

Course Syllabus

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About This Course

CLIM 429 Atmospheric Thermodynamics – Fall 2026

TR 10:30-11:45am – Research Hall 121 “*The Climate Lab*”

Instructor: Paul Dirmeyer pdirmeye@gmu.edu (<mailto:pdirmeye@gmu.edu>)

Office Hours: Thu 11:45-1:00 or by appointment

Catalogue Description:

Thermodynamics of the atmosphere, properties of dry and moist air, air parcel as a thermo-dynamic system, atmospheric stability and convection, cloud formation and stability indices



Course Objectives:

1. Develop an understanding of atmospheric thermodynamic processes.
2. Acquire the mathematical skill and physical principles of atmospheric thermodynamics.
3. Apply the mathematical skill and physical principles to solving atmospheric thermodynamics problems.

Prerequisites: CLIM 111 and MATH 114, or permission of instructor

Grading: Homework: 35%, Mid-term: 25%, Final: 35%, Surveys: 6%

There are 7 HW problem sets. Each set carries 5% of total grade. HW problems are due on the date as indicated in the syllabus @11:59PM. Late submission will be accepted only in case of sickness, or pre-approval by the instructor at least two days before due day. You get a *second chance* on all homework – after graded homework is returned, resubmit up to the day before the Final Exam for an improved grade!

Grading Scale: Final grade out of 100 points (grade curves may be applied)

A+	A	A-	B+	B	B-	C+	C	C-	D	F
≥97	<97; ≥93	<93; ≥90	<90; ≥87	<87; ≥83	<83; ≥80	<80; ≥77	<77; ≥73	<73; ≥70	<70; ≥60	<60

Course Textbook (required reading in advance of each class – see calendar below):

Petty, G. W., 2008: *A First Course in Atmospheric Thermodynamics*, Sundog Publishing, 334pp

This book is in the [GMU bookstore](https://gmuecampus.com/shop-by-course/) , or may be purchased directly from the publisher [Sundog Publishing, LLC](http://www.sundogpublishing.com/)  or through on-line booksellers.

**Common Course Policies:**

George Mason University maintains [Common Course Policies](https://stearnscenter.gmu.edu/home/gmu-common-course-policies/) that apply to you, as a student, in all of your courses.

Prior to First Day of Class:

Read and understand the Appendices of the textbook!

Bring to Class:

Calculator (or calc app); laptop computer; a way to take notes; your brain! (●—●)

Other Course Resources:

A blank *Skew-T log-P* diagram [is available here \(https://canvas.gmu.edu/courses/79814/files/26951782?location=course_syllabus_79814&wrap=1\)](https://canvas.gmu.edu/courses/79814/files/26951782?location=course_syllabus_79814&wrap=1) ↓ [\(https://canvas.gmu.edu/courses/79814/files/26951782/download?location=course_syllabus_79814&download_frd=1\)](https://canvas.gmu.edu/courses/79814/files/26951782/download?location=course_syllabus_79814&download_frd=1) 🏠.

Atmospheric sounding website: <http://weather.uwyo.edu/upperair/sounding.html> 📄
(<http://weather.uwyo.edu/upperair/sounding.html>)

AMS glossary of meteorology: http://glossary.ametsoc.org/wiki/Main_Page 📄 (http://glossary.ametsoc.org/wiki/Main_Page)

Weekly Calendar (subject to change)

Week	Topics	Reading	Homework Due
1 (Aug 25, 27)	Atmospheric composition and structure; Thermodynamic systems and variables	Section 1.1-1.4 (https://canvas.gmu.edu/courses/79814/files/folder/Presentation%20PDFs?preview=27990650); 2.1-2.2 (https://canvas.gmu.edu/courses/79814/files/folder/Presentation%20PDFs?preview=27345383)	



2 (Sep 1, 3)	Physical properties of air	<u>3.1-3.3</u> (https://canvas.gmu.edu/courses/79814/files/folder/Presentation%20PDFs?preview=28094398)	Ch1 (Tue)
3 (Sep 8, 10)	Moisture in the air	<u>3.4-3.5</u> (https://canvas.gmu.edu/courses/79814/files/folder/Presentation%20PDFs?preview=28094398)	
4 (Sep 15, 17)	Hydrostatic balance; Ideal atmospheres	4.1; 4.2	Ch3 (Thu)
5 (Sep 22, 24)	Pressure in practice; Pressure-volume work	4.3; 5.1	
6 (Sep 29, Oct 1)	First law of thermodynamics, Dry adiabatic processes; Mid-term review	5.2-5.4	Ch4 (Tue)
7 (Oct)	Mid-term; Carnot cycle	5.5	



6, 8)			
8 (Oct 13, 15)	Reversible processes, Enthalpy	5.6-5.8	
9 (Oct 20, 22)	Entropy, Second law; Moist processes	6.1-6.2; 7.1-7.2	Ch5 (Thu)
10 (Oct 27, 29)	Clausius- Clapeyron; Moisture variables;	7.3; 7.4-7.5	
11 (Nov 5)**	Lifting Condensation Level, the Heated Condensation Framework	7.6	Ch7i (Thu)
12 (Nov	Moist adiabatic lapse rate; Equivalent	7.7; 7.8-7.10	



10, 12)	potential temperature and wet-bulb temperature		
13 (Nov 17, 19)	Atmospheric stability	8.1-8.4.1	Ch7ii (Thu)
14 (Nov 24)	Atmospheric convection; stability indices	8.4.2-8.5	
15 (Dec 1, 3)	Fun with profiles & boundary layer meteorology; Review		Ch8 (Thu)
Dec 15	Final Exam 10:30am to 1:15pm	Emphasis on Ch 5-8	



****Election Day** – no class on Nov 3.

Homework sets will be administered using [Gradescope](https://www.gradescope.com/)  (<https://www.gradescope.com/>), which allows you to scan and upload hand-written assignments.

Homework Assignments [number of problems]:

Ch1: 1.1, 1.2, 1.3, 1.4, 1.5 [5]

Ch3: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.10, 3.11 [8]

Ch4: 4.2, 4.4, 4.5, 4.6, 4.9, 4.15, 4.16 [7]

Ch5: 5.3, 5.4, 5.5, 5.6, 5.8, 5.10, 5.11, 5.12 [8]

Ch7i: 7.1, 7.2, 7.4, 7.6, 7.8, 7.9, 7.10, 7.11 [8]

Ch7ii: 7.13, 7.16, 7.21, 7.22, 7.23, 7.24 [6]

Ch8: 8.2, 8.4, 8.5, 8.6, 8.7, 8.9 [6]

Post-Chapter Surveys: After each chapter, a survey will be distributed on Blackboard for you to provide feedback on the teaching and textbook. Points toward the final grade will be given for responding.

Bonus Points: If you find a mistake in either the textbook or class notes and bring it to my attention *before* I mention it in class, you get a bonus point toward your final grade! Maximum 5 bonus points per student.

Common Policies at GMU: Please see the published University policies for academic standards, accommodations for students with disabilities, family educational rights and privacy (FERPA), and non-discrimination policies [at this link](https://stearnscenter.gmu.edu/home/gmu-common-course-policies/) (https://stearnscenter.gmu.edu/home/gmu-common-course-policies/) - these policies are common to all of your courses.



AI Tools: AI resources won't be very useful for homework assignments in this class, as you will mostly be writing out mathematical solutions to problems by hand. You should practice thinking for yourself, which will serve you better in the future! However, if you do use AI as a reference tool, to clarify meaning or your own writing, please declare your use as a matter of academic transparency. Please review the University's [current policies on AI](https://www.gmu.edu/ai-guidelines/ai-guidelines-students). (https://www.gmu.edu/ai-guidelines/ai-guidelines-students)

Homework Assignments: Discussions about coursework inside and outside of the classroom with me or your fellow students *are encouraged*, and you may study and work on homework assignments together. However, copying homework solutions

directly from one another is prohibited.

Exams: Cheating during exams is a violation of the academic code and will be reported to the university for appropriate action.

