Study questions on Kant - Part 1 (Huggett, Chapter 11)

Concerning the Ultimate Foundation of the Differentiation of Regions of Space

1. According to Kant, what does a region of space consist of?
2. According to Kant, how do we determine the position of places in nature?
3. According to Kant, what does the "complete principle of determining a physical form" rest on?
4. According to Kant, what distinguishes a right hand from a left hand?
5. What is Kant's definition of an "incongruent counterpart"? Give an example.
6. Kant refers to an "inner principle" by which incongruent counterparts can be distinguished. Why can't this inner principle be associated with the different ways in which the parts of an object are connected to each other?
7. Suppose the only thing in the universe was a human hand. Does Kant think it necessarily would have to be a right hand or a left hand?
8. Suppose the only thing in the universe was a human right hand. What does Kant think this would entail about the reality of space?

Commentary

9. What does it mean to say that mirror images are incongruent?
10. In 2-dimensional space, does the letter "F" have an incongruent counterpart? Explain.
11. Why does the definition of incongruent counterparts in 2-dimensional space need to be restricted to local regions of space?
12. How are the concepts of "handedness" and "incongruence" related?
13. How can a relationist respond to the charge that there are no relational differences between right and left hands?
14. According to Kant, would reflecting the entire universe to produce a mirror image result in a different universe? Would such a mirror image count as a different universe for a relationist?
15. How can the "reflected universe" example be used as an argument against absolute space?

Study questions on Kant - Part 2 (Huggett, Chapter 12)

The Critique of Pure Reason

1. Does Kant think all knowledge begins with experience? Does he think all knowledge arises purely out of experience?
2. What characteristics must knowledge have to be considered *a priori* for Kant?
3. Give an example of *a priori* knowledge.
4. What is an analytic judgement? Give an example.
5. What is a synthetic judgement? Give an example.
6. Are judgements of experience analytic or synthetic?
7. What is the "pure form of sensibility"? In what sense is it *a priori*?
8. What is space, according to Kant?
9. If knowledge of space were *a posteriori* (aquired through experience alone), what would this entail about truths like "there is only one straight line between any two points"?
10. What does it mean to say that Euclidean geometry consists of synthetic *a priori* knowledge?
11. What does Kant mean when he says, "It is therefore solely from the human standpoint that we can speak of space"?

Commentary

12. What does the existence of consistent non-Euclidiean geometries entail about Kant's claim that Euclidean geometry consists of synthetic *a priori* truths?
13. Is it a necessary and universal truth that through any point only one line can be drawn that is parallel to another line?
14. How does elliptical geometry differ from Euclidean geometry?
15. How does hyperbolic geometry differ from Euclidean geometry?

Study questions on Poincaré (Huggett, Chapter 13)

Space and Geometry

1. Why does Poincaré claim that, if there were no solid bodies in nature, there would be no geometry?
2. According to Poincaré, what does it mean to say that space is homogeneous and isotropic?
3. What does Poincaré mean when he says that geometry is only the summary of the laws by which images we experience succeed each other? How is this different from Kant's conception of geometry?
4. In what sense is Poincaré's sphere world a non-Euclidean world?
5. According to Poincaré, what is the role of experiment in determining the geometric properties of physical space?

Experiment and Geometry

6. According to Poincaré, will astronomical observations of, say, the parallax of distant stars ever enable us to decide what the geometrical properties of space are?
7. How can Poincaré claim both that no experiment will ever be in contradiction with Euclidean geometry and that no experiment will ever be in contradiction with Lobatschewskian geometry?

Commentary

8. In discussing Poincaré's heated disk, why should we replace his heat deformation force with a "universal" deformation force that affects all things in the same way?
9. Why do the surveyors in the disk world believe their space is infinite?
10. Why do the surveyors in the disk world believe the geometrical properties of their space are Lobatschewskian (hyperbolic)?
11. How might other disk scientists argue against the conclusion of the surveyors in #10?
12. According to Poincare, what factors influence any attempt at conducting surveying measurements?
13. What does it mean to say that the choice of geometry is a convention?

Study questions on Einstein (Huggett, Chapter 14)

The Problem of Space, Ether, and the Field in Physics

1. What are two ways of regarding concepts, according to Einstein?
2. What does the concept of space presuppose?
3. According to Einstein, does Newtonian absolute space affect masses? Do masses affect it?
4. What role did the ether have for 19th century physicists?
5. According to Einstein, what is the relationship between a physical field and physical space (*i.e.*, the ether)?
6. What is the significance of Lorentz transformations?
7. What is the principle that characterizes the heuristic method of the special theory of relativity?
8. What does the empirical equivalence of inert and gravitational masses entail?
9. What must be done to the principle in #7 above in order to arrive at the general theory of relativity?
10. How are Riemannian spaces different from Euclidean space?
11. The metric field $g_{\mu\nu}$ determines the structure of a Riemannian space. What did Einstein assume about the metric field?
12. In what sense is space no longer absolute in general relativity?