MIDSTATE COLLEGE
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Spring 2019

Course Number & Name: MET 101 Principles of Weather
Credit hours: 6 quarter hours
Method of Delivery: eLearning – (optional in-person/classroom support as requested)

Course Description: (IAI P1 905L) An introductory physical science course with a laboratory component and a term paper. This course examines the natural processes which create weather and its temporal and geographic variations and includes an analysis of the basics of weather forecasting. Current tools and techniques of weather analysis will be applied to weather forecasting of storms, blizzards, hurricanes, tornadoes, drought, and flooding.

Text(s) & Manual: *Weather Studies: Introduction to Atmospheric Science, 6th Ed - AMS (electronic format), and e-Investigations Manual 2018-19*
Author(s): Joseph M. Moran
Publisher: American Meteorological Society 2015
ISBN: 978-1-944970-27-7 (ePackage combo of text and Investigations Manual - $144 – for a 6 month rental. Non-expiring version - $190)

Materials needed for this course: A computer with internet connection, Microsoft PowerPoint, Microsoft Word, Adobe Digital Editions ePub Reader, speakers, sound card.

Topics:
- Monitoring Weather
- Atmosphere: Origin, Composition, & Structure
- Solar & Terrestrial Radiation
- Heat, Temperature, & Atmospheric Circulation
- Air Pressure
- Humidity, Saturation, & Stability
- Clouds, Precipitation, & Weather Radar
- Wind & Weather
- Atmosphere's Planetary Circulation
- Weather Systems of Middle Latitudes
- Thunderstorms & Tornadoes
- Tropical Weather Systems
- Weather Analysis & Forecasting
- Light & Sound in the Atmosphere
- Climate & Climate Change

Course Objectives: Upon completion of this course, the student will be able to:

1. Describe the elements and controls of weather phenomena (i.e., solar energy, heat, moisture, and pressure, etc.)
2. Describe the basic elements of air masses, fronts, stability, cyclogenesis, and storms.
3. Learn and apply the basics to sophisticated forecasting methods for various weather phenomena (i.e., rain, tornadoes, etc.).
4. Analyze data, maps, charts, graphs, and tables related to weather phenomena.
5. Describe and discuss problems as they relate to weather (i.e., global warming, acid rain, etc.).
6. Gain hands-on experience in the calculations related to weather as performed in laboratory by experiment.

Midstate Grading Scale:

90 - 100	A
80 - 89	B
70 - 79	C
60 - 69	D
0 - 59	F

Midstate Plagiarism Policy:

Plagiarism is using another person's words, either by paraphrase or direct quotation, without giving credit to the author(s). Plagiarism can also consist of cutting and pasting material from electronic sources by submitting all or a portion of work for assignment credit. This includes papers, computer programs, music, sculptures, paintings, photographs, etc. authored by another person without explicitly citing the original source(s). These actions violate the trust and honesty expected in academic work. Plagiarism is strictly against the academic policy of Midstate College. Its seriousness requires a measured, forceful response which includes consequences for inappropriate and/or no citation.

In courses containing writing assignments, the College promotes the use of an electronic resource which compares the student's writing against previously submitted papers, journals, periodicals, books, and web pages. Students and instructors can use this service to reduce the incidence of plagiarism. This electronic resource has been found to conform to legal requirements for fair use and student confidentiality. It is able to provide a report to the student indicating the parts of the assignment that match.

Student Success:

The Office of Student Success is available to students seeking tutoring for individual classes or who need assistance with writing assignments. Information is also available on test taking techniques, how to take notes, developing good study skills, etc. Contact Student Success in Room 110 (in person); (309) 692-4092, extension 1100 (phone); studentsuccess@midstate.edu (email).

Instructor: Ed Shimon **Email:** eshimon@midstate.edu **Cell:** 217-314-0103

Policies and Procedures: Attendance will be taken each week by your submission of homework, participation in discussions and upon completion of exams. Some lab writing assignments will need to be typed and saved as a Microsoft Word document, then uploaded to Midstate LMS. A Term Paper will be completed in a Word document and submitted into Midstate LMS.

Late Work: You are expected to check into the course regularly, and with that turn in any and all assignments when they are due. Weekly assignments are due at 8 am the next Monday (unless otherwise stipulated). Late work will NOT be accepted.

Grading Specifications

Midterm Exam:	= 100 pts
Final Exam:	= 100 pts
Term Paper:	= 150 pts
Term Paper Checkpoints	= 50 pts
Summary (10 pts / chapter)	= 150 pts
Lab assignments (20 pts/chapter)	= 300 pts
Discussion (10 pts per week)	= 100 pts
Critical Thinking (10 pts each)	= 50 pts
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Total:	1000 pts

900 – 1000 pts	90-100%	=	A
800 – 899 pts	80-89%	=	B
700 – 799 pts	70-79%	=	C
600 – 699 pts	60-69%	=	D
0 – 599 pts	<=59%	=	F

Examination Information: Two exams will be multiple choice with essay questions.

Term Paper Information: The term paper project will be worth a total of 200 points toward the final grade. That will include the finished paper at 150 points and the periodic check-points during the quarter worth 50 points. The term paper will be a descriptive analysis of a weather topic that interests the student (instructor approval required). Topics should be drawn from chapter materials covered within the Weather Studies course books. The paper must be 3 to 4 pages in length, including figures and references. At least one reference must be from a peer-reviewed journal article of a weather related nature (i.e. AMS Weather and Forecasting, AMS Journal of the Atmospheric Sciences, etc). The paper will be in 12-point Calibri font, double spaced, with 1” margins.

Term paper completion check points will be:

Week 3: Subject chosen and approved by instructor - 10 Points
Week 5: Outline and References approved by instructor - 15 points
Week 8: Rough draft dropped into Turnitin for writing help - 25 points
Week 10: Paper Due by 8 am Monday at the end of week 10 – 150 points

Weekly Outline

Week One:

Topics: Monitoring the weather

Objectives: Student will be able to understand the patterns of Highs, Lows, the weather associated with each, and their general directions of movement.

Assignments: Read chapter one.

Lab work: Complete Investigations 1A & 1B

Discussion Question: An intense low pressure system tracks northeastward just offshore from Cape Hatteras, NC to just east of Cape Cod, MA. Describe the general direction of surface winds over New England as the center of the storm moves towards Nova Scotia.

Critical Thinking: Why are near-simultaneous weather observations essential for drawing weather maps?

Summary: In one paragraph, summarize what you learned in chapter 1. For the best chance of full credit, please try to include discussion on at least 5 topics from the main objectives at the beginning of the chapter.

Week Two:

Topics: Atmosphere: Origin, Composition, and Structure

Objectives: Student will have basic understanding of the atmosphere, its evolution to its present state and the ways in which we study it by measurements.

Assignments: Read chapter 2.

Lab work: Complete Investigations 2A & 2B

Discussion Question: A mountaintop is closer to the Sun than the surrounding lowlands and yet mountaintops are colder than lowlands. Explain why.

Critical Thinking: What is the significance of stratospheric ozone for life on Earth?

Summary: In one paragraph, summarize what you learned in chapter 2. For the best chance of full credit, please try to include at least 5 topics from the main objectives at the beginning of the chapter.

Week Three:

Topics: Solar & Terrestrial Radiation/Heat, Temperature, and Atmospheric Circulation

Objectives: Students will examine radiation and radiative transfer processes in the Earth system. Students will also examine the relationship of temperature to heat energy. It also looks at energy transfer processes involving radiation, sensible and latent heating that determine local temperatures.

Assignments: Read Chapters 3 & 4.

Lab work: Complete Investigations 3A & 3B and Investigations 4A & 4B

Discussion Question: A traffic sign along a highway warns motorists that a bridge surface freezes before the road surface. Why does the bridge surface freeze first?

Summary: Chapter 3: In one paragraph, use your own words to summarize what you learned in chapter 3. For the best chance of full credit, please try to include at least 5 topics from the main objectives at the beginning of each chapter.

Chapter 4: In one paragraph, use your own words to summarize what you learned in chapter 4. For the best chance of full credit, please try to include at least 5 topics from the main objectives at the beginning of the chapter.

***Term Paper week 3 check-point:** Subject chosen and approved by instructor (10 pts)

Week Four:

Topic: Air pressure/Humidity, Saturation, and Stability

Objectives: Students will understand the effects of the weight of air on the surface of the Earth. Students will also have a basic understanding of water vapor, its measures, and phase changes along with the atmospheric processes that produce them and in turn are affected by them.

Assignments: Read chapters 5 & 6.

Lab work: Complete Investigations 5A & 5B and Investigations 6A & 6B

Discussion Question: How does stability affect the vertical development of cumuliform clouds?

Summary: Chapter 5: In one paragraph, use your own words to summarize what you learned in chapter 5. For the best chance of full credit, please try to include at least 5 topics from the main objectives at the beginning of the chapter.

Chapter 6: In one paragraph, use your own words to summarize what you learned in chapter 6. For the best chance of full credit, please try to include at least 5 topics from the main objectives at the beginning of the chapter.

Week Five:

Topics: Clouds, Precipitation, and Weather Radar/Wind and Weather

Objectives: Students will examine liquid water in the atmosphere, the saturation conditions that form clouds, their growth processes to produce precipitation, and how that precipitation is measured at the surface and detected while still aloft by radar. Students will also discuss the forces that act on air parcels.

Assignments: Read Chapters 7 & 8.

Lab work: Complete Investigations 7A & 7B and Investigations 8A & 8B

Discussion Question: What is the value of weather radar operating in the Doppler mode in forecasting severe thunderstorms including those that may spawn tornadoes.

Summary: Chapter 7: In one paragraph, summarize what you learned in chapter 7 For the best chance of full credit, please try to include at least 5 topics from the main objectives at the beginning of each chapter.

Chapter 8: In one paragraph, summarize what you learned in chapter 8. For the best chance of full credit, please try to include at least 5 topics from the main objectives at the beginning of the chapter.

Term Paper week 5 check-point: Outline & References approved by instructor (15 pts)

Week Six:

Midterm:

Open Book
40 multiple choice questions worth 2 pts each
2 essays worth 10 pts each
2 hour time limit in Midstate LMS

Week Seven

Topics: Atmosphere's Planetary Circulation/Weather Systems of Middle Latitudes

Objectives: Students will examine the global circulation of the atmosphere, the wind belts, upper level wave flows, the jet stream, and El Niño. Students will also examine the surface and upper air weather characteristics of mid-latitude air masses and extratropical cyclones with their fronts.

Assignments: Read Chapters 9 & 10.

Lab work: Complete Investigations 9A & 9B and Investigations 10A & 10B

Discussion Question: Describe the changes that take place in cloud cover as a warm front approaches your locality. In other words, describe how the clouds change with respect to type and height above the ground as the warm front gets closer to your location, as well as any weather that might occur during that time.

Summary: Chapter 9: In two paragraphs, summarize what you learned in chapters 9 & 10. For the best chance of full credit, please try to include at least 5 topics from the main objectives at the beginning of the chapter.

Chapter 10: In one paragraph, summarize what you learned in chapter 10. For the best chance of full credit, please try to include at least 5 topics from the main objectives at the beginning of the chapter.

Week Eight:

Topics: Thunderstorms and Tornadoes

Objectives: Students will examine the structure, formation, and life cycles of thunderstorms and their related weather hazards, including tornadoes.

Assignments: Read Chapter 11.

Lab work: Complete Investigations 11A & 11B.

Discussion Question: What is the relationship between a mesocyclone and a tornado?

Critical Thinking: What combination of atmospheric conditions favors development of a supercell thunderstorm?

Summary: Chapter 11: In one paragraph, summarize what you learned in chapter 11. For the best chance of full credit, please try to include at least 5 topics from the main objectives at the beginning of the chapter.

Term Paper week 8 check-point: Rough draft dropped into Turnitin for writing help. (25 pts)

Week Nine:

Topics: Tropical Weather Systems

Objectives: Students will examine the life cycles and inner-workings of tropical cyclones (hurricanes)

Assignments: Read Chapter 12.

Lab work: Complete Investigations 12A & 12B

Discussion Question: Why are Atlantic hurricanes most likely to form in late summer and early autumn - much later than the time of peak incoming solar radiation?

Critical Thinking: How is it possible for a tropical storm to cause considerable inland flooding?

Summary: Chapter 12: In one paragraph, summarize what you learned in chapter 12. For the best chance of full credit, please try to include at least 5 topics from the main objectives at the beginning of the chapter.

Week Ten:

Topics: Weather Analysis and Forecasting

Objectives: Students will examine the measurement and observation of weather conditions, and the collection and communication of the observations in the international meteorological community.

Assignments: Read Chapter 13.

Lab work: Complete Investigations 13A & 13B

Discussion Question: Describe the role of numerical models in scientific weather forecasting.

Critical Thinking: Why does an extensive winter snow cover tend to be self-sustaining?

Summary: Chapter 13: In one paragraph, use your own words to summarize what you learned in chapter 13. For the best chance of full credit, please try to include at least 5 topics from the main objectives at the beginning of each chapter.

***Term Paper:** Due in Final Format at **8 AM Monday at the end of week 10** (150 pts – [50 pts on-time, 100 pts content])

Week Eleven:

Topics: Light and Sound in the Atmosphere / Climate and Climate Change

Objectives: Students will examine the behavior of light in the atmosphere and associated optical phenomena that result, as well as explore the properties of sound waves and how temperature and wind affect the speed of sound waves traveling through the atmosphere. Students will also examine the synthesis of weather conditions that form climate, as well as discussion of the factors that cause climate to vary over many time scales.

Assignments: Read Chapters 14 and 15.

Lab work: Complete Investigations 14A & 14B and Investigations 15A & 15B

Discussion Question: Demonstrate that the ocean is a major player in Earth's climate system.

Summary: Chapter 14: In one paragraph, use your own words to summarize what you learned in chapter 14. For the best chance of full credit, please try to include at least 5 topics from the main objectives at the beginning of the chapter.

Chapter 15: In one paragraph, use your own words to summarize what you learned in chapter 15. For the best chance of full credit, please try to include at least 5 topics from the main objectives at the beginning of the chapter.

Week Twelve:

Final Exam:

Open Book on all material (Chapters 1 to 15)
40 multiple choice questions worth 2 pts each
2 essays worth 10 pts each
3 hour time limit in Midstate LMS

Lab Description / Estimated Time to Complete / Delivery Method Matrix

Lab Description (What is the student asked to do? Please describe)	**Time to Complete (Time Spent)**	**Delivery method** The students submit the lab assignments to the learning management system; do they have to go outside to observe the weather to complete the lab assignment?
Complete Investigations 1A - Surface Air Pressure Patterns • Show the patterns of surface air pressures across the nation at map time by drawing lines of equal pressure (isobars). • Locate regions of relatively high and low air pressures on the same surface map. • Answer 9 lab questions, including 5 in the applications section, after analyzing the hand-drawn pressure maps	1.5 hours	Students watch an instructor video that explains the process of drawing isobars on a surface map. Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual. Students read the additional instructional material at the start of and throughout the Lab Investigation 1A pages 1 to 8. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate Learning Management System (LMS)
Complete Investigation 1B – Air Pressure and Wind • Describe the relationship between the patterns of relatively high and low air pressure areas (Lows or Ls and Highs or Hs) on a surface weather map and the direction of surface winds. • Apply the hand-twist model of wind direction to the circulation in actual highs and lows. Watch course video explanation of the Hand-Twist Model • Hand Analyze isobars on a surface map • Answer 16 lab questions, including 8 in the applications section	1.5 hours	Students watch a course video on the pressure Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 1B pages 9 to 16. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS

Complete Investigation 2A – Surface Weather Maps •Decode the symbols commonly appearing on a surface weather map and describe weather conditions at various locations. •Identify fronts appearing on the map, the weather likely to be occurring on either side of a front, and the motion of fronts. •Describe general relationships between wind patterns and the high and low air pressure centers shown on weather maps. • Answer 32 lab questions, including 15 in the Applications section	2 hours	Students watch an instructor video describing weather symbols commonly seen on a weather map. Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 2A pages 17 to 27. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 2B – The Atmosphere in the Vertical •Describe the vertical temperature structure of the atmosphere in the troposphere (the "weather" layer) and in the lower stratosphere. •Compare the temperature profile specified by the U.S. Standard Atmosphere with actual soundings of the lower atmosphere. • Answer 15 lab questions, including 8 in the Applications section	1 hour	Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 2B pages 28 to 36. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 3A – Weather Satellite Imagery •Distinguish among the different basic types of weather-satellite imagery and describe the information they can provide. •Interpret probable atmospheric conditions from weather-satellite imagery. • Answer 22 lab questions, including 13 in the Applications section	1.5 hours	Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 3A pages 37 to 44. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS

Complete Investigation 3B – Sunlight Throughout the Year •Describe the variation of solar radiation received at the top of Earth's atmosphere at equatorial (0°), midlatitude (45°N), and polar (90ºN) locations over the period of a year. •Estimate and compare the annual and seasonal effects of sunlight received at equatorial, mid-latitude, and polar locations during the different seasons of the year. Analyze daily insolation diagrams • Answer 16 lab questions, including 6 in the Applications section	1.25 hours	Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 3B pages 45 to 54. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 4A – Temperature and Air Mass Advection •Draw lines of equal temperature (isotherms) to reveal the pattern of air temperatures across the nation at map time. •Locate regions on a weather map where cold and warm air advection is occurring. •Relate warm and cold air advection patterns to circulations of weather systems. • Answer 32 lab questions, including 18 in the Applications section	2.25 hours	Student watch course video on hand analysis for isotherms Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 4A pages 55 to 64. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 4B – Heating and Cooling Degree-Days and Wind-Chill •Calculate the number of heating or cooling degree-days accumulated on a given day, and demonstrate the use of current data to determine the number of heating or cooling degree-	1.5 hours	Students watch video on hand analyzing heating degree day isolines. Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material

days in selected locations. •Describe the pattern of average annual heating-degree totals over the coterminous United States. •Determine the wind-chill temperature based on temperature and wind observations. • Answer 21 lab questions, including 12 in the Applications section		at the start of and throughout the Lab Investigation 4B pages 65 to 73. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 5A – Air Pressure Change •Identify air pressure changes and other local weather conditions that indicate the passage of a cold front. •Relate local air pressure changes and weather conditions to the presence of different air masses before and after the passage of a cold front. •Estimate the speed of movement of a strong, well-defined cold front. • Answer 21 lab questions, including 19 in the Applications section	1.75 hours	Students watch Instructor video on meteograms Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 5A pages 74 to 82. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 5B – Atmospheric Pressure in the Vertical •Draw lines of constant pressure on a vertical plot of the atmosphere. •Explain what air pressure is. •Explain how variations in air temperature cause differences in air pressure. •Describe how density contrasts between warm and cold air produce horizontal variations in air pressure at different altitudes in the atmosphere. • Answer 28 lab questions, including 9 in the Applications section	2 hours	Students watch course video using Pressure blocks to describe atmospheric thickness differences in hot and cold airmasses. Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 5B pages 83 to 95. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS

Complete Investigation 6A – Clouds, Temperature, and Air Pressure •Describe how air temperature changes as air pressure changes. (temperature strip in a plastic bottle experiment- squeeze bottle-temp rises) •Make clouds appear and disappear in a hypothetical bottle – experiment. Water in bottle, then add smoke from match. •Describe the role condensation nuclei play in enhancing cloud formation. •Explain how most clouds form in the atmosphere. • Answer 27 lab questions, including 17 in the Applications section	2 hours	Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 6A pages 96 to 106. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 6B – Rising and Sinking Air •Describe how to use a Stüve diagram to follow atmospheric temperatures and pressures. •Determine the temperature of air that rises or sinks in the atmosphere. •Describe how the water vapor saturation of air can affect atmospheric temperatures. • Answer 32 lab questions, including 16 in the Applications section	2 hours	Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 6B pages 107 to 116. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 7A – Precipitation Patterns •Describe different mechanisms leading to the formation of clouds and precipitation in low pressure systems. •Locate areas of precipitation based on weather radar depictions. •Indicate the general relationship between the uplift of air and the formation of clouds and precipitation.	1.5 hours	Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 7A pages 117 to 124. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS

• Answer 20 lab questions, including 14 in the Applications section		
Complete Investigation 7B – Doppler Radar •Describe aspects of the actual wind that are detected by Doppler radar. •Determine the speed of the wind toward or away from the radar site. •Construct the wind pattern as detected by Doppler radar. • Answer 24 lab questions, including 13 in the Applications section	1.75 hours	Students watch instructor video on Doppler radar analysis Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 7B pages 125 to 135. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 8A – Surface Weather Maps and Forces •Describe the horizontal forces that act on air parcels. •Show the directions toward which these atmospheric forces act. •Relate these horizontal forces to the winds reported on weather maps. • Answer 31 lab questions, including 14 in the Applications section	2 hours	Students watch course video on Coriolis effect – index card experiment Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 8A pages 136 to 148. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 8B – Upper-Air Weather Maps •Describe the topography of upper-air constant-pressure surfaces based on height contours, including the identification of topographical Highs, Lows, ridges, and troughs. •Identify the general relationship between height contours and the temperature of the underlying	2 hours	Students watch instructor video on 'Analyzing upper air maps' Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 8B pages 149 to 159.

atmosphere. •Describe the relationship between the height contours and wind direction on upper-air weather maps. • Answer 28 lab questions, including 17 in the Applications section		Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 9A – Westerlies and the Jet Stream •Describe the wave patterns exhibited by the meandering upper-air westerlies. •Determine the location of the polar-front jet stream on an upper-air weather map. •Explain the general relationships between the jet stream in the upper-air westerlies and the paths air masses and storms take. •Describe how atmospheric temperature patterns are associated with the upper-air circulation and the jet stream. • Answer 26 lab questions, including 19 in the Applications section	2 hours	Students watch an instructor video on Upper-air wave patterns Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 9A pages 160 to 171. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 9B – El Nino •Describe the neutral (long-term average) conditions of the tropical Pacific Ocean and atmosphere. •Compare El Niño and La Niña conditions to neutral conditions. •Explain how atmospheric conditions during El Niño are transmitted beyond the tropical Pacific area. • Answer 29 lab questions, including 14 in the Applications section	2 hours	Students watch an El Nino/La Nina instructor video Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 9B pages 172 to 186. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 10A – The Extratropical Cyclone •Draw on diagram and describe the pattern of surface winds and weather in a model extratropical cyclone.	2 hours	Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material

•Specify the type of weather associated with fronts that rotate about an extratropical cyclone's low-pressure center. •Compare and contrast the weather associated with cold fronts and warm fronts. • Answer 33 lab questions, including 15 in the Applications section		at the start of and throughout the Lab Investigation 10A pages 187 to 196. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 10B – Extratropical Cyclone Track Weather • Draw frontal position progression as a low pressure system tracks from Colorado through Arkansas to the Great Lakes. •Describe the sequence of changes in weather that typically takes place on the right (warm) side of a Northern Hemisphere cyclone track. •Describe the sequence of changes in weather that usually takes place on the left (cold) side of a Northern Hemisphere cyclone track. • Answer 27 lab questions, including 16 in the Applications section	2 hours	Students watch Frontal progression instruction video Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 10B pages 197 to 206. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 11A – Thunderstorms •Describe the appearance of thunderstorms on radar and infrared satellite imagery. •Identify probable locations of thunderstorms on radar and infrared satellite imagery. •List some of the modes of occurrence of thunderstorms. • Answer 22 lab questions, including 17 in the Applications section	1.5 hours	Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 11A pages 207 to 214. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 11B – Tornadoes •Explain the seasonal variation of tornado activity. •List some of the characteristics of the path of an intense tornado.	1.5 hours	Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation

•Describe the general weather conditions favorable for formation of tornadic thunderstorms. • Answer 16 lab questions, including 11 in the Applications section		11B pages 215 to 225. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 12A – Hurricanes •Describe the track taken by a hurricane that occurred in the western North Atlantic Ocean. •Indicate the probable position of highest storm surge when a hurricane makes landfall. • Answer 28 lab questions, including 8 in the Applications section	2 hours	Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 12A pages 226 to 238. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 12B – Hurricane Wind Speeds and Pressure Changes •Hand analyze time plot of pressure of a hurricane over a point. Describe the relationship between the maximum wind speeds and the central pressure in a hurricane. •Categorize the damage potential of a hurricane based on wind speeds. •Explain how wind speeds in hurricanes are affected by landfall. • Answer 24 lab questions, including 14 in the Applications section	1.5 hours	Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 12B pages 239 to 248. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 13A – Weather Instruments and Observations •Describe the Automated Surface Observing System (ASOS) and the data it provides. •Describe how to access weather observations for the U.S. and the world via the Internet. • Answer 13 lab questions, including 5 in the Applications section	1.5 hours	Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 13A pages 249 to 259. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the

		answer sheet utilizing the Midstate LMS
Complete Investigation 13B – Weather Forecasts •Describe the general elements of a weather forecast. •Compare the forecasts available to the public by NWS forecast offices with resulting weather conditions. • Answer 14 lab questions, including 2 in the Applications section	1 hour	Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 13B pages 260 to 270. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 14A – Atmospheric Optical Phenomena •Explain how light interacts with atmospheric water droplets and ice crystals to form rainbows and halos. •Describe the implications of these optical phenomena for the state of the atmosphere. • Answer 15 lab questions, including 4 in the Applications section	1.5 hours	Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 14A pages 271 to 278. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 14B – Atmospheric Refraction Do coin in a cup experiment (before/after water added) •Describe how refraction of light varies with solar altitude. •Explain how solar refraction affects length of daylight. • Answer 15 lab questions, including 6 in the Applications section	1.5 hours	Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 14B pages 279 to 285. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 15A – Visualizing Climate •Portray the statistical climate values of mean monthly temperature and	2 hours	Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual

average monthly precipitation in a graphical form called the climograph. •Compare temperature and precipitation distributions on climographs from different locations noting similarities and differences. •Explain how certain climograph patterns can be explained by various climate controls. •Relate certain patterns of temperature and precipitation to particular climate classification types. • Answer 23 lab questions, including 2 in the Applications section		Students read the additional instructional material at the start of and throughout the Lab Investigation 15A pages 286 to 302. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS
Complete Investigation 15B – Local Climate Data •Interpret information appearing in Local Climatic Data, Annual Summary with Comparative Data based on weather data collected at a local National Weather Service office. •Determine how to access archived climate data from the NCEI. • Answer 30 lab questions, including 6 in the Applications section	2 hours	Assignment completion is accomplished remotely on a personal PC/laptop using student access to the online or downloaded Weather Studies Investigations Lab Manual Students read the additional instructional material at the start of and throughout the Lab Investigation 15B pages 303 to 316. Students complete homework by highlighting answers to the questions on an instructor supplied answer sheet MS Word document, then submit the answer sheet utilizing the Midstate LMS

Grading Rubric for Discussion Forum,
Critical Thinking
&
Summary Submissions

	Due	Word Count *(minimum)*	Possible Points	Directions
Discussion Forum Initial Post	Thursdays 8:00 AM	60	7	Posts must be well-thought-out answers to the topics and questions posted. I am looking for understanding of the concepts and terms discussed in the textbook and investigations manual, with your own ideas and thoughts where applicable.
Discussion Forum 1 Response Post	Mondays 8:00 AM	35	3	For each weekly discussion, you need to reply to **at least ONE** classmate's posts. They must be at least 35 words, and add a new idea or thought to the conversation. The post can agree or disagree with the original poster's answer and in both cases you must back up your statements with the concepts discussed. Posts must be well-thought-out answers to the topics and questions posted. I am looking for understanding of the concepts and terms discussed in the textbook and investigations manual, with your own ideas and thoughts where applicable.
Critical Thinking	Mondays 8:00 AM	60	10	Posts must be well-thought-out answers to the questions posted. I am looking for understanding of the concepts and terms discussed in the textbook and investigations manual with your own ideas and thoughts where applicable.
Summary	Mondays 8:00 AM	150	20	Your summary should focus on AT LEAST 5 of the objectives from the beginning of each chapter. Do not just list the objectives word for word. Paraphrase the objectives and use your own words to demonstrate that you understand the concepts and terminology.

Please….

No Text Regurgitation:

Text Regurgitation is simply repeating what is in the book; and is a waste of your time, and my time. We have both read the book so please don't just "regurgitate" (repeat) text book information. I'm more interested on what your 'take-aways' were. What are your understandings of the objectives. Free-text writing and opinions are ok to add. Put some feeling into your work!

TERM PAPER GRADING CRITERIA

Name: Grade:

APA Format (20 points):

How well did you follow APA style? Are your citations and references in the correct format? Are the quotations, seriations, and headings in the right style?

Writing Style (20 points):

How well written is your paper? Are the sentences grammatical well crafted, and generally free of spelling errors? How well organized is it? Is every point in its proper place, or do you jump around without apparent coherence?

Content (60 points):

1) **Introduction (10 points):**

How well do you show that your topic is relevant to the subject matter of the class? Why is it generally important? Does it have theoretical or practical importance?

2) **Topic Discussion (40 points):**

How well do you define or describe the topic. Did you include a thorough discussion on the main theories, methodologies, and substantive information in the topical area? Is the information from the references correctly utilized and remains true to form?

3) **Conclusion (10 points):**

How well did you summarize the main points of the term paper. Did you include some general interest discussion on how you plan to use the knowledge of the topic. Are there any areas for further study you would like to embark on in the future.

Total (100 points – 10% of overall grade):

Appendix A

Possible term paper topics (Not all inclusive, suggest one of your own if desired):

1. Sun/Solar Radiation
2. Seasons (or one of them – Spring, Summer, Fall, Winter) including why they occur
3. Hydrologic cycle
4. Thunderstorms
5. Lightning
6. Thunder
7. Hail
8. Rain
9. Snow
10. High pressure systems
11. Low pressure systems
12. Hurricanes
13. Trade winds
14. Temperature
15. Humidity
16. Wind
17. Jet stream
18. Air Masses (Or one of them, Continental Polar, Continental tropical, Maritime Polar, Maritime Tropical, etc)
19. El Nino/La Nina
20. Ocean circulations
21. Stability
22. Doppler Radar
23. Tornadoes
24. Downburst Winds
25. Climate Change (Global Warming)
26. Atmospheric Optics / Optical Phenomena (Rainbows, Halos, Fata Morgana, Mirage, etc)
27. Clouds
28. Troposphere
29. Stratosphere
30. Atmospheric soundings (weather balloon launch information)
31. Flash Flooding
32. Wind Chill and Heat Index
33. Polar Ice Evolution
34. Global Atmospheric Circulations (ie Hadley Cell, Ferrel Cell, Polar Cell)
35. History of Meteorology
36. ozone depletion (i.e., ozone hole)
37. Arctic Oscillation
38. North Atlantic Oscillation
39. Saffir-Simpson Hurricane Scale
40. Santa Ana Winds

41. Smog/Fog
42. space weather
43. weather instruments
44. weather folklore
45. wind energy
46. Fujita scale (for measuring tornadoes)

Famous Weather Events

1. 1862 Great California Floods
2. 1900 Galveston Hurricane
3. 1935 Labor Day Hurricane
4. 1938 New England Hurricane
5. Palm Sunday tornado outbreak (1965)
6. Hurricane Hugo (1989)
7. The “Perfect Storm” (1991)
8. Hurricane Andrew (1992)
9. Storm of the Century (1993)
10. Midwest Flooding (1993)
11. Moore OK Tornado Outbreaks (1999 & 2013)
12. Hurricane Katrina (2005)
13. Illinois Groundhog Day Blizzard – Lakeshore Drive shut-down (Feb 2011)
14. Southeast Tornado Outbreak – Tuscaloosa (2011)
15. Midwest Tornado Outbreak – Joplin (2011)
16. US Summer Heatwave/Drought (2012)
17. Superstorm Sandy (2012)
18. Historic Buffalo Lake Effect Snow Event (80” snow) (Nov 2014)
19. Hurricane Harvey (Houston/Texas floods) 2017
20. Hurricane Irma – Florida (2017)
21. Hurricane Maria – Puerto Rico (2017)
22. Hurricane Michael – Florida (2018)

Famous People in Meteorology

1. Galileo
2. Fahrenheit
3. Celsius
4. Luke Howard
5. Beaufort
6. Fujita
7. Da Vinci