

## GEO1111 : Lecture 1 Questions

### **1) Explain the meaning of the “Earth as a system” and give an example of this.**

The idea of treating our investigations of the Earth as a system is to view the Earth as a whole as opposed to the traditional viewpoint taken by separating disciplines such as chemistry, physics and geology. In treating the Earth as a system we try to integrate these disciplines and investigate the inter-relationships between the biosphere, geosphere, atmosphere etc. which will lead to a fuller understanding of the Earth. An example of viewing the Earth as a system would be the relationship between a volcanic eruption and the transport of ash through the atmosphere and the effect this has on climate/weather.

### **2) What are the steps in deductive reasoning? Give a very general example of deductive reasoning in the Earth Sciences that was not the one covered in class.**

- 1) Collection of scientific facts (**data**)
- 2) Development of one or more working **hypotheses** to explain the facts
- 3) Development of observations & experiments to **test** the hypotheses
- 4) Acceptance, modification (iteration), or rejection

e.g. We observe that the climate is warming - This could be due to the release of CO<sub>2</sub> into the atmosphere by humans or the cyclical nature of the Earth's climate.

### **3) There are two methods of scientific inquiry. How are they different?**

Only recently in the last few hundred years has geology moved in to the deductive (Darwinian) method. The inductive (Baconian) method is commonly applied in geology, leading to the emergence of general patterns from collections of specific observations and measurements. Such patterns allow for formulations of tentative hypotheses, which were explored and theory developed. The development of such theories allows for the application of deductive (Darwinian) method. Deductive method tests existing theories and hypotheses by collecting experimental observations. In geology, deductive method can be applied to the extinction of the dinosaurs, climate change, natural resource exploration etc.

### **4) The extinction of the dinosaurs (and many other species) occurred at ~65 Ma. List evidence and observations that support the theory of a bolide impact?**

- Mexico Chicxulub Crater formed at that time
- Tektites and other anomalies related to ash, soot, glass that are found at ~30 sites globally
- C, S, and Ir chemical anomalies in the rock record occur at that time

### **5) What principle in geology does the phrase “the present is the key to the past” describe?**

Principle of uniformitarianism .. it describes that Earth processes that operate today are the same as those that operated throughout geologic time.

- 6) Geology is a science that pursues an understanding of
- the Earth's atmosphere
  - the Earth's cryosphere
  - the Earth as a system**
  - the solar system
  - the Earth's lithosphere
- 7) According to the principle of uniformitarianism,
- Geologic processes we observe today have operated in the past.**
  - Geologic process in the past operated at the same rate as they do today
  - All of the planets formed from a uniform solar nebula early
  - Earth was covered by a uniform magma ocean
  - Most hypothesis are really laws
- 8) Geology is different from most other sciences because
- Geology deals with large spatial scales and complex natural systems
  - Geology deals with times scales that are much greater than most other sciences
  - Most of the evidence used in geology is fragmented and/or incomplete
  - Geology can only be done in the field, not the lab
  - A, B, C**
- 9) Observation and description are important in geology because
- Controlled experiments are not always possible
  - Systems are complex
  - Nature is commonly the laboratory
  - Time scales are vast
  - All of the above**
- 10) The extinction of the dinosaurs was synchronous with geochemical anomalies in the rock record:
- S and C isotopes
  - CO<sub>2</sub>
  - Iridium
  - Enriched uranium
  - Both a and c**