

OUTCOMES BASED LEARNING MATRIX

Course: Physical Oceanography

Department: Physical Science

Physical Oceanography

This course is intended to acquaint students with the physical aspects of the marine environment . Major topics included in the course are: the origin of the Earth and its oceans, the role of plate tectonics in forming the ocean basins, the physical geography of the ocean basins, the physical and chemical properties of water, the influence that the Earth's atmosphere and oceans have on each other and the planet, ocean currents, waves, tides, coastal processes, and the nature of marine sediments.

*COURSE OUTCOMES	OUTCOMES ACTIVITIES	ASSESSMENT TOOLS
<i>Upon completion of this course, each student should be able to</i>		
1. Describe the location of Earth relative to the solar system, the Galaxy, and the wider universe	- study the text and lecture material	- quiz on the text and lecture material (R,W,)
2. Describe the origin of Earth (with evidence) and its oceans	- study the text and lecture material	- quiz on the text and lecture material (R,W,CT)
3. Describe the structural make up of Earth including the composition and dimensions of each of the zones. Explain how this information has been obtained.	- study the text and lecture material - do the lab exercise on "Scientific Notation and the Metric system"	- quiz on the text, lecture material and lab (R,W,CT,QS)
4. Explain the system of longitude and latitude for locating points on the Earth's surface	- study the text and lecture material - complete the lab exercise entitled "Geography of the Marine Environment"	- quiz on the text, lecture material and lab (R,W,CT,QS)
5. Contrast the ocean basins and	- study the text and lecture material	- quiz on the text and lecture material

continents in terms of elevations and depths and rock compositions		(R,W,)
6. Contrast the dimensions of the three major ocean basins	- study the text and lecture material	- quiz on the text and lecture material (R,W,QS)
7. Explain the relationship between the lithosphere and asthenosphere and contrast their characteristics	- study the text and lecture material	- quiz on the text and lecture material (R,W,CT)
8. Explain the cause of mantle convection and the connection between mantle connection and sea floor spreading	- study the text and lecture material - complete the exercise on earthquakes	- quiz on the text and lecture material and lab exercise (R,W, CT, QS)
9. List the major discoveries since the 1960's that have provided evidence for sea floor spreading	- study the text and lecture material - complete the exercise on sea floor spreading	- quiz on the text and lecture material and sea floor spreading exercise (R,W,CT, QS)
10. Explain how magnetic reversals contribute to our understanding of sea floor spreading	- study the text and lecture material - complete the exercise on sea floor spreading	- same as above
11. Identify the major plates that make up the Earth's lithosphere	- study the text and lecture material	- quiz on the text and lecture material (R,W)
12. Discuss the three types of plate boundaries and the processes associated with each	- study the text and lecture material - view film on plate tectonics	- quiz on the text and lecture material and film (R,W,CT)
13. Describe the various physical environments that make up the ocean basins and the features characteristic of each	- study the text and lecture material	- quiz on the text and lecture material (R,W,CT)
14. Distinguish between submarine trenches and canyons and their mode of origin	- study the text and lecture material	-quiz on the text and lecture material (R,W)
15. Contrast 4 different technologies used in determining ocean depths	- study the text and lecture material	- quiz on the text and lecture material (R,W)

16. Compare marine sediments by source , properties and distribution	<ul style="list-style-type: none"> - study the text and lecture material - examine the sediment samples provided in lab and classify each according to instructions 	<ul style="list-style-type: none"> - quiz on the text and lecture material and lab (R,W,CT)
17. Describe the instruments and methods employed in marine sediment sampling	<ul style="list-style-type: none"> - study the text and lecture material - complete the exercise on constructing a bathymetric chart - complete the exercise which examines the bathymetry of the western Atlantic and Gulf of Mexico 	<ul style="list-style-type: none"> - quiz on the text and lecture material and lab exercises (R,W,CT,QS)
18. Cite examples of sea floor mineral resources	<ul style="list-style-type: none"> - study the text and lecture material 	<ul style="list-style-type: none"> - quiz on the text and lecture material (R,W)
19. Describe the structure of the water molecule and the impact it has on the properties and behavior of water	<ul style="list-style-type: none"> - study the text and lecture material - complete the exercise on the properties of water 	<ul style="list-style-type: none"> - quiz on the text and lecture material and lab on the properties of water (R,W,CT,QS)
20 Describe the role of latent heat in the phase changes that water undergoes and its significance to Earth's climate	<ul style="list-style-type: none"> - study the text and lecture material 	<ul style="list-style-type: none"> - quiz on the text and lecture material (R,W,CT)
21. Identify the ions that constitute the bulk of dissolved material in sea water and their source	<ul style="list-style-type: none"> - study the text and lecture material 	<ul style="list-style-type: none"> - quiz on the text and lecture material (R,W)
22. Discuss the density of sea water, and its conversion to a sigma T value, and how it is influenced by changes in temp. pressure and salinity	<ul style="list-style-type: none"> - study the text and lecture material - complete the lab exercise on water masses 	<ul style="list-style-type: none"> - quiz on the text and lecture material and lab (R,W,CT,QS)

23. Explain the reasons for the variations in salinity one sees along the coasts and at different latitudes in the oceans	- study the text and lecture material	- quiz on the text and lecture material (R,W,CT)
24. Explain the variation in solar radiation that occurs with latitude	- study the text and lecture material	- quiz on the text and lecture material (R,W,CT)
25. Explain the components involved in the Earth's energy budget and how they relate to long term temps. on Earth	- study the text and lecture material	- quiz on the text and lecture material (R,W,CT)
26. Describe and explain the seasonal changes in sea surface temperatures that occur	- study the text and lecture material	- quiz on the text and lecture material (R,W,CT)
27. Compare and contrast the manner in which land and sea respond to exposure to sunlight	- study the text and lecture material	- quiz on the text and lecture material (R,W,CT)
28. Explain the movement of the atmosphere that occurs in response to variations in Earth's surface temperature	- study the text and lecture material	- quiz on the text and lecture material (R,W,CT)
29. Explain the Coriolis effect and its influence on wind direction	- study the text and lecture material	- quiz on the text and lecture material (R,W,CT)
30. Describe the major wind belts on Earth and how they change seasonally	- study the text and lecture material	- quiz on the text and lecture material (R,W)
31. Describe the pattern of wind driven surface circulation that occurs in the oceans	- study the text and lecture material - complete the exercise on ocean currents	- quiz on the text and lecture material and lab (R,W,CT,QS)
32. Relate the changes in temperature and salinity that occur across latitudes in the ocean basins to density driven	- study the text and lecture material	- quiz on the text and lecture material (R,W)

currents		
33. Discuss the layered structure of the water masses that form the Atlantic and the source of these layers	- study the text and lecture material - complete the exercise on water masses	- quiz on the text and lecture material and lab (R,W, CT)
34. Explain the relationship between atmospheric winds and the Coriolis effect to the large gyres that form in the oceans	- study the text and lecture material	- quiz on the text and lecture material (R,W,CT)
35. Identify regions of convergence and divergence of ocean currents and relate these processes to the development of upwelling and downwelling	- study the text and lecture material	- quiz on the text and lecture material (R,W,CT)
36. Identify the various parts of an ocean wave and relate its various properties such as wavelength, period and speed	- study the text and lecture materials	- quiz on the text and lecture material (R,W,CT, QS)
37. Explain the connection between wind velocity, storm duration and fetch to wave properties	- study the text and lecture material - complete the exercise on wave forecasting	- quiz on the text and lecture material and lab (R,W,CT, QS)
38. Describe the interactions that can occur between waves and their influence on wave properties	- study the text and lecture material	- quiz on the text and lecture material (R,W,CT)
39. Contrast "sea" conditions with swell	- study the text and lecture material	- quiz on the text and lecture material (R,W)

40. Contrast the characteristics and properties of deep and shallow water waves	- study the text and lecture material	- quiz on the text and lecture material (R,W,)
41. Explain the cause of wave refraction and its effects on the shore line	- study the text and lecture material - view the film on waves and coasts	- quiz on the text and lecture material and film (R,W,CT)
42. Describe the sequence that leads to breaking waves in shallow, coastal waters	- study the text and lecture material - complete the exercise on shallow water waves and coastal properties	- quiz on the text and lecture material and exercise (R,W,CT,QS)
43. Contrast the different characteristics of winter and summer beaches and explain the reasons for these differences	- study the text and lecture material - view film "Portrait of a Coast"	- quiz on the text and lecture material and film (R,W,CT)
44. Describe the coastal processes that result in such features as long, sandy beaches, sand bars, spits, bay mouth bars etc.	- study the text and lecture material	- quiz on the text and lecture material (R,W,CT)
45. Describe the characteristics seen in the tides observed in Boston Harbor over a period of a month	- study the text and lecture material - complete the exercise on "Tides"	- quiz on the text and lecture material and lab (R,W,CT,QS)
46. Explain the forces responsible for the tidal patterns observed above in 45	- study the text and lecture material	- quiz on the text and lecture material (R,W,CT)
47. Contrast the tides observed in the Gulf of Mexico with those seen in the Atlantic	- study the text and lecture material	- quiz on the text and lecture material (R,W,CT)
48. Explain the wide range in tides observed in the Bay of Fundy	- study the text and lecture material	- quiz on the text and lecture material (R,W)

49. Draw and label a profile of a beach from the off shore region through the fore shore, berm, back shore to dunes	- study the text and lecture material	- quiz on the text and lecture material (R,W)
50. Contrast the characteristics associated with primary and secondary coasts	- study the text and lecture material	- quiz on the text and lecture material (R,W,CT)
51. Discuss the changes occurring in sea level today, their possible causes, and its impact on shorelines	- study the text and lecture material	- quiz on the text and lecture material (R,W,CT)
52. Discuss the different types of estuaries that occur and their ecological importance	- study the text and lecture material	- quiz on the text and lecture material (R,W)
53. Discuss the importance of coastal wetlands to the ecology of Earth	- study the text and lecture material	- quiz on the text and lecture material (R,W)