Philosophy of Science Comprehensive Exam – Questions Compilation

A. General philosophy of science

1. Can scientific realism be reconciled with the view that even the best scientific theories are revised and replaced by new ones with fundamentally different ontologies?

2. Explain the difference between Mayo's notion of severe testing with error statistical methodology and Popper's falsifiability.

3. Does the failure of reductionism imply disunity of science?

4. Must scientific explanations be causal?

5. If models incorporate idealizations, then can they really help us understand the natural world?

6. Is the rejection of the value-free ideal a threat to the autonomy of the sciences?

7. Explain and assess the view that crucial experiments in science are impossible.

8. What is meant by the "experimenters' regress"? Can it be avoided?

9. Explain how Wimsatt understands the concepts of robustness and robustness analysis in "Robustness, Reliability and Overdetermination" (1981). Provide an example of a type of robustness analysis in science that illustrates what its function is.

10. In what sense is Structural Realism meant to be the "best of both worlds"? Does it succeed in its aim?

11. Argue for or against the following claim: "The laws of our best theories are all *ceteris paribus* laws." (You should begin by defining *ceteris paribus* laws.)

12. Explain the "Humean" conception of scientific laws. Does it do justice to the concept of law as it is used in science? Why or why not?

13. What is the problem of underdetermination and do you agree that it challenges the notion of a crucial experiment?

14. Can robust results across various experimental settings solve the experimenter's regress?

15. Assess the following claim: From an epistemic viewpoint, simulations are equivalent to experiments?

16. Does the use of approximations and idealizations in science imply anti-realism?

17. Can non-epistemic values contribute to scientific progress?

18. Would the unity of science hypothesis still stand if all that science has to offer are local ceteris paribus lawlike principles?

19. Explain and assess the characterization of robustness analysis as a mean to find truth "at the intersection of independent lies."

20. Summarize and criticize the multiple realizability argument against reductionism.

21. To what extent materiality affects the explanatory power of models?

22. What are exploratory experiments and what are they good for? What criteria should we use to evaluate them? Can (or should) they be standardized in some ways?

23. In causal modeling, is it possible to get from probabilities to causes? What condition(s) would be required?

24. How does the ubiquity of diverse pre-theoretical assumptions and value-judgements in science affects the epistemic standing of scientific theories? Your answer should contain at least one example of pre-theoretical assumption and value judgement.

25. Do you agree with the following statement: "the structural realist solution to the problem of referential continuity in theory change boils down to relationalism"?

26. What is the nature of the disagreement between Collins and Franklin on the experimenter's regress problem?

27. When it comes to testing high-level theories (such as General Relativity or Evolution), which approach is better: Bayesian or error-statistical?

28. What role(s) do counterfactuals play in the interventionist account of causation?

29. Compare deductive-nomological, statistical-relevance, and mechanistic (a la Machamer, Darden, and Craver) explanations. Make sure to explain the main pros and cons of each model.

30. Explain and critically assess the view that inductive risk challenges the value-free ideal of science.

B. Philosophy of Physics

1. Explain and assess one account of the nature of probabilities in the Everett / Many Worlds Interpretation.

2. Evaluate the following claim: "A moving rod contracts because of how it is made up and not because of the nature of its spatio-temporal environment."

3. Critically discuss the following claim, in light of recent literature on the philosophy of spacetime: "A spacetime theory postulates the existence of an unobservable object (spacetime) in order to explain observable phenomena (relative motions)."

4. In some of the literature on the foundations of statistical mechanics, one finds the claim that, though the Gibbsian framework may be useful for certain purposes, for foundational discussions the Boltzmannian approach should be taken as more fundamental. Explain and critically assess this claim.

5. Discuss and evaluate an important argument for realism concerning the quantum state, and an important contrary argument.

6. Explain what is at stake in the debate between "dynamical" and "kinematical" interpretations of special relativity.

7. Explain the philosophical motivations behind the "many-worlds" interpretation of quantum mechanics, and evaluate some of the most important objections.

8. Explain what is at stake in contemporary debates regarding the proper space-time representation of Newtonian physics.

C. Philosophy of Mind/Brain Sciences

1. The term "representation" is absolutely everywhere in the cognitive sciences. Is there a settled answer to what they are and what they do? More specifically, is the term used in a consistent way in, say, "representation reconsidered" and in techniques like representational similarity analysis? Explain your answer with specific examples.

2. In what ways do mental disorders, and our current best understanding of them, challenge classical computational theory of mind?

3. Is the existence of "narcissistic" or "egocentric" perceptual systems a challenge to Representational Theory of Mind/Computational Theory of Mind? Why or why not?

4. What is the HPC view of natural kinds and what verdict does it give on whether mental disorders are natural kinds?

5. What is the MPC view of natural kinds and what verdict does it give on whether mental disorders are natural kinds?

6. Ian Hacking claims that mental disorders are subject to "looping effects". What are "looping effects" and what are the purported implications of such effects for "kind" status of mental disorders?

7. Are mental disorders natural kinds? If they are not natural kinds, what kinds of kinds are they and why?

8. What is the nature of explanation in psychology and how does it differ from explanation in neuroscience?

9. Can psychology and neuroscience by unified? Why or why not?

D. Philosophy of Biology

1. 1. Preformationism is an historical doctrine in embryology said to have been superseded by the discovery of DNA. Yet some scientists and philosophers claim that preformationist thinking still pervades the study of genetics and development. Describe and evaluate these arguments and the evidence supporting them.

2. Describe the challenge to the Modern Synthesis presented by developmental systems theory and epigenetic inheritance. Does the challenge necessitate abandoning the "central dogma" of molecular biology that DNA is a repository of information.

3. Is natural selection a causal process or a mere statistical phenomenon?

4. Explain how the following claim by Robert MacArthur captures one of the key empirical challenges to model-building in ecology: "If the [geographical patterns in biodiversity] were wholly fortuitous and due to accidents of history, their explanation would be a challenge for geologists, but not for ecologists." What was MacArthur solution to this problem and how did it exacerbate the debates over the incapacity of theoretical models to capture ecological phenomena?

Philosophy of AI

1. Scientists are increasingly using machine learning tools to make predictions and draw inferences from large data sets. Yet these results are often characterized as "opaque" due to the complexity of the resulting algorithms. What, if anything, does the opacity of ML methods imply regarding what they can contribute to scientific inquiry? (It may be helpful to draw a contrast between theory- or model-based reasoning.)

2. What do successes of deep learning methods suggest regarding how it is possible to "learn" concepts or abstract categories from a large data set? (Note that this is only a how-possibly question, and does not regard how such learning could be implemented in human brains.)

Philosophy of Social Sciences

1. In a brand-new article* in *Sociological Theory*, Jan Fuhse appears to want to drag us back to the Vienna Circle fights when he says, "We cannot know the real features of the social world, only what our theoretical perspectives make us see. … Theories should be assessed not for their ontologies but for what they allow us to see and how they connect to empirical observations." This statement seems to put into question not only the proper relationship between concepts, theories, and realities, but to dismiss the importance of even thinking about the proper relationship between sociological conceptions of "the social world" and the world itself.

Q. Write an answer integrating authors from the reading list that establishes your position regarding the constructivist claims that Fuhse makes — in other words, *does, can, or should sociological theory care about the propriety of its ontological claims about the world?* In your response, anticipate the critiques of the opposing side and be sure to show where the Vienna Circle fits in all of this.

> *Note: You are not expected to go read this article. Rather, use this as a starting point for your discussion.

2. Sociological thinking has had to grapple with the debates regarding *where we start our thinking:* in other words, whether we must start with human individuals in a methodologically-individualistic way, or begin with some deterministic and ethereal notion of "society" and fall prey to the ecological fallacy. Put another way, does society start with individuals (and therefore sociologists must as well to know society)? Or does society exist *sui generis* as Durkheim claims and therefore requires a different mode of knowing. It would appear that this is not only a *methodological* question, but also an *epistemological* one regarding the knowability of a world that we know exists yet cannot objectively and directly see.

Q. Develop an argument that addresses this conundrum that links methodology and epistemology by bringing together the texts from the culture and cognition and philosophy of social science sections of your reading list.