Name: _____

Directions: The following exam consists of 20 questions, for a total of 100 points with 4 bonus points. Read each question carefully (note: answers may break onto the next page).

*For each question, choose one and only one (the best) answer (unless the question states otherwise). In cases where you are asked to choose all that apply, it is possible that the **all** or **none** of the options are correct. Finally, note that "iff" stands for "if and only if".*

1 Multiple Choice

1.1 Basic Concepts

1. (4 points) Which of the following are four key features of the positivistic view of science (Circle all that apply)
    A. science a constellation (aggregation) of a set of facts, theories, and methods.
    B. science is accumulative: science is the piecemeal development of this set of facts, theories, and methods.
    C. science is **not** accumulative. Rather, each scientific era defines its own truth; as such, the shift from one scientific era to the next does not result in the increase of knowledge or truth.
    D. science is realistic: scientific theories and facts describe the real world and each generation, each new theory moves us closer towards describing the real world.
    E. science is **not** realistic
    F. science is governed by a value-free, neutral, objective method that relies heavily on neutral observations, mathematics, and logic.
    G. science is **not** governed by a value-free, neutral, objective method; it is instead just as much shaped by human bias and contextual conditions like non-scientific beliefs people hold.

2. (4 points) What are the three possible responses to the historian's dilemma consider in class and in the handout (Circle the three that apply)
    A. reject that science is accumulative
    B. reject that there is anything like an objective, value-free scientific method
    C. reject that science is accumulative and there is anything like an objective, value-free scientific method.
    D. reject that novel predictions and consistency are the decisive features in determining which theory is better than another.

3. (4 points) If two paradigms are absolutely incommensurable, which of the following is true (indicate one and only one):
    A. they cannot be compared
    B. they can be compared, and one can be said to be better than the other
    C. they can be compared but only in some limited ways (and these limited ways allow us to determine which paradigm is objectively better than the others)

4. (4 points) According to Kuhn, what is a scientific crisis?
    A. a state of science where serious anomalies threaten the current paradigm.

B. a state of science where there are no fundamentals and science has not reached a state of maturity where it can be called "normal science"

C. a state of science where some limited (and often unimportant) part of a theory (paradigm) is in conflict with observation and/or experiments

5. (4 points) According to Kuhn, when does a build up of anomalies become serious (indicate all that apply):

   A. when the anomaly influences some fundamental component of the paradigm and this anomaly resists repeated resolution within the paradigm

   B. when the anomaly is a problem of pressing social concern (and it cannot be solved by the paradigm)

   C. when there are a large number of them (anomalies)

6. (4 points) What are the two most radical parts of Kuhn's theory (indicate both):

   A. that the history of science and theory-change does not reveal a linear progress to increasingly better theories

   B. that science is not characterized by the use of an objective, value-free, theory-neutral method

   C. that science really does have a single, objective, value-free (neutral) method that cuts across all paradigms and when this method is applied correctly, scientific truth is discovered (and this truth increases as we shift from one paradigm to the next).

7. (4 points) According to Lakatos, which part of his research programs are modifiable?

   A. the protective belt

   B. the hard core

   C. the paradigm

   D. the entire research program

   E. none of the above

8. (4 points) According to Lakatos, what two characteristics of a research program make one research program better than another research program? (Indicate both)

   A. the program retains its coherence (consistency) in the face of falsifying observations by modifying the protective belt

   B. the program retains its coherence (consistency) in the face of falsifying observations by modifying the hard core

   C. the program retains its coherence (consistency) in the face of falsifying observations by modifying any part of the theory (program, paradigm)

   D. the program explains various observations (phenomena) in a simpler, more intuitive way

   E. the program has a number of confirmed novel predictions

9. (4 points) According to Feyerabend, is there something distinctive about the scientific method that makes it better than other methods of exploring the world, e.g. astrology, black magic, voodoo, fortune-telling?

   A. No, according to Feyerabend, there is nothing about the scientific method that makes it better than any other method.

   B. Yes, according to Feyerabend, there is some distinctive method to science (e.g. Bayesianism, inductivism, falsificationism, etc.) and, intuitively, this method is more likely to produce what is true than non-scientific methods like astrology or black magic.

10. (4 points) If Feyerabend were forced to describe the method of science, what principle (or rule) would he say best describes it?

A. Anything goes.

B. that science makes use of a step-by-step (algorithmic) method that begins with observations and generalizes these observations to scientific laws.

C. that scientists propose hypotheses and then seek out experiments to falsify these hypotheses

D. that the method of of science is best described by making use of probability theory, e.g. the probability of any given scientific hypothesis is a function of the confirmed observations minus the falsified observations.

11. (4 points) According to the instrumentalist, scientific theories only describe (indicate one answer):

A. what appears to us (appearances)

B. what appears to us AND the world that lies behind those appearances.

C. the observable and unobservable world relative to a paradigm

D. the observable and unobservable world relative to a research program

12. (4 points) What does the scientific instrumentalist say about unobervables (e.g. subatomic particles) posited by a scientific theory.

A. a scientific theory ought not to be understood as attempting to describe what is unobservable; instead, when a scientific theory (model) involves an unobservable, these unobservables should be understood as merely useful constructs (tools, ideas) for making predictions

B. scientific theories describe (refer to) the real world; if the theory involves an unobservable, then this unobservable can only be understood as existing in the world.

C. scientific theories do not actually posit unobservables (they are not even a part of the theory); that is, our best scientific theories do not even have concepts or terms for unobservable entities

13. (4 points) What are the two key objections to the instrumentalist position? (indicate both)

A. instrumentalism is false since it relies on a fuzzy (unclear, vague) distinction between what can be observed and cannot be observed

B. instrumentalism is false for consider a scientific theory T that makes use of unobservables (e.g. subatomic particles, force of gravity, etc.). T often makes novel predictions that are confirmed by observation. If T did not refer to the world, then these predictions would be miraculous. There are no miracles. Therefore, T refers to the world, and so unobservable entities refer to the world.

C. instrumentalism is false because all scientific knowledge is limited by what we can observe.

D. instrumentalism is false because we cannot know that there are really things like perfect circles or mathematical lines existing in the world.

14. (4 points) The optimistic version of scientific realism says what (choose the best answer):

A. Scientific realism is true and science will ultimately be successful in describing the world (the real).

B. Scientific realism is true but science ultimately will *not* be successful in describing the world (the real).

C. Scientific realism is false and science ultimately aims only to describe what is observable.

D. Scientific realism is true and science ultimately aims only to describe what is observable.

15. (4 points) What objection does the optimistic scientific realist raise toward the pessimistic scientific realist?

A. the optimistic scientific realist position must be true for if the pessimistic version were true, then scientists would be pursuing a goal that they can never achieved (which is irrational)

B. the optimistic scientific realist position must be true for science can only describe what is observable and unobservable; it cannot describe spiritual or non-scientific entities.

C. the pessimistic realist position must be false since the world is too complex to fully describe.

D. the pessimistic realist position must be false since the history of science shows a repeated falsification of theories, a pattern we can infer will continue to the future.

2 Short Answer

16. (10 points) Describe Kuhn's theory of science (state and briefly describe each of the key steps in how science progresses from pre-science to new normal science) and articulate one criticism of Kuhn's theory.

17. (10 points) Describe Lakatos's theory of science. In particular, (i) describe its core features, (ii) explain how it responds to the Duhem-Quine problem, and (iii) and finally explain how it is not a relativist theory like Kuhn's.

18. (10 points) Describe Feyerabend's theory of science. In particular, (i) what are the two components of the theory and (ii) articulate at least one problem with Feyerabend's view.

19. (10 points) Describe the scientific realist view of scientific theories. In particular, (i) explain the two parts of the theory and (ii) articulate one problem with the scientific realist theory.

20. (4 points (bonus)) Explain how the acceptance of the Copernican theory based upon its explanation of apparent retrograde motion is problematic for Lakatos's account of why certain research programs are replaced by other research programs.