points] Bertrand Russell, a famous philosopher, once said that a false proposition can be used to prove anything. A student raised his hand and said, "In that case, given that $1 = 0$, prove that you are the Pope." Russell immediately replied, "Add 1 to both sides of the equation: then we have $2 = 1$. The set containing just me and the Pope has 2 members. But $2 = 1$, so it has only 1 member; therefore, I am the Pope." (HINT: Evaluate Russell's response to the questioner, and not whether or not this event really happened.)
 - (c) [5 points] Stem cell research should be banned because it kills helpless embryos that may grow into warm and friendly people.
 - (d) [5 points] The failure of evolution is based on the misapplication of the second law of thermodynamics, which has implications for the entropy of biological systems.
 - (e) [5 points] Alien civilizations may very well exist, but there is not yet any evidence that they do.
 - (f) [5 points] You can't prove that UFOs don't exist. Therefore, they exist.
 - (g) [5 points] How long will we let scientists perpetuate the folly that is evolution?
 - (h) [5 points] Our first manned mission to Mars will either fail or succeed.
 - (i) [5 points] Why do you have a chip on your shoulder?
23. (LCTTA-01TQ02)
- (a) [4 points] In one complete and coherent sentence, explain what is meant when we say that an argument or a claim is scientifically valid.

(b) [4 points] In one complete and coherent sentence, explain the difference between *accepting* and *believing*.

(c) [4 points] The following quote is from a nationally syndicated radio talk show broadcast on Monday, December 7 2009. The broadcast's transcript is freely available online. Your instructor heard the broadcast live. Following is a quote from the broadcast excerpted from one paragraph. It is presented out of context, but the context is not necessary to answer the question you will be asked. Note that this very course falls under three of the four cited "Corners of Deceit" by virtue of it being a science course at an academic institution funded (mostly) by a state government.

ClimateGate was advanced by propaganda and by public perception that men and women of science dressed up in lab coats were honest brokers of facts, when in fact all they were were greedy, grubby leftists on the take. Most of science is funded by grant. Science, government, academia, and media, have all been corrupted. They are the Four Corners of Deceit.

There is a logical error in this excerpt. In no more than two or three sentences, identify the logical error and briefly explain its significance.

(d) [4 points] In one complete and coherent sentence, state Occam's razor in your own words. You will not get credit for a statement copied from elsewhere.

(e) [4 points] Consider the following passage. Note that the first two sentences are historical facts and upon research, are found to be true.

The greatest library of the ancient world, which stood in Alexandria, Egypt, eventually burned down. There are many stories explaining the fire. One of them blames the seventh-century Muslim leader Caliph Omar, who reasoned that either the books in the library agreed with the Quran, in which case they were superfluous, or they contradicted the Quran, in which case they were heretical. At best the library was unnecessary, and at worse it was a danger to the faith, so Omar ordered the library burned.

In one complete and coherent sentence, state the name of the logical fallacy in Omar's reasoning.

24. (LCTTA-01TQ03) In class, you observed that most, if not all, of the numbers on a box of straws were demonstrably incorrect or at least inconsistent with each other. The question of whether or not I had tampered with the boxes of straws before class was raised.

(a) [10 points] Present a **fallacious** argument that supports the hypothesis that I **did not** tamper with the boxes. Explicitly identify the fallacy in your argument.

- (b) [10 points] Now present a **valid** argument that supports the hypothesis that I **did not** tamper with the boxes. This argument must not contain any fallacy.
25. [10 points] (LCTTA-01TQ04) “Science must be considered unholy because it does not explicitly include mention of a supreme deity and, therefore, must be abandoned by all people of faith.” Critique this statement’s premise and conclusion.
26. [10 points] (LCTTA-01TQ05) “Evolution is just a theory and should not be accepted as the truth.” Evaluate this statement’s use of terminology.
27. (LCTTA-01TQ06) In exchange for a generous donation to a worthy organization, you receive two tickets to a concert given by one of your favorite musical groups. A representative from the organization explains that the tickets will be sent to you by certified mail early next week. After one week, the tickets have not arrived. You call the organization and a (different) representative tells you the tickets will actually be sent next week by certified mail.
- Now, you know that when you get a letter or package by certified mail, you have to sign for it at the post office. If you are not at home when your mail is delivered, the postal carrier will leave a notice in your mailbox that you must present, along with identification, at the post office to get the letter or package. You also know the postal carrier will make three attempts to deliver the item to you and then may return it to the sender. With just one week to go until the concert, the tickets still have not arrived. You once again call the organization and this time they decide that something has probably gone wrong and promise to look into the situation and get back to you later that day. In the meantime, you call your local post office to see if perhaps the tickets are there, and indeed they are. They have been there for over a week. The postal worker tells you that your carrier left at least two different notices about the package in your mailbox. After a trip to the post office, you finally get the tickets.
- (a) [15 points] List **three** possible explanations you can think of, no matter how far fetched, for how the delivery notices failed to show up in your mailbox. **Do not attempt to rule out any explanations at this point.** State each explanation with complete sentences.

- (b) [15 points] Of the possible explanations you have listed, list the one(s) that cannot be tested or are not falsifiable. Do not list any others.
- (c) [15 points] For **each** remaining explanation, briefly discuss how you would go about testing it. Include consideration of **every** possible outcome of each test.
28. LCTTA-01TQ07a Each of the following examples may contain a fallacy. If an example does, simply state the name of the fallacy. If an example does not, state that there is no fallacy. There is no need for complete sentences here.
- (a) [4 points] Joe, you told us in class that there is no such thing as *gravity*, but it's mentioned in this textbook I borrowed from the library. I also heard it mentioned on a PBS documentary last night. Even NASA refers to *gravity*. If all those sources refer to *gravity* then it must be a legitimate word.
- (b) [4 points] As scientific models, both evolution and the Big Bang get the facts wrong. This means all scientific models can, and probably do, get the facts wrong too and are inherently wrong.
- (c) [4 points] Some people say that God created the Universe. Scientists say that the Universe was created with the Big Bang. I don't see how there can be any other possible explanation so the correct explanation has to be one of these two.

- (d) [4 points] Consider the following mathematical proof that fourteen added to itself four times is twenty-five. You should write out the steps based on the explanation to make sure you understand the process. Okay, to add fourteen to itself four times, write five fourteens vertically, with columns aligned. Now, add up all the digits in the rightmost column to get twenty and write the twenty. Next, add up all the digits in the leftmost column to get five, and write the five under the zero of the twenty. Finally, add the twenty and five to get twenty-five. Therefore, fourteen added to itself four times is twenty-five. Q.E.D.

29. LCTTA-01TQ07b

- (a) [4 points] If you take this astronomy course, your religious beliefs may be challenged. If your religious beliefs are challenged, your faith may be tested. If your faith is tested, you might begin to question the very existence of God. If you question the existence of God, you open yourself up to spending eternity in Hell. You should think very carefully before taking this astronomy course.
- (b) [4 points] You've always been told that no two unique numbers can be equal to each other, but that's wrong! Here's the proof. Let a and b be any two nonzero numbers.

$$a = b \tag{1}$$

$$a^2 = ab \text{ (multiply both sides by } a) \tag{2}$$

$$a^2 - b^2 = ab - b^2 \text{ (subtract } b^2 \text{ from both sides)} \tag{3}$$

$$(a + b)(a - b) = b(a - b) \text{ (factor both sides)} \tag{4}$$

$$(a + b)\cancel{(a - b)}^1 = b\cancel{(a - b)}^1 \text{ (divide both sides by } (a - b)) \tag{5}$$

$$a + b = b \tag{6}$$

$$\text{But } a = b \text{ so} \tag{7}$$

$$2b = b \tag{8}$$

$$2\overset{1}{\cancel{b}} = \overset{1}{\cancel{b}} \text{ (divide both sides by } b) \tag{9}$$

$$\therefore 2 = 1 \tag{10}$$

So we've been told wrong all these years!

- (c) [4 points] Okay Ms. Einstein, if you're so smart then tell us all how two observers can measure different time intervals just because one observer is moving relative to the other. Can you do that?
- (d) [4 points] I like to think that someday, I will discover a new form of life on a distant planet that orbits another star on the other side of our galaxy.
- (e) [4 points] What an insulting question to ask! You're no scientist. This interview is over!

- (f) [4 points] Pick any two numbers and I can prove they are equal. Here's the proof. If $a^b = a^c$, then $b = c$. Let $a = 1$. Then we have $1^b = 1^c$. Therefore, $b = c$.
- (g) [4 points] Adolph Hitler was a vegetarian and was evil. Sam is a vegetarian. Therefore, Sam, like all vegetarians, is also evil.
- (h) [4 points] Joe Heafner isn't qualified to work on any issue related to detailed research protocols in biology. He doesn't have a Ph.D. in biology.
- (i) [4 points] Consider the following mathematical proof that $25 \div 5 = 14$. You should write out the steps based on the explanation to make sure you understand the process. Okay, to divide five into twenty-five, proceed as follows. Five doesn't go into two, but five goes into five one time, so put a one above the five. Now, multiply five by one and put a five underneath the existing five. Now, subtract five from twenty-five to get twenty. Now, five goes into twenty four times so put a four next to the one. Multiply four by five to get twenty, so write down the twenty and subtract. Twenty from twenty gives zero. Therefore, there is no remainder so five goes into twenty-five fourteen times. Q.E.D.
- (j) [4 points] Consider the following mathematical proof that $14 \times 5 = 25$. You should write out the steps based on the explanation to make sure you understand the process. Okay, to multiply fourteen by five, you proceed from the rightmost column to the leftmost column. Five times four is twenty, so write down twenty. Next, five times one is five, so write a five under the twenty. Now, add up the columns to get twenty-five. Therefore, fourteen times five is twenty-five. Q.E.D.
- (k) [4 points] Consider the following mathematical proof that fourteen added to itself four times is twenty-five. You should write out the steps based on the explanation to make sure you understand the process. Okay, to add fourteen to itself four times, write five fourteens vertically, with columns aligned. Now, add up all the digits in the rightmost column to get twenty and write the twenty. Next, add up all the digits in the leftmost column to get five, and write the five under the zero of the twenty. Finally, add the twenty and five to get twenty-five. Therefore, fourteen added to itself four times is twenty-five. Q.E.D.
- (l) [4 points] Consider the following mathematical proof that $28 \div 7 = 13$. You should write out the steps based on the explanation to make sure you understand the process. Okay, to divide seven into twenty-eight, proceed as follows. Seven doesn't go into two, but seven goes into eight one time, so put a one above the seven. Now, multiply one by seven and put a seven underneath the existing eight. Now, subtract seven from twenty-eight to get twenty-one. Now, seven goes into twenty-one three times so put a three next to the one. Multiply three by seven to get twenty-one, so write down the twenty-one and subtract. Twenty-one from twenty-one gives zero. Therefore, there is no remainder so seven goes into twenty-eight thirteen times. Q.E.D.

- (m) [4 points] Consider the following mathematical proof that $13 \times 7 = 28$. You should write out the steps based on the explanation to make sure you understand the process. Okay, to multiply thirteen by seven, you proceed from the rightmost column to the leftmost column. Seven times three is twenty-one, so write down twenty-one. Next, seven times one is seven, so write a seven under the twenty-one. Now, add up the columns to get twenty-eight. Therefore, thirteen times seven is twenty-eight. Q.E.D.
- (n) [4 points] Consider the following mathematical proof that thirteen added to itself six times is twenty-eight. You should write out the steps based on the explanation to make sure you understand the process. Okay, to add thirteen to itself six times, write seven thirteens vertically, with columns aligned. Now, add up all the digits in the rightmost column to get twenty-one and write the twenty-one. Next, add up all the digits in the leftmost column to get eight, and write the eight under the one of the twenty-one. Finally, add the twenty-one and seven to get twenty-eight. Therefore, thirteen added to itself six times is twenty-eight. Q.E.D.
30. LCTTA-01TQ08 Here is an actual letter to the editor published recently in the local newspaper. There are some very minor editing errors in the print version and they have been corrected here. Both the original letter and all published responses are available online.

William McCall's article on children and faith healing illustrates one of many free passes superstition gets in our modern society and its consequences. Chad Schuermeyer's letter illustrates the damage this free pass does to our society. There is no evidence that disease has been cured by prayer. No amputee has ever come forth with a regrown limb as an answer to a prayer. No dead person has ever been resurrected no matter how many prayers were offered. There is no way to test prayer's efficacy because there can be no control group; people can always pray silently. Thus prayer, like any aspect of the supernatural, has no place in valid science. As a teacher, I have overheard students claim to rely on prayer for passing college-level courses when simply studying and doing the required work would suffice. It is difficult to blame these students, though, because they have been indoctrinated all their lives by people (sometimes parents) and institutions (schools that claim to offer education but offer religious indoctrination instead) who undermine education and intellectual development, but were treated the same way and so perpetuate the cycle. Our society is destined for intellectual failure if this cycle is not broken.

As you may have predicted, this letter elicited many responses. Some of the responses are presented here (anonymously) and you are asked to evaluate them. **You are not being asked whether or not you agree with either the original letter or any of the responses.** Examining these responses provides a rich and real world application of critical thinking skills so essential in all of science and is much more interesting than answering textbook questions.

- (a) [5 points] One response to this letter contains the following:

I personally believe he created us in his image. I also believe he placed a few nuts among us just to keep things interesting.

What is the name of the fallacy in this passage (no need for a complete sentence)?

- (b) [5 points] One response to this letter contains the following:

I am living proof of prayer, as I am alive and well from a terminal illness.

As a scientist, very briefly assess the validity of this claim.

- (c) [5 points] This same writer's reply began with the sentence
I beg to differ with [original author's] assessment that there is no scientific proof that prayer and faith heals anyone.
The writer's fourth sentence is
Faith is not something to be analyzed by science.
Very briefly comment on the logical relationship between these two statements.
- (d) [5 points] One response contains the following:
In response to the recent letter by [original author], I would suggest that he travel the intellectual road of so many others in history who have tried to prove that Jesus Christ was a phony.
Where in the original letter did the author implicate Jesus Christ was a phony?
- (e) [5 points] The same response contains the following, referring to the request in the previous part:
A lawyer by the name of Lee Strobel did just that, only to find that Jesus had to be who the Bible says He is.
What is the name of the fallacy in this passage (no need for a complete sentence)?
- (f) [5 points] Yet another response contains the following:
Our country is in the shape it's in now because God has been taken out of the public square. Judgement day is coming.
What is the name of the fallacy in this passage (no need for a complete sentence)?
- (g) [5 points] Finally, which statement or claim in the original letter prevents an individual from holding personal religious beliefs despite evidence supporting the scientific claims presented there?
31. [10 points] LCTTA-01TQ09 At what point, if any, in the scientific process can a framework be conclusively proven correct? Why? Defend your response. Use no more than five sentences.
32. [10 points] LCTTA-01TQ10 Consider the following flawed argument:
Persons with doctoral degrees are not specifically trained to deliver classroom instruction. Your instructor does not have a doctoral degree. Therefore, your instructor can deliver classroom instruction superior to that from someone without a doctoral degree.

What is the flaw?

33. [10 points] LCTTA-01TQ11

(a) [6 points] According to your recent research, what are the two general types of knowledge and which is preferred in an introductory science course?

(b) [6 points] According to your recent research, what is the ultimate source of all scientific knowledge?

34. [10 points] LCTTA-01TQ12 Why is allowing students to "opt out" of learning certain topics problematic?