

Meteorology & Climatology

Course Number: 116

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Remind App Join Code: fhsmetclim



Course Description

Meteorology and Climatology will serve as an introductory course to the various physical processes underlying atmospheric and weather phenomena, including concepts related to global climate change, and the impacts of weather and climate on society. This course will introduce students to basic concepts involved in the analysis of weather phenomena on a global and local scale. Particular attention will be devoted to the analysis and interpretation of local weather charts and diagrams with the goal of creating regular classroom and school weather reports. With perspective in mind, this course will also study Earth's climate through an analysis of climatic controls, classification schemes and feed-back cycles, including an examination of past global climates and global climate change scenarios. Topics addressed include makeup of the atmosphere, seasonality, heat and radiation balance, temperature, moisture and atmospheric stability, air pressure and wind, air masses and weather patterns, severe weather, instrumentation, local weather analysis and forecasting, as well as, the history of climate change.

My Expectations of You and Your Performance

I expect strong performance from all of my students. As you work towards completing this course, you will benefit greatly by developing a professional attitude in working with both the course material and your fellow colleagues. Your work should be of high quality, exhibiting pride and confidence in your knowledge and understanding of the material. Writing assignments should be edited and complete. Quantitative problem solving should be systematic and intelligible. The following guidelines will help make you successful in this course and throughout your future endeavors:

Oral and Written Communications

Becoming a savvy communicator is a life-long endeavor. Effective communications require intent, diligence, and hard work. Effective oral and written communications are among the few skills that once developed, will advance your future careers and place you at the forefront of your profession. In this course, your communications will be evaluated on the basis of content, effectiveness, grammar, and organization. References and spelling will also count in all written work that is submitted. As you face the challenge of improving your own communication style and prowess, remember the words of Mark Twain: "Tell them what you gonna tell 'em, tell 'em it, then tell 'em what you told 'em."

Problem Sets and Quantitative Calculations

One of the goals of this course is to communicate the solutions to problems. I have high expectations of you and your problem solving abilities and require neat, methodical submission from you. I must be able to follow your logic and discern your results. Moreover, you should be able to understand the problem and its solution. After all, it is your work! Concern for accuracy, precision, and reasonableness should become your goal as an effective communicator and scientist. Techniques to improve your presentation of various calculations include the following items. Always restate the problem on your answer sheet. Label your givens, unknowns, and the equations that are used. Be explicit in unit conversions and always label the units. Be reasonable with significant digits. Show your work and highlight your answer. Consider sources of error and discuss them when significant. Finally, review all answers for reasonableness. Evaluating reasonableness is a skill that takes time to master but is necessary in the development of experience and insight.

Laboratory Component:

Laboratory investigations are designed to complement the "indoor classroom" portion of the course by providing opportunities to learn about our environment through firsthand observations, to test concepts and principles which have been introduced in this class, to explore specific issues and problems in greater depth, and to gain an awareness of the importance of confounding variables which exist in the real world. These labs will invite students to think critically, to observe environmental systems, to develop and conduct well-designed experiments, to utilize presentations, to think analytically and apply concepts to the solution of environmental problems, to form conclusions and to evaluate their quality and validity, to propose further questions for study and to communicate accurately and meaningfully about observations and conclusions.

Supplies

Required Supplies:

- 1) A notebook dedicated to warm-ups, short essay responses, article reviews
- 2) A loose-leaf notebook with pockets and tabs (1–1.5 Inch Binder Preferred)
 - Tab 1: Notes
 - Tab 2: Activities / Labs
 - Tab 3: Reference Tables
 - Tab 4: Syllabus & Grade Sheet
- 3) Extra paper; two pencils and a black or blue pen
- 4) Colored pencils or markers. (Red, Blue, Black, Purple → Frequent Use)

Classroom Rules

General Class Rules are: Be Prepared, Be Polite, Be Honest, and Be Attentive.

Specific Class Rules are:

- Do Not Interrupt - If the teacher or another student is speaking to the class, raise your hand to be recognized. Do not break in or make "side" comments to a neighbor. When I raise my hand as a signal to be quiet, stop talking and look at me.
- Stay in Your Seat - Do not walk around during class unless directed to do so. Have everything you need ready before class begins.
- Leave the Food at Home - Students may not eat or drink in the classroom. Closable containers of water are permitted. Gum will be permitted unless it becomes a problem: dispose of it wrapped properly into a trash can. Do not disrupt your neighbors and/or the class by asking for or offering gum during class.
- Work Only on Science - The class period is reserved for learning about science; do not work on other subjects during class time unless you have been given specific permission to do so.
- Nothing Goes Airborne - Nothing will go airborne in class at any time. This includes pens, paper, and other students.
- Cell Phones, iPods, "Devices" - Please place cell phones on silent and leave them in your bag, purse, pocket, etc. Cell phones and other devices will be confiscated and returned at the end of the day if they become an issue in the classroom. After three confiscations of your devices, they will be turned over to the office for appropriate disciplinary actions to be taken.

Tardies and Late Arrivals

A Student who is not in the classroom at the appropriate time is considered either late or tardy. A student is **tardy** if he is **without a pass** after the bell. A student is **late** if he arrives **with a pass** after the bell. Tardy and Late students are not to disrupt the class. Late students need quietly set their pass onto the teacher's desk and sit down. There is no penalty for arriving late with a pass. The tardy penalty is explained below:

- **First and Second Tardies**-- Student receives a warning.
- **Third Tardy** – Written discipline referral is sent to the office for detention to be assigned.
- **Fourth (and continued) Tardies** – Student will forfeit 5 points from their 9-week grade for each additional tardy accumulated. A discipline referral will be sent to the office for every third tardy accumulated.

Absences

In general, regular attendance is necessary to fully benefit from a course. If an absence occurs, students are responsible for seeing me to discuss what assignments were missed and for making up the missed work. Students will be given one day for each day of absence upon return to school to make up the work that has been missed.

Assignments

1. Assignments are due at the beginning of class. Anything turned in after the beginning of the class period will be counted as a late assignment.
2. The following point deductions apply to all late work (non-Negotiable):
 - Adequate notice will be given for all homework, and students should do their best to turn in work on time. If any homework, labs, papers or other projects are late they will have a 50% grade reduction.
 - Any materials submitted after the test for a unit is given will be counted as a zero!

Restroom/Drinks/Locker

You will be excused to the restroom during the first and last five minutes of class only! In addition, students are not allowed to leave the classroom more than twice during a given week unless it is an emergency. You will not be permitted to go to the restroom, a locker, or the water fountain unless it is an emergency or you have completed all work to my satisfaction during class. Come to class prepared! If a pattern of use is established, you will be asked to sit down! In order to maintain restroom privileges, you must correctly fill out the restroom sign-out sheet at the front of the room and take the classroom hall pass.

Help/Tutoring

Please schedule an appointment with me if you would like any assistance with the material. I am available most days before school, after school, as well as, during my planning period. Please make sure you tell me when you plan on coming in to see me!

Grading Systems

All students' work will be evaluated against an established set of criteria. Homework, classroom participation, quizzes, tests, lab reports, and projects will be graded and contribute to a student's overall grade. Point values will be given to graded assignments such as tests, quizzes, and lab reports on a case-by-case basis. There will be no supplemental extra-credit assignments what-so-ever! There are no retakes of tests or quizzes; each grade is final. The following grading scale will be used on all graded material: *(Note: All grades are final and will not be curved or manipulated in any manner unless specified by the teacher.)*

91% - 100% = A	81% - 90% = B	70% - 80% = C	60% - 69% = D	0% - 59% = F
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Tests: Tests will be given at the conclusion of each major **unit** of discussion. Tests may involve more than one "book" chapter. All tests are considered cumulative and can include material from previous tests, labs, activities, etc. Knowledge is a continuation of understanding, not a fragmented cluster of random intellectual thought.

Quizzes: These will include regularly scheduled quizzes on the material (10 - 20 pts each) and pop quizzes (15 – 20 pts each).

Homework: We will have regularly assigned homework plus a project each grading period.

Labs: We will be doing as many laboratory experiments as possible. We will supplement this with "virtual" labs done using the internet. Students will be required to understand and agree to certain safety standards before participating in laboratory experiments.

Class Activities: These in-class assignments will include both individual and group work.

Notebooks: Well organized materials are often the key to success. Notebooks will be collected at regular intervals for review by the teacher.

Final Exam: There will be two final exams throughout the semester, one at the end of each 9-week grading period. These exams will include an analysis of underlying themes from the course and the student's ability to relate topics discussed to real-world scenarios and settings.

Cheating

It is expected that students will use genuine, sincere, and fair means for the accomplishment of the projects and tests from which evaluations of progress shall be determined. Students found plagiarizing, copying or cheating in any way will receive automatic zeros and have phone calls made to their parents.

Students who are found copying homework will have both sets of homework destroyed and will need to redo that homework independently. This means that if someone asks to “see” your completed homework, you should politely say “No.” You may tell them what the assignment is, and offer to consult on specific problems, but do not give your homework to anyone but the teacher.

Discipline

I do not anticipate having behavior problems in a class such as Meteorology & Climatology. It is my philosophy to extend to you both my respect and my greatest effort as an instructor. I ask only for the same in return, both for myself and for your classmates. Discipline problems will not be tolerated! Student Discipline problems will be solved by the following: student / teacher conference; office referral; teacher / parent phone call and/or conference.

Citizenship Guidelines: I will assign a citizenship grade to students on report cards. The following criteria shall be used in determining a student's citizenship grade for each 9-week grading period:

1. Attends class regularly
2. Comes to class on time.
3. Comes to class with necessary materials.
4. Completes homework assignments.
5. Meets deadlines.
6. Does his/her own work when independent work is required; does not cheat.
7. Exercises reasonable care of school property.
8. Shows respect for others.
9. Does not disrupt class; exercises good conduct.

Student Handbook

The rules and guidelines listed above are adapted from the student handbook. All rules and regulations listed in the student handbook will be strictly enforced in this course. For any items not covered by this syllabus, please refer to the student handbook.

Cell Phone / Personal Technology Use

Cell Phone Use Guidelines:

1. Cell phones and associated technology have a place in the classroom when used appropriately and serve as a classroom aid, not distraction.
2. Cell phones are only to be used as directed by the teacher during instruction and/or laboratory exercises.
3. If asked to put your cell phone away, the student will do so politely without incident. If a second warning is necessary, the student will place their cell phone on the teacher's front desk and retrieve it at the end of the period. If a third warning is required, the student will be written up for improper use of a cell phone during class.
4. Headphones, AirPods, earphones, EarPods or earbuds of any type are not to be used during class unless permission is given by the teacher on a case by case basis.
5. **Student use of class outlets for charging of their cell phone is not permitted. Do not ask!**

Course Outline

~ Unit One: Introduction

- A. Meteorology
 - a. Definition and atmospheric variables
 - b. Importance
 - c. Scientific Method
- B. Historical Development
 - a. Period of speculation
 - b. The Greeks and their influence
 - c. Dawn of scientific Meteorology
- C. Growth of Modern Meteorology
 - a. 19th Century Meteorology
 - b. Modern Meteorology
- D. Importance of the Atmosphere
 - a. Origin and composition
 - i. Primeval atmosphere
 - ii. Modern atmosphere
 - 1. Homosphere
 - 2. Heterosphere
- E. Structure of the Atmosphere
 - b. Historic views
 - c. Modern interpretation
 - i. "Spheres"
 - ii. "Pauses"
 - d. Vertical Structure

~ Unit Two: Solar Radiation

- A. Earth – Sun Relationships
 - e. Earth's motions
 - f. The seasons
 - g. Earth's orientation
 - h. Solstices and Equinoxes
- B. The Nature of Radiation
 - a. Electromagnetic spectrum
 - b. Wave length, speed, and frequency as related to solar radiation
- C. Mechanisms of Heat Transfer
 - a. Conduction, Convection, Radiation
 - b. Laws of Radiation
- D. Emission and Absorption of Radiation
 - c. Effects of temperature
 - d. Stefan-Boltzmann Law
 - e. Wien's Law
- E. Interaction with the Atmosphere
 - f. Heat balance
 - g. Reflection
 - h. Scattering
 - i. Absorption

~ Unit Three: Temperature

- A. Air Temperature Data and Controls
 - a. Basic Calculations
 - b. Isotherms
- B. Temperature Controls
 - a. Land & Water
 - b. Ocean Currents
 - c. Altitude
 - d. Geographic Position
 - e. Cloud Cover & Albedo
- C. Distribution, Cycles, and Daily Variance of Temperature

- D. Temperature Measurement
 - a. Mechanical & Electrical Thermometers
 - b. Instrument Shelters
- E. Heat Stress and Windchill: The Human Comfort Factor

~ Unit Four: Atmospheric Moisture & Stability

- A. Water in the Air (evaporation)
 - a. Hydrologic Cycle
- B. States of Water (unusual properties of water)
 - a. Gas, Liquid, Solid
 - b. Latent heat
- C. Expressing Atmospheric Humidity
 - a. Vapor pressure
 - b. Mixing ratio / saturation mixing ratio
 - c. Absolute, Specific, and Relative humidity
 - d. Dew point
- D. Measuring Humidity
 - a. Hygrometer
 - b. Sling psychrometer and Psychrometric Tables
- E. Adiabatic Change
 - a. Dry and Wet Adiabatic Lapse Rate
 - b. Determining stability
- F. Lifting Mechanisms within the Atmosphere
 - a. Orographic Lifting
 - b. Frontal Wedging & Convergence
 - c. Convective Lifting
- G. Atmospheric Stability and Instability

~ Unit 5: Condensation and Precipitation

- A. Cloud Formation
- B. Cloud Classification
- C. Types of Fog
- D. Precipitation
 - a. How Precipitation Forms
 - b. Types of Precipitation
 - i. Precipitation Measurement
 - c. Severe and Hazardous Weather
 - d. Weather Modification

~ Unit Six: Air Pressure Atmospheric Circulation

- A. Wind and Air Pressure
 - a. Measuring Air Pressure
 - b. Pressure and Altitude
 - c. Influence of Temperature and Water Vapor
- B. Forces Affecting Wind
 - a. Pressure Gradient
 - b. Coriolis Force
 - c. Friction
 - d. Winds Aloft and at the Surface
 - i. Wind Measurement
- C. Scale and Structure of Wind Patterns
- D. Local Winds
- E. Global Winds
 - a. Ocean Currents
 - b. Precipitation Distribution

~ Unit Seven: Air Masses & Fronts

- A. What are Air Masses
 - a. Source Region
 - b. Classification
 - c. Modification
- B. North American Air Masses
- C. Frontal Weather
 - a. Types of Fronts
 - b. Midlatitude Cyclones and Polar-Front Theory
 - i. Life Cycle
 - ii. Cyclonic and Anticyclonic Formation
 - iii. Divergence and Convergence
 - c. Anticyclonic Weather and Atmospheric Blocking
 - d. Modern View: Conveyor Belt Model
- D. Severe Weather & Societal Consequences
 - a. Thunderstorms
 - b. Lightning
 - c. Tornadoes
 - d. Hurricanes

~ Unit Eight: Changing Climates and the World

- A. The Climate System
 - a. How is Climate Change Detected
 - b. Natural Causes of Climate Change
 - c. Human Impact of Global Climate
- B. The Role of Gases in Climate and Climate Change
- C. Climate Feedback Mechanisms
- D. Consequences of Climate Change
 - a. Global Warming
 - b. Sea-level Rise
 - c. Changes in the Arctic
 - d. Ocean Acidity
- E. Climate Controls
- F. World Climates
 - a. The Wet Tropics
 - b. Tropical Wet and Dry
 - c. Dry
 - d. Humid Mid-Latitude
 - e. Humid Continental
 - f. Polar
 - g. Highland

~ Unit 9: Weather Mapping and Interpretation ** (Ongoing Throughout the Semester) ******

- A. Meteorological Measurements and Interpretation
- B. Data Analysis and Modeling
- C. Weather Forecasting and Numerical Prediction
- D. Optical Phenomena in the Atmosphere
 - a. Light and Matter Interactions
 - b. Mirages
 - c. Rainbows
 - d. Halos, Sun Dogs, Solar Pillars
 - e. Glories, Coronas
 - f. Iridescent Clouds

Lab Safety Contract

Science is a hands-on laboratory class. Students will be doing many laboratory activities that may require the use of chemicals, laboratory equipment, and other items which, if used incorrectly, can be hazardous. Safety in the science classroom is the number 1 priority for students, teachers, and parents. To ensure a safe science classroom, a list of rules has been developed and provided to you in this student safety contract. These rules must be followed at all times.



GENERAL GUIDELINES

1. Conduct yourself in a responsible manner at all times in the laboratory.
2. Follow all written and verbal instructions carefully. If you do not understand a direction or part of a procedure, **ASK YOUR TEACHER BEFORE PROCEEDING WITH THE ACTIVITY.**
3. Never work alone in the laboratory. No student may work in the science classroom without the presence of the teacher.
4. When first entering a science room, do not touch any equipment, chemicals, or other materials in the laboratory area until you are instructed to do so.
5. Perform only those experiments authorized by your teacher. Carefully follow all instructions, both written and oral. Unauthorized experiments are not allowed.
6. Do not eat food, drink beverages, or chew gum in the laboratory. Do not use laboratory glassware as containers for food or beverages.
7. Be prepared for your work in the laboratory. Read all procedures thoroughly before entering the laboratory. Never fool around in the laboratory. Horseplay, practical jokes, and pranks are dangerous and prohibited.
8. Always work in a well-ventilated area.
9. Observe good housekeeping practices. Work areas should be kept clean and tidy at all times.
10. Be alert and proceed with caution at all times in the laboratory. Notify the teacher immediately of any unsafe conditions you observe.
11. Dispose of all chemical waste properly. Never mix chemicals in sink drains. Sinks are to be used only for water. Check with your teacher for disposal of chemicals and solutions.
12. Labels and equipment instructions must be read carefully before use. Set up and use the equipment as directed by your teacher.
13. Keep hands away from face, eyes, mouth, and body while using chemicals or lab equipment. Wash your hands with soap and water after performing all experiments.
14. Experiments must be personally monitored at all times. Do not wander around the room, distract other students, startle other students or interfere with the laboratory experiments of others.
15. Know the locations and operating procedures of all safety equipment including: first aid kit(s), and fire extinguisher. Know where the fire alarm and the exits are located.

16. Know what to do if there is a fire drill during a laboratory period; containers must be closed, and any electrical equipment turned off.

CLOTHING

17. Any time chemicals, heat, or glassware are used, students will wear safety goggles. NO EXCEPTIONS TO THIS RULE!
18. Contact lenses may need to be removed under certain circumstances.
19. Dress properly during a laboratory activity. Long hair, dangling jewelry, and loose or baggy clothing are a hazard in the laboratory. Long hair must be tied back, and dangling jewelry and baggy clothing must be secured. Shoes must completely cover the foot. No sandals allowed on lab days.
20. On announced days, you may be requested to wear a "junk" shirt in the lab setting to protect valuable clothing.

ACCIDENTS AND INJURIES

21. Report any accident (spill, breakage, etc.) or injury (cut, burn, etc.) to the teacher immediately, no matter how trivial it seems. Do not panic.
22. If you or your lab partner is hurt, immediately (and loudly) yell out the teacher's name to get the teacher's attention. Do not panic.
23. If a chemical should splash in your eye(s) or on your skin, immediately flush with running water for at least 20 minutes. Immediately (and loudly) yell out the teacher's name to get the teacher's attention.

HANDLING CHEMICALS

24. All chemicals in the laboratory are to be considered dangerous. Avoid handling chemicals with fingers. Do not taste or smell any chemicals.
25. Check the label on all chemical bottles twice before removing any of the contents. Take only as much chemical as you need.
26. Never return unused chemicals to their original container.
27. Never remove chemicals or other materials from the laboratory area.

HANDLING GLASSWARE AND EQUIPMENT

28. Never handle broken glass with your bare hands. Use a brush and dustpan to clean up broken glass. Place broken glass in the designated glass disposal container.
29. Examine glassware before each use. Never use chipped, cracked, or dirty glassware.
30. If you do not understand how to use a piece of equipment, ASK THE TEACHER FOR HELP!
31. Do not immerse hot glassware in cold water. The glassware may shatter.

HEATING SUBSTANCES

32. Do not operate a Bunsen Burner by yourself. Take care that hair, clothing, and hands are a safe distance from the flame at all times. Use of a Bunsen Burner is only allowed in the presence of the teacher.

33. Heated glassware remains very hot for a long time. They should be set aside in a designated place to cool and be picked up with caution. Use tongs or heat protective gloves if necessary.
34. Never look into a container that is being heated.
35. Do not place hot apparatus directly on the laboratory desk. Always use an insulated pad. Allow plenty of time for hot apparatus to cool before touching it.

Name: _____ Period: _____ Date: _____

Syllabus / Lab Safety / Classroom Rules and Considerations
Signature Sheet

I verify that I have read and do fully understand the classroom policies and expectations for this class at Freeport Senior High School. Specifically, I understand the policies and expectations regarding the following:

1. The course syllabus and objectives
2. The course procedures and daily expectations
3. The grading and assignment requirements/policies
4. The use of cell phones inside of Room 51 (MY DEVICE CAN ONLY BE OUT IF GIVEN PERMISSION, I WILL POLITELY SET MY DEVIDE ON THE FRONT TABLE IF THE DEVICE IS DETERMINED TO BE A DISTRACTION, I WILL BE WRITTEN-UP IF NOT COMPLIANT)
5. All students deserve to be treated politely and respectfully as an equal
6. Late work will receive a deduction of 50%

In addition,

- I have read and do understand the policies of the Freeport Area School District as printed in the student handbook.
- I have read and do understand the Freeport Area School District attendance policies and understand that my capability in this class will be negatively impacted by lack of attendance and “catching up” is my responsibility.
- I acknowledge and agree with the Freeport Area School District computer use policy and understand that classroom laptops and related equipment are to be treated properly and my conduct during use will adhere to district policy.

Parent Signature: _____ Date: _____

Student Signature: _____ Date: _____

Return this signed form to your teacher. Keep the printed documents and policies in your binder.

***** DETACH AND RETURN THIS PAGE ONLY *****