

Partho Sanyal Ray

HU3101 End Semester Examination Autumn 2018

Time: 3 hours

Marks: 50

1. The following observations have been made from a number of studies. Based on these observations generate a hypothesis. Also write the null hypothesis. What will be the independent and dependent variables of this hypothesis? What will be the falsification experiment to test this hypothesis? (5)
 - A. Cyclometalated iridium complexes have important applications as phosphorescent probes for cellular imaging due to their photophysical properties and specific localization in subcellular compartments.
 - B. Treatment of cells with 11 novel cyclometalated iridium complexes showed that only one of them, C2, localizes to the endoplasmic reticulum of cells.
 - C. The H-bond between the 2'-OH of phenyl ring and cyclic N of imidazole of C2 causes the specific localization to the endoplasmic reticulum of cells.
2. You have treated a set of cells with a compound X and are investigating its effect on the time-dependent movement of a protein from the nucleus to the cytoplasm. You take samples of the cells every hour for 4 hours after treatment with X, separate out the nucleus and cytoplasm, and test whether the protein is present in the nucleus or cytoplasm at each time point. List all the controls that you will include in this experiment to be able to conclusively interpret the result. (5)
3. Give an example in which a "singular existential statement" can falsify a "universal statement". When the cumulative falsifying evidence becomes strong enough that it becomes unreasonable to support the existing theory, it gives rise to a new theory. What is this called and who named it? (5)
4. How did Positivism influence the development of Biology in the second half of the 19th century and why? How would you think a materialist scientist convince a positivist scientist about the existence of a gene (Info: A gene is a particular segment of DNA which influences a particular characteristic of an organism but cannot be directly perceived by our five senses)

OR

How did Positivism influence the development of Physics in the second half of the 19th century and why? How would you think a materialist scientist convince a positivist scientist about the existence of a proton (Info: A proton is a subatomic particle which cannot be directly perceived by our five senses). (5)

5. Give an example of reductionist thought in Chemistry. Illustrate the dialectical law of transformation of quantitative changes into qualitative changes with an example from Physics **OR** Chemistry **OR** Biology. (5)

Answer any one of Questions 1 or 2. Questions 3, 4 and 5 are compulsory.

1. Some scholars think that not Thales, but Uddalak-Aruni should be given the credit of being the first scientist of the world. Give your opinion citing facts and reasons. (10)

OR

2. Much of Aristotle's physics was proved wrong; but his work in biology has lasting value. Justify. (10)

3. What is an irrational number? Give the Pythagorean proof of the existence of irrational numbers. (1+4)

4. Fill in the blanks:

..... materialism examines the subjects of the world in relation to each other within a, environment, in contrast to materialism, which examines parts of the world within a, environment. *Dialectics of*..... is an unfinished work by that applies ideas – particularly those of dialectical materialism – to science. (5)

5. Fill in the blanks:

The Sulva-Sutras, were written between and 300 B.C. These contained the instructions for making special to the gods. These were made out of A common example is wanting to build a altar which had the same area as a altar. For this to work, they needed an approximation of , calculating procedures, and accurate construction methods. The four major Sulva Sutras are : (1)(2), (3) and (4)..... (5)