

Weather and Climate Processes: Detailed Outline

MONDAY: Energy in and energy out on a global scale

Morning

8:00 Breakfast

8:30 Course Overview

- Introductions / Teachers / Course presenters (15 minutes), then photo (5 minutes)
- Content overview (Scott, Thomas, Brian - 10 minutes)
- Overview of course structure / assignment / credit / instructional approach / mixing / Different Voices / Historical Scientist / question and suggestion box (All - 10 minutes)
- Practical details: stipends, meals, credit, parking, etc., plus time for questions (Melissa - 5 minutes)

9:15 Engage / Explore / Explain: Energy & Radiation, Part I

- Energy concepts: *What is energy?*
- Conservation of energy: *Can energy be created or destroyed?*
- A bit about the electromagnetic spectrum: Scales of energy and wavelength, different physics of the different kinds of radiation.
 - ▶ Rainbow Glasses
 - ▶ Sunburn Beads
 - ▶ IR Goggles
 - ▶ Writing with Light

10:15 Break

10:30 Engage / Explore / Explain: Energy & Radiation, Part II

- Way out in the EM Spectrum: *Thermal Camera Activity*
- Radiation as a means of energy transfer: *Feel the Heat, Color and Cooling*

11:00 Extend

- How does the earth keep warm: *Glass plates - what's going on?*

11:20 Evaluate: “My form of energy is the best.”

11:55 “Get to know a table host”

12:00 Lunch

Afternoon

12:45 Different Voices & Historical Scientist

1:15 Extend: Planetary Energy Balance

- Lecture by Scott on this topic

1:45 Engage/Explore: Radiation and Energy on Earth

- Angle Variation with Cars or Insects, Solar Cells & Basketballs
- Greenhouse effect / Earthy cools by radiation
- Clear vs. Cloudy

2:30 Explain: Radiation and Energy on Earth

- Days and Seasons
- Greenhouse Effect

3:15 Break

3:30 Extend: Energy & Seasons

- Peak Radiation vs. Peak Temperature (Melissa, 2012)

3:45 Evaluate

- Energy Cubes

4:00 Processing / Planning / Question Time

4:30 Adjourn

Evening The Light, The Dark and the Stars

TUESDAY: Air & water & clouds

Morning

8:00 Breakfast

8:30 Engage / Explore / Explain / Evaluate

- Weighing air
- Pouring air
- Molecules in a box
- Marshmallow mashers (observe and discuss)
- Peep poofers (observe and explain - a bit of evaluation!)
- Temperature changes on compression / expansion (explain what is happening at an atomic level)
- Buoyancy demos
- Tipping point
- Launch solar-powered hot air balloon

9:45 Explain: Stability, Buoyancy, Convection

- Stable & unstable systems
- Parcels, buoyancy, vertical motion, convection

10:30 Break

10:45 Extend

- Be the Parcel, Part I (Dry only)
- Temperature profiles of the atmosphere (James 2011)

11:15 Evaluate

- TBD

11:30 Processing / Planning / Question Time

12:00 Lunch

Afternoon

12:45 Different Voices, Historical Scientist

1:15 Engage / Explore / Explain: Water, Energy and Phase Transitions

- Transferring energy with water vapor
 - Double boiler
 - Heating and cooling the skin
- Transpiration (fish tank over grass)
- Heat packs
- Supercooled water
- Cloud in a bottle
- Vapor pressure, “Why can hot air hold more moisture than cold?”
- Hand boiler
- Ice cream!

2:30 Break

2:45 Explain: Water in the Atmosphere

- Phase Changes & Latent Heat
- Clouds
- Thunderstorms

3:30 Extend

- Absolute vs. relative humidity: “Humidibeasts”

3:45 Processing / Planning / Question Time

4:15 Evaluate: Clouds in a Glass of Beer

4:30 Adjourn

Evening New Belgium Brewery Tour

WEDNESDAY: Global weather and climate

Morning

8:00 Breakfast

8:30 Engage / Explore: Forces and Moving Air

- Forces, pressure differences, gravity [LSOP activities]
- Rotation and the Coriolis “force” [LSOP activities]
- Large-scale weather [spin tanks, part I]

9:15 Explain: The general circulation

- Circulation “cells”
- Trade winds, westerlies, role of mid-latitude storms
- Ocean circulation (& El Nino?)

10:00 Break

10:15 Extend, Part I

- Climate zones (Erica 2011)

10:45 Extend, Part II: Climates of the World

- Tropics, temperate zones, polar caps
- Deserts and forests and grasslands

11:15 Evaluate

- Spin It Up! (Debate on altering the earth’s rotation rate.)

11:45 Processing / Planning / Question Time

12:00 Lunch

Afternoon

12:45 Different Voices, Historical Scientist

1:15 Engage / Explore

- Weather vs. Climate (candy)
- Tailpipe vs. blow dryer
- How much CO₂ comes out of your tailpipe (pumpkins!)
- Simple Climate Model

2:00 Explain: Climates of the Past & Future

- Continental drift and deep time
- Ice Ages
- Medieval & Little Ice Age climates

2:45 Break

3:00 Explain: Climate Change

- Why it's simpler than you think
- How much change
- The long tail

3:30 Extend: Solutions

- Wedges “personal edition” - my carbon footprint

3:45 Evaluate

- Dealing with skeptics: Discussion

4:00 Processing / Planning / Question Time

4:15 Closing / Next Steps

4:30 Adjourn

Evening Retro 80's at the Lagoon