

Monday Morning

8:00 – 8:30 Breakfast

8:30 – 9:15 Course Overview and Pre-Test

- Introductions / students, teachers (10 minutes)
- Overview of course structure / assignment / credit / instructional approach (5 Es) (10 minutes)
- Practical details: stipends, meals, bathrooms, etc. (5 minutes)
- Pre-test (10 minutes)
- Overview of syllabus (10 minutes)

Energy & Radiation

9:15 – 10:15 Engage / Explore / Explain

- Forms of energy
- Energy transfers
- Conservation of energy

10:15 – 10:30 Break

10:30 – 11:15 Engage / Explore / Explain

- Hot objects emit radiation
- Radiation as a means of energy transfer

11:15 – 12:00 Extend

- Follow the Energy
- Planetary Energy Balance

12:00 – 1:00 Lunch

Monday Afternoon

Radiation and Seasons

1:00 – 2:15 Engage / Explore / Explain

- A romp through the electromagnetic spectrum:
 - Rainbow glasses
 - Near IR goggles
 - Infrared Insects
 - Far IR (Thermal Cam)
 - Transmission / absorption

2:15 – 3:15 Explain

- Electromagnetic waves & energy
- Spectrum of emitted radiation
- Angles, gradients and seasons

3:15 – 3:30 Break

3:30 – 4:30 Extend

- “The Cube” – how we know what we know.
- EM spectrum activities that relate to this.

Tuesday Morning

Pressure, Density, Temperature, Buoyancy

8:00 – 8:30 Breakfast

8:30 – 9:45 Engage & Explore

- Pouring air
- Launch hot air balloon
- Ideal gas laws (Molecules in a box)
- Weighing air
- If hot air rises—why is it cold in the mountains?
- Tipping point

9:45 – 10:45 Explain

- Gas laws, buoyancy
- Temperature structure of the atmosphere
- Parcels & the environment
- Lapse rates & stability

10:45 – 11:00 Break

11:00 – 12:00 Extend

- Gas law activities: Changing pressure, changing temperature, changing volume

12:00 – 1:00 Lunch

Tuesday Afternoon

Phases of Water, Latent Heat, and Clouds

1:00 – 2:00 Engage & Explore

- Transferring energy with water vapor
 - Double boiler
 - Heating and cooling the skin
- Super-cooled beverages liquids
 - Heat packs
 - Beverages
- IR thermometers (clear sky & cloudy)
- Water droplets and IR (IR thermometer and the fish tank)
- Hand boiler

2:00 – 3:00 Explain

- Phases of water & latent heat
- Saturation, relative humidity, dew point
- Fog and clouds
- Moist vs. dry lapse rates and vertical motion
- Conditional stability

3:00 – 3:15 Break

3:15 – 4:15 Extend

- Cloud in a bottle
- Liquid nitrogen ice cream

Wednesday Morning

Convection and Precipitation

8:00 – 8:30 Breakfast

8:30 – 9:00 Balloon Launch

We'll start the day somewhat differently—by launching a weather balloon. The Launch Team will answer off all your questions before releasing the balloon right at 9:00.

9:00 – 9:20 Balloon Data

As the balloon rises, we'll watch data come in. It will keep going... We'll analyze the data later.

9:20 – 10:00 Engage & Explore

- Alter humidifier
- Terminal velocity vs. water drop size
- Convection and convection cells

10:00 – 11:00 Explain

- Precipitation processes
- Structure of clouds
- Rain and storms

11:00 – 12:00 Extend

The balloon will have sent back data that we will analyze.

12:00 – 1:00 Lunch

- Patricia will facilitate discussion with teachers

Wednesday Afternoon

Forces and Winds

1:00 – 2:15 Explore

- Newton's laws
- Vector nature of forces
- Forces in circular motion
- Gravitational potential
- Angular momentum

2:15 – 3:15 Explain

- Pressure gradient, gravity, friction
- Forces due to the earth's rotation
- Balances: Hydrostatic, geostrophic, gradient
- Flows around highs and lows at the surface and aloft

3:15 – 3:30 Break

3:30 – 4:30 Extend

- Interpreting weather maps

Thursday Morning

Rotation and Global Circulation

8:00 – 8:30 Breakfast

8:30 – 9:45 Explain

- Review ideas of the poleward energy transport and the forces due to the earth's rotation
- How the rotation of the earth affects the motion of air, water and energy in the atmosphere
- How the motion of air, water and energy in the atmosphere explains the earth's climate zones

9:45 – 10:00 Break

10:00 – 10:45 Extend

- We'll see these ideas in action by looking at the motion of fluids in a spinning tank.

10:45 – 12:00 Extend

- Observing motions of air in the atmosphere
- Satellites and satellite imagery

12:00 – 1:00 Lunch

Thursday Afternoon

Fronts and Storms

1:00 – 1:15 Engage & Explore

- Warm and cold fronts demonstration

1:15 – 2:45 Explain

- Temperature gradients
- Life cycle of a midlatitude cyclone
- Convergence and divergence
- Warm and cold advection
- Cold and warm fronts

2:45 – 3:00 Break

3:00 – 4:30 Extend

- weather map analysis, station plots, forecast models and forecast activity

Friday Morning

Climate Change & Global Warming, Impacts

8:00 – 8:30 Breakfast

8:30 – 9:45 Engage & Explore

- Radiative transfer and layers of the atmosphere
- Placemats and radiation
- Making a model
- Feedbacks
- Chaos & predictability

9:45 – 10:45 Explain

- Simple physics of increased CO₂
- Positive and negative feedbacks
- Climate observations
- Climate models
- Climate predictions
- Dealing with skeptics

10:45 – 11:00 Break

11:00 – 12:00 Extend

- Analysis of climate data sets

12:00 – 1:00 Lunch

Friday Afternoon

Mitigating and Adapting to Climate Change

1:00 – 1:30 Engage & Explore

- How much energy things use
- Energy & efficiency

1:30 – 2:30 Explain

- Carbon cycle and greenhouse gases
- Economics of energy and CO₂
- Alternative energy and energy conservation

2:30 – 2:45 Break

2:45 – 3:00 Next steps: Lectures, classes, activities

Post-test

3:00 – 3:45 Extend (Christine)

- Carbon mitigation initiative game

3:45 – 4:30 Closing

- Cups
- Cubes, part II
- Cake
- Thanks and closure