EOSC326, Earth and Life Through Time, Sept-Dec 2011, University of British Columbia

http://www.eos.ubc.ca/courses/eosc326/eosc326.htm

Complete set of learning goals

Please realize that learning goals are a continuously evolving characterization of what students can expect to be able to do after a course or module. They are not permanent. Each year they will evolve. They are intended to provide a sense of scope and expectations for students, and to help instructors design and prioritize activities and assessments.

OVERARCHING COURSE LEVEL LEARNING GOALS:

1. Express how the concept of geological time is an important factor in our understanding of the evolution of the Earth System.
2. Apply basic geological principles and geoscience knowledge in the interpretation of Earth's geological and biological history.
3. Describe how the biosphere has adapted to exploit various environments in the Earth's oceans over time

MODULE 1: INTRODUCTION

1. Introduction 1: Welcome to the course
    a. Introduction to the overall course goals and scope
    b. Introduction to clickers
    c. Discussion about geology, paleontology and the geosciences
2. introduction 2: earth system science
    a. What are the Earth Systems and how are they classified?
    b. What degrees of complexity do systems demonstrate?
    c. How are Systems related to each other? How do they interact?
3. Basics of Stratigraphy
    a. Distinguish between the four branches of stratigraphy.
    b. Compare three 18th century hypotheses about Earth's formation by identifying both the observations that support, and the arguments against, Neptunism, Catastrophism and Uniformitarianism.
    c. Use basic principles of stratigraphy, unconformities and cross cutting relationships to interpret relative age relationships of rocks in any given cross section.
    d. Understand how a better understanding of stratigraphy started to challenge the idea of a "Young Earth"
4. Facies: Sediments in Time and Space
    a. Define a lithostratigraphic "formation"
    b. Define a sedimentary facies and and explain how they may differ laterally
    c. Predict how facies will change vertically in response to sea level rise (transgression) and fall (regression)
    d. Define Walther's Law
    e. List mechanisms of global (eustatic) and local sea level change.

   f. Relate sedimentary environments to the types of sediments deposited in those environments and how this all relates to Earth System Science.

5. Correlating Rocks: Biostratigraphy and Type Sections
   a. Describe the hierarchical structure of Lithostratigraphic and chronostratigraphic terminology
   b. Describe the development of the science of biostratigraphy including the scientists involved and the sequence of understanding that has resulted in modern biostratigraphic practice.
   c. Define a fossil range and use them to construct biozones.
   d. Given the relative value of different fossils appraise their use as biostratigraphic markers (zone fossils)
   e. List and name the major periods of the geological time scale and associated dates.
   f. Define what a international reference (type) section is and discuss the criteria that are used in their selection.
   g. Define the difference between relative and absolute dating
   h. Describe how radioactivity can be used to date rocks
   i. Appraise the limitations of radiometric dating
6. The interpretation of fossils
   a. Define paleoecology as a combination of paleobiology and taphonomy
   b. Describe how functional morphology, developmental morphology, organisms interactions and biological limiting factors effect the paleobiological interpretation of a fossil organism.
   c. Discuss how “mode of life” of a fossil organism will effect paleontological interpretation and preservation potential.
   d. Define taphonomy and interpret fossils in terms of life (biocoenosis) and different types of death (thanatocoenosis) assemblages.
   e. Describe fossilization processes and media.
   f. Understand the importance of lagerstatten

MODULE 2: EARTH ORIGINS AND EARLY LIFE

7. Formation of Continents / Oceans/ Atmosphere
   a. Describe and explain the early evolution of Earth’s crust.
   b. Describe the early development of Earth’s atmosphere.
   c. Describe the origin of Earth’s oceans and identify possible sources of water.
8. Early Life: The Paleontological evidence
   a. Discuss the paleontological evidence for the early life on Earth
   b. Describe the late heavy bombardment and young faint sun paradox in relation to the early history of life on Earth
   c. Discuss the fossil evidence of life on Mars and its implications for the evolution of life on Earth.
   d. Account for the Huronian glaciation and the rise of the eukaryotes
9. Snowball Earth: the rise of the Metazoa
   a. Describe the evidence and the various paradoxes presented by the Snowball Earth Hypothesis
   b. Explain how oxygen concentrations may be a driving force in the evolution of the Metazoa.
   c. Describe some of the first possible metazoans.

d. Describe the Ediacaran Biota and their possible biological affinities

10. The Cambrian Explosion
    a. Describe the timing of the Cambrian explosion
    b. Discuss possible causes of the Cambrian explosion
    c. Examine the different models for diversification in the early Cambrian
    d. Describe the major forms and general mode of life of creatures that appeared during the Cambrian explosion
    e. Discuss the significance of the Burgess Shale and other Cambrian Lagerstatte.

MODULE 3: MASS EXTINCTIONS

11. Extinctions 1: The Mass Extinction Concept
    a. Express the difference between extinction and mass extinction.
    b. Describe major changes in diversity through the Phanerozoic in relation to the development of the geological time scale
    c. Explain how plate tectonics may be related to changes in diversity through the Phanerozoic.
    d. Describe the major mass extinction events during the Phanerozoic and review the proposed causes of mass extinction with particular reference to the Ordovician mass extinction event
    e. Account for the proposed periodicity of mass extinctions and suggest possible causes for that periodicity.
    f. Interpret stable isotope data
12. Extinctions 2: P-Tr and K-P
    a. Describe the evidence for the extinction events
    b. List possible extinction hypotheses for the extinction events
    c. Understand how Earth System Science applies to the study of Extinction Events.

MODULE 4: THE VERTEBRATES

13. The origin of the Vertebrates
    a. Describe the key features of the chordates and vertebrates
    b. Account for the development of vertebrates skeleton
    c. Discuss the evolutionary history of the vertebrates from the early chordates to the fish
14. Moving onto land
    a. Describe the difference between Phyletic Gradualism and Punctuated equilibrium
    b. Discuss the importance of transitional fossil forms
    c. Account for the evolution of the first limbs and the tetrapods