

# Scientific Thinking

section 14

23-May, 2009

## A Final Examination in Five Acts

This examination ends after exactly **90** minutes.  
You will be told when you have 5 minutes left, and 1 minute left.

**ANYONE WRITING AFTER THE EXAM IS OVER WILL  
AUTOMATICALLY LOSE 25% OF POINTS FOR CHEATING.**

This exam contains **210** possible points. Your final score will be calculated out of 200 points.  
Therefore, you have the opportunity to earn 10 extra credit points on this exam.

Full Name: \_\_\_\_\_

AUC Student ID Number: \_\_\_\_\_

I hereby state that I have not violated the AUC academic integrity policy in the preparation for, or the taking of, this exam. I understand that this exam will not be graded without my signature below.

Signature: \_\_\_\_\_

This exam contains **5 pages**. Make sure you have all the pages before proceeding.

# **Act I: enter the universe**

(65 points)

- a) Briefly describe the Big Bang theory. **(15 points)**
- b) Is the Big Bang theory scientific? Why or why not? **(20 points)**
- c) What are three predictions made by the theory, and how have they been tested? **(30 points)**

# Act II: character development

(50 points)

- a) Briefly describe the key ideas of Relativity. **(10 points)**
- b) Briefly describe the key ideas of Quantum Mechanics. **(10 points)**
- c) What is a unified theory? Give an example of a unified theory. **(10 points)**
- d) Why are scientists trying to unify the theories of Relativity and Quantum Mechanics? Include three specific possible reasons. **(20 points)**

# Act III: the plot thickens

(55 points)

Consider the following passage (for our purposes, the terms *metaphysical* and *metaphysician* may be replaced with *philosophical* and *philosopher*, respectively):

"I do not understand," Bishop Morehouse said. "It seems to me that all things of the mind are metaphysical. That most exact and convincing of all sciences, mathematics, is sheerly metaphysical. Each and every thought-process of the scientific reasoner is metaphysical. Surely you will agree with me?"

"As you say, you do not understand," Ernest replied. "The metaphysician reasons deductively out of his own subjectivity. The scientist reasons inductively from the facts of experience. The metaphysician reasons from theory to facts, the scientist from facts to theory. The metaphysician explains the universe by himself, the scientist explains himself by the universe."

"Thank God we are not scientists," Dr. Hammerfield murmured complacently.

- Jack London, *The Iron Heel* (1908)

- a) Using the skills and knowledge you have gained from this course, evaluate Ernest's definition of science and scientific thinking. Is he correct or incorrect, and why? **(10 points)**
- b) What roles do questions and answers play in scientific thinking, and how do they relate to Ernest's definition? **(15 points)**
- c) What does Ernest mean when he says "the scientist explains himself by the universe"? **(10 points)**
- d) We have repeatedly stated that science cannot prove things "true". If this is the case, what is the value of scientific thinking? **(20 points)**

# Act IV: the twist

(30 points)

1. You are a health minister for your country's government. One of your employees comes to you and says there is a rumor of a deadly disease spreading in another country. As a scientific thinker, what is the first question you should ask?
  - A) What country is the disease in?
  - B) What is the name of the disease?
  - C) What is the evidence for the rumor?
  - D) In which university did your employee study?
  - E) What degrees does your employee hold?
2. It seems that this rumor is worth investigating further. As a scientific thinker, who should you contact first?
  - A) A Nobel-prize winner from your country.
  - B) An expert on this disease from an international organization.
  - C) The head of the most prestigious hospital in your country.
  - D) The most famous journalist in your country.
  - E) The head of a pharmaceutical company that makes a drug for this disease.
3. You get in touch with this person and she talks to you about this disease. She then makes a set of suggestions for how your country should deal with this disease. What should you do first?
  - A) Find out if her suggestions will actually impact the spread of the disease.
  - B) Find out how much it will cost to do her suggestions.
  - C) Find out if there will be an environmental effect from her suggestions.
  - D) Find out if she could make money if you use her suggestions.
  - E) Find out if anyone else has used suggestions like this.
4. Justify your answer to #3 in one sentence.
5. You've gotten the answer to your first question, and it seems promising. Which question would you like answered next?
  - A) Find out if her suggestions will actually impact the spread of the disease.
  - B) Find out how much it will cost to do her suggestions.
  - C) Find out if there will be an environmental effect from her suggestions.
  - D) Find out if she could make money if you use her suggestions.
  - E) Find out if anyone else has used suggestions like this.
6. Justify your answer to #5 in one sentence.

# Act V: a happy ending

(10 points)

Consider the following comic:



<<http://www.stuff.co.nz/opinion/cartoons/1251890/Mike-Moreu>>

Why might this comic be funny? What is it making reference to?