

OUTCOMES BASED LEARNING MATRIX

Course: Meteorology

Department: _Physical Science

Meteorology

This course is designed to provide students with an understanding of the dynamic processes at play within the Earth's fluid atmosphere and an appreciation of the role of these processes in producing weather. Topics covered on the course include: the origin and evolution of the Earth's atmosphere, the structure and characteristics of the atmosphere, the Earth/Sun relationships and their influence on the seasons, solar and terrestrial radiation, the hydrologic cycle, the gas laws, global circulation, weather systems and fronts, storms and analysis of weather maps. Weekly laboratory exercises have been designed to complement the topics covered in lecture.

Course Outcomes	Outcomes Activities	Assessment Tools
1. Distinguish between weather and climate	Study the text and lecture material	Quiz on the text and lecture material (R,W)
2. Identify the basic elements that describe both weather and climate	Study the text and lecture material	Quiz on the text and lecture material (R,W)
3. Discuss the importance of each of the following atmospheric components: CO ₂ , H ₂ O, O ₃ , and dust	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
4. Briefly outline the stages in the origin and evolution of Earth's atmosphere	Study the text and lecture material	Quiz on the text and lecture material ((R,W,CT)
5. Construct a diagram showing a cross section of Earth's atmosphere and describe each zone	Study the text and lecture material Complete the exercise on the vertical structure of the atmosphere	Quiz on the text, lecture material and lab (R,W,CT,QS)
6. Summarize the cause and possible effects of stratospheric ozone depletion	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
7. Discuss the factors believed to be involved in global warming	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
8. Define the terms listed in the vocabulary reviews at the ends of each chapter	Look up the terms in the chapters and in the glossary at the end of the text	Quiz on scientific vocabulary (R,W)

9. Describe the motions that Earth experiences as it orbits the Sun	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
10. Discuss the connection between the movement of Earth in space and variations in the receipt of sunlight	Study the text and lecture material Complete the lab on Earth-Sun Geometry	Quiz on the text, lecture material, and lab (R,W,CT,QS)
11. Explain why it is that Earth experiences seasons	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT,QS)
12. Explain the characteristics of and times of equinoxes and solstices	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
13. Explain the significance of terrestrial latitude to intensity of solar radiation received	Study the text and lecture material and results of the lab on Earth-Sun geometry	Quiz on the text and lecture material (R,W,CT,QS)
14. State the basic laws governing radiation	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT,QS)
15. Distinguish between the three mechanisms of heat transfer and give an example of each	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
16. Explain the difference between scattering, reflection and absorption of radiation	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
17. Discuss the factors involved in variations of albedo between surfaces	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
18. Explain why the atmosphere is heated chiefly by terrestrial radiation	Study the text and lecture material Complete the lab on Earth's surface energy budget	Quiz on the text, lecture material, and lab (R,W,CT)
19. Explain the difference between heat and temperature	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
20. Discuss the factors one must take into consideration in order to obtain an accurate reading of air temp.	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)

21. Explain how a liquid in glass thermometer works	Study the text and lecture material	Quiz on the text and lecture material (R,W)
22. Contrast the Fahrenheit, Celsius, and Kelvin temperature scales and be able to convert from one to another	Study the text and lecture material Complete the lab on temperature phenomena	Quiz on the text, lecture material, and lab (R,W,CT,QS)
23. Be able to compute the daily temp. mean and range as well as the monthly and annual means and ranges given the appropriate information	Study the text and lecture material	Quiz on the text and lecture material (R,W,QS)
24. Be able to construct an isotherm chart for a geographical area given temps. across the region	Study the text and lecture material and the lab on temp. phenomena	Quiz on the text, lecture material and lab (R,W,CT,QS)
25. List and explain the various factors responsible for the differential heating of land vs. water	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
26. List and explain the primary controls in the world wide distribution of temperature	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
27. Explain the difference between water in its three states and relative energy level of the molecules in each state	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
28. Describe the movement of water through the hydrologic cycle	Study the text and lecture material	Quiz on the text and lecture material (R,W)
29. Discuss the processes by which water changes from one state to another and the energy exchange required for each change	Study the text and lecture material Complete the lab on atmospheric moisture	Quiz on the text, lecture material, and lab (R,W,CT)
30. State the relationship between air temp. and the amount of water it is capable of maintaining	Study the text and lecture material	Quiz on the text and lecture material (R,W)

31. Explain the difference between mixing ratio, absolute humidity and relative humidity	Study the text and lecture material Complete the lab on saturation and atmospheric stability	Quiz on the text, lecture material, and lab (R,W,CT)
32. Be able to determine the relative humidity and dew point temp. using a sling psychrometer	Study the text and lecture material	Quiz on the text and lecture material (R,CT,QS)
33. Explain the difference between adiabatic cooling and lapse rate	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
34. Given values of atmospheric temp. with altitude, be able to characterize the stability of the atmosphere	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT,QS)
35. Describe the weather associated with stable and unstable atmospheric conditions	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
36. Explain the processes by which atmospheric stability is modified	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
37. Identify the characteristics used in the classification of clouds	Study the text and lecture materials	Quiz on the text and lecture materials (R,W)
38. Identify the basic cloud types on the basis of form and height	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
39. Discuss the role that condensation nuclei play in cloud formation	Study the text and lecture material	Quiz on the text and lecture material (R,W)
40. Outline the steps involved in the formation of raindrops by the Bergeron process	Study the text and lecture material Complete the lab on cloud drops and rain drops	Quiz on the text, lecture material, and lab (R,W,CT)
41. Describe the steps that lead to precipitation through the collision-coalescence process	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
42. List the five types of fog discussed in the text and discuss the details of their formation	Study the text and lecture material	Quiz on the text and lecture material (R,W)

43. Distinguish between sleet, hail, glaze, freezing rain, and discuss how each forms	Study the text and lecture material	Quiz on the text and lecture material (R,W)
44. Explain how air pressure is influenced by air temp. and density	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
45. Explain how an aneroid barometer and a mercury barometer work	Study the text and lecture material	Quiz on the text and lecture material (R,W)
46. Explain the connection between variations in air pressure and wind	Study the text and lecture material Complete the lab on isobars and pressure gradients	Quiz on the text, lecture material and lab (R,W,CT)
47. Explain the relationship between isobar spacing and wind velocity	Study the text and lecture material	Quiz on the text and lecture material (R,W)
48. Describe the conditions under which a sea breeze forms and explain the principle it illustrates	Study the text and lecture material	Quiz on the text and lecture material ((R,W,CT)
49. Describe the Coriolis effect and indicate its cause and its influence on a freely moving body	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
50. Discuss the factors that influence the magnitude of the Coriolis effect	Study the text and lecture material Complete the lab on atmospheric motion	Quiz on the text, lecture material and lab (R,W,CT,QS)
51. Contrast geostrophic winds with surface winds	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
52. Describe the weather associated with regions of high and low pressure	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
53. Explain the relationship between cyclonic and anticyclonic pressure patterns, surface wind flow and the development of updrafts and downdrafts	Study the text, lecture material and results of the lab on atmospheric motion	Quiz on the text and lecture material (R,W,CT)

54. Sketch and label a diagram showing the idealized three-cell model of global circulation	Study the text and lecture material	Quiz on the text and lecture material (R,CT)
55. Discuss the influence that the continents and oceans have on global air pressure and winds	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
56. Explain why air flow aloft is predominantly westerly	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
57. Contrast the direction of prevailing winds across New England between winter and summer and explain the differences	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
58. Explain the factors responsible for the subtropical high pressure zone and the air mass characteristics of the region	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
59. Explain the formation of the ITCZ and its associated weather	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
60. Explain the reasons for the formation of the polar front and describe its location and associated weather	Study the text and lecture material Complete the lab on mid-latitude cyclones	Quiz on the text, lecture material and lab (R,W,CT)
61. Explain what an El Nino is and how it may influence the weather of North America	Study the text and lecture material Complete the lab on weather map analysis	Quiz on the text, lecture material and lab (R,W,CT)
62. Identify the factors considered in classifying air masses and list the air mass classes	Study the text and lecture material	Quiz on the text and lecture material (R,W)
63. Discuss the criteria that an air mass source region must meet	Study the text and lecture material	Quiz on the text and lecture material (R,W)
64. Describe the various ways that air masses become modified over time	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)

65. Characterize the stability of an air mass designated with a “k” and explain how this influences weather. Do the same for an air mass designated “w”	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
66. Identify the atmospheric conditions associated with cP,mP,cT, mT, cA, mE air masses	Study the text nad lecture material	Quiz on the text and lecture material (R,W)
67. Describe what a weather front is	Study the text and lecture material	Quiz on the text and lecture material (R,W)
68. Draw a cross-section through both a warm front and a cold front and contrast the weather associated with each	Study the text and lecture material Complete the lab on mid-latitude cyclones	Quiz on the text, lecture material and lab ((R,W,CT)
69. Distinguish between warm type and cold type occluded fronts	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
70. Describe the changes in wind direction, pressure, cloud type and coverage, precipitation, and temperature as the center of a wave cyclone passes to the north of an observer	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
71. Do the same for a cyclone that passes to the south	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
72. Explain the relationship between the development of a wave cyclone and flow in the upper atmosphere	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
73. Describe the stages in the evolution of a typical wave cyclone over the U.S.	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
74. Explain what a cyclone is and identify the various atmospheric disturbances that fall into this category	Study the text and lecture material	Quiz on the text and lecture material (R,W)

75. Distinguish between air mass thunderstorms and frontal system thunderstorms	Study the text and lecture material	Quiz on the text and lecture material (R,W)
76. Describe the stages in the evolution of a typical thunderstorm	Study the text and lecture material Complete the lab on thunderstorms	Quiz on the text, lecture material and lab (R,W,CT)
77. Explain what a squall line is and how they may develop	Study the text and lecture material	Quiz on the text and lecture material (R,W)
78. Summarize the steps that lead to the development of lightning and thunder	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
79. Explain how and when tornadoes are most likely to occur	Study the text and lecture material	Quiz on the text and lecture material(R,W,CT)
80. Describe the conditions that lead to the formation of hurricanes	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
81. Distinguish between tropical depressions, tropical storms, and hurricanes	Study the text and lecture material	Quiz on the text and lecture material (R,W)
82. Explain the source of the energy that powers a hurricane	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)
83. Explain what happens to cause a hurricane to weaken as it moves over land or cold water	Study the text and lecture material	Quiz on the text and lecture material (R,W,CT)