Lesson Plan #4

Title: Weather Unit Intro  
Date: March 26th, 2009  
Time: 0948-1033hrs.

Name: Mr. Lance Cunningham  
Grade Level: 9th

Content Objectives:
Students will begin to develop an understanding of the forces and interactions behind the basic weather phenomena present within the Earth's troposphere.

State Standards:
3.5.7.C – Describe basic elements of meteorology.
- Identify different air masses and global wind patterns and how they relate to the weather patterns in different regions of the U. S.
3.5.10.C – Interpret meteorological data.
- Analyze information from meteorological instruments and online sources to predict weather patterns.
- Describe weather and climate patterns on global levels.

Rationale:
Students should learn this material in order to be able to understand the higher or more complicated functions of our lower atmosphere. This, in turn, is important to the students in order to be able to recognize what the local weather is and why it occurs so as to be able to decide upon behaviors that they may choose to change or appropriate, with regard to their effects on their world and community.

I chose to teach this lesson after this fashion as I am seeking a more conducive lesson format to student learning. I have, in the past, performed lessons in the fashion primarily of lecture and found that the attention spans and cognitive development of students of this level are not capable of assimilating a forty-odd minute mid to high level lecture effectively. My hypothesis contends that a shorter period of equivalent level lecture followed by a challenging activity directly related to the lecture material may provide the students with a more sustained academic gain.

Materials:
Teacher:
- Computer, 'Promethean', displayable lecture notes (ch15_intro_to_weather.ppt), notes handout key (ch15_intro_to_weather_notes_key.pdf), in-class worksheet key (ch15_inclass_assignment_key.pdf)

Students:
- Writing utensil, paper, notes handout (ch15_intro_to_weather_notes.pdf), in-class worksheet (ch15_inclass_assignment.pdf)
Procedures:

Transition Motivation:

"So we've finished talking about the atmosphere and local winds; which take place near mountain/valley systems and beaches. Now let’s figure out why that stuff is valuable to us. What can it effect, what effects it? Weather. What is weather?"

Behavioral Objectives:

Using this basic information, they will begin to reconstruct their cognitive framework for understanding the local phenomena we refer to as weather to include that it is a system of identifiable cause and effect. Using this new framework and the processes demonstrated in class they will then formulate hypotheses, based upon given data, for the placements and behaviors of these discussed atmospheric features.

Organizer:

The basic agenda will be written on the side 'wipe-board' and will consist of:

- Introduction to Weather (w/ completion notes handout)
- In-class worksheet (will be collected in period tomorrow)

Sequence of Lesson:

I. Transition (What do we know already)
   A. Air pressure
   B. Winds
      1. Trades
      2. Prevailing Westerlies
      3. Polar Easterlies
      4. Local Breezes
         a. Mtn./Valley
         b. Land/Sea
   C. Earth's Atmosphere
      1. Layering
      2. Composition

II. Air Masses - a large body of air that has the same properties as the surface over which it formed
   A. Differences this may cause
      1. Water Content
      2. Temperature
   B. Types
      1. Continental Tropic (cT)
      2. Continental Polar
      3. Continental Arctic
      4. Maritime Tropic
      5. Maritime Polar
   C. These masses do change their properties as they travel over/through places that differ from them. These changes are often noticeable. How?
      1. Rain
      2. Gain moisture (make it feel dry)
      3. Imagine mT moving over PA
         a. Expected temperature of air relative to local?
         b. Expected water content relative to local?
         c. Potential result of this? - Rain likely
III. Why would it move - Pressure differences
   A. Air moves from areas of high pressure to areas of low
   B. Balloon/Tire example
   C. High pressure systems
      1. Descending air - hence clear skies (no lifting condense)
      2. Outflow at ground - Coriolis deflection makes clockwise
   D. Low pressure systems
      1. Rising Air - lifting condensation, hence cloudy
      2. Inflow at ground - Coriolis make counter-clockwise wind
      3. Always a low between two highs (diagram outflows)

IV. Follow-up
   A. In-class assignment
   B. Homework assignment (is IV.A if not completed in period)

V. Extension(s) (will broach if generally finished w/ IV.A)
   A. Air parcel
   B. Fronts
      1. Warm - warm air moves over stationary cold
      2. Cold - cold air moves under stationary warm
      3. Stationary - neither air mass moves toward the other
      4. Occluded - ***TO COMPLICATED TO ATTEMPT w/ t***

Assessment Strategies:

Academic gains will be formatively assessed during the lecture portion of the lesson through the questions asked of students and via their level and accuracy of the participation in whole group activity. Further evaluation of their understanding will be performed using their response in individual assignments, both in-class and homework, in order to develop an idea of the general position and vector of their progress with regard to each element of the lesson taught.

Closure:

Transition to next lesson:

I will state that this subject will be continued, and further developed in lecture tomorrow with Mr. Wilson. Also, I will relate that the assignment that they are taking home with them will require some advance reading and thought in order to complete but that the contained material will be included in future development.

Assessment:

- Level of willing participation during whole-group activity
- Accuracy or on task nature of above participation
- In-class worksheet
- Homework assignment (in-class worksheet if not complete)

Homework Assignment:

In-class worksheet if not complete
Name: _______________________________ Date: ____________________

Air Mass: ____________________________________________________________

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

Air Masses (Named for _________________________________)


Air Masses do

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________


cT: ____________________________ mT: ____________________________
cP: ____________________________ mP: ____________________________
cA: ____________________________

Winds are generated by ____________________________ where air moves
from areas of ____________________________ to areas of ____________________________

High pressure systems are caused by ____________________________

_____________________________________________________________________

This falling air makes it hard for any other air to be rising at the same place. Without
rising air there is no cooling due to lifting, and so no condensation. This means cloud
formation is unlikely and that is why High Pressure systems are generally associated with
clear skies.

Diagram of winds around a High: ___________________ causes
this clockwise wind pattern.
Air is moving out of a ______________________ and into a ______________________ which is a region where air is _________________. Rising air ______________ until it reaches the ______________ and then the water vapor in it ________________, forming clouds. This process is why Lows are associated with poorer weather.

Diagram of winds around a Low: __________________________ causes this counterclockwise wind pattern.

If there are any two areas of High pressure they will force an area between them to become a __________
Air Mass: a large body of air that has the same properties as the surface over which it formed

<table>
<thead>
<tr>
<th>Air Masses (Named for where they originate)</th>
<th>Tropical</th>
<th>Polar</th>
<th>Arctic</th>
</tr>
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<tr>
<td>Continental</td>
<td>cT</td>
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<tr>
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<td>mT</td>
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<td></td>
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</tbody>
</table>

Air Masses do change based on the conditions that they encounter when moving, but there changing is often noticeable.

- cT: dry and hot
- cP: dry and warm
- cA: dry and cold
- mT: wet and hot
- mP: wet and warm

Winds are generated by pressure differences or gradients where air moves from areas of higher pressure to areas of lower pressure

High pressure systems are caused by air high up cooling, becoming denser and falling into the same space that air down here was already occupying. This falling air makes it hard for any other air to be rising at the same place. Without rising air there is no cooling due to lifting, and so no condensation. This means cloud formation is unlikely and that is why High Pressure systems are generally associated with clear skies.

Diagram of winds around a High: The Coriolis effect causes this clockwise wind pattern.
Air is moving out of a higher pressure system and into a lower pressure system which is a region where air is lifted or rising. Rising air cools until it reaches the Dewpoint temperature and then the water vapor in it condenses, forming clouds. This process is why Lows are associated with poorer weather.

Diagram of winds around a Low:

The Coriolis effect causes this counterclockwise wind pattern.

If there are any two areas of High pressure they will force an area between them to become a Low.
1) Air masses that form over land would be expected to be: Wet / Dry (Circle one)
2) Air masses that form over water are expected to be: Wet / Dry (Circle one)

For #2-4 choose the best fit words from: Warm, Polar, Arctic, Tropical, Cold, Moderate

3) Air masses that form in the low latitudes are called ____________ and would be ____________ in temperature.
4) Air masses that form in the very high latitudes are called ____________ and would be ____________ in temperature.
5) Air masses that form in the mid to high-mid latitudes are called ____________ and would be ____________.

You are vacationing at the Mosquito Coast, Central America (~15°N), and find that the winds are coming from the NE over the North Atlantic.

6) What wind belt would you expect this to be? _________________________________
7) What air mass do you expect forms over Honduras? ___________________________
8) What air mass do you expect the invading to be? _____________________________
9) Please try to diagram the interaction between these two air masses below
   (remember density differences).

10) Would you expect any inclement weather due to this? Yes / No (Circle one)
11) Please explain your reasoning:
   _______________________________________________________________________
   _______________________________________________________________________
   _______________________________________________________________________
1) Air masses that form over land would be expected to be: Wet / Dry (Circle one)
2) Air masses that form over water are expected to be: Wet / Dry (Circle one)

For #2-4 choose the best fit words from: Warm, Polar, Arctic, Tropical, Cold, Moderate

3) Air masses that form in the low latitudes are called Tropical and would be Warm in temperature.
4) Air masses that form in the very high latitudes are called Arctic and would be Cold in temperature.
5) Air masses that form in the mid to high-mid latitudes are called Polar and would be Moderate.

You are vacationing at the Mosquito Coast, Central America (~15°N), and find that the winds are coming from the NE over the North Atlantic.

6) What wind belt would you expect this to be? NE Trade Winds – or – Trade Winds
7) What air mass do you expect forms over Honduras? cT – or – Continental Tropical
8) What air mass do you expect the invading to be? mT – or – Maritime Tropical
9) Please try to diagram the interaction between these two air masses below
    (remember density differences).
    a. Just to see what they are thinking.

10) Would you expect any inclement weather due to this? Yes / No (Circle one)
    a. Evaluate based upon diagram in #9.
11) Please explain your reasoning for #10:
    a. Is their reasoning for #10 based upon #9 feasible?
“For after all it’s more important to know whether there will be weather than what the weather will be?”

-Norton Juster’s ‘Whether man’ in The Phantom Tollbooth
What do we know a bit about already?

• Air pressure

• Which controls: Winds (Trades, Prevailing Westerlies, Polar Easterlies, Local, Jet Streams...)

• Temperature

• The atmosphere’s layers and composition

• And quite a bit more!

But, we’ve always looked at the extremely large scale. Let’s narrow our scope a bit and take a closer look.
Air Masses

Air Mass – a large body of air that has the same properties as the surface over which it formed

How might air differ based on where it comes from?

• Water content (forming over ocean vs. land)

• Temperature (forming in the arctic, high-latitudes or tropics)
Air Masses, continued

• So, we have the right variables for a 3 x 2 grid
  – These are named for where they originate

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• These air masses do change based on the conditions that they encounter when moving, but their changing is often noticeable. How might that be?
Imagine a maritime tropical air mass moving into and over Pennsylvania.

• What do you expect its temperature to be relative to ours?
  – Warmer than it

• Do you expect it to have more or less water vapor in it than our present air?
  – It’s probably pretty wet air

• So we have warm, wet air moving into a relatively cold region and lifted over mountains. Anybody got an umbrella?
But, why would it move?

• Our winds are generated by differences in pressure.

• Air moves from areas of high pressure to areas of low pressure.
  – Think of a tire, or a balloon. The inside of either, inflated, is at a very high pressure. The millions of air molecules inside are pushing very hard on everything they bounce off. They are trying very hard to leave that high pressure environment, to a lower pressure one.

• If nothing is acting as a constraining force, the air leaves rapidly. Wind.
Pressure Systems

• These areas of High pressure are the result of air high up cooling, becoming denser and falling into the same space that air down here was already occupying.
  – This sinking air makes it hard for any air below to rise through it, but we need rising air cooling to form clouds; that is why high pressure systems generally mean good weather.

• Don’t forget the Coriolis Effect, the air flowing out of these Highs is affected and so assumes a clockwise motion in the northern hemisphere.
Pressure Systems, continued

• The air is moving out of the previous High pressure systems and into a Low pressure system.
  – Coriolis has the winds flowing in assuming a C.C.w. rotation

• A Low pressure system is a region where the molecules of air are leaving the system by moving upward, or rising. We know that they can’t be going outward at the ground, because the air coming from the High would bounce them back.
  – This rising air cools as it ascends, this cooling can drop its temperature to the $T_d$. At that point the water vapor in it would begin condensing into clouds. This is why Lows are associated with poor weather.
I’m sure you all are beginning to hate this word, but, ‘High’ and ‘Low’ are relative terms.

• If there are any two areas of high pressure, they will force an area between them to become a Low.
  – Think about it, the air is flowing out of the highs, these winds will meet at a point on the map between the highs and that place then will need to reduce the air in it by moving it upward. Hence, a Low.
This fourth lesson, an introduction to the weather on Earth and its functions, went pretty well. I changed the format of my lesson, from being a full period of lecture to instead being roughly half lecture with the remainder of the time being devoted to activity. I managed to teach all of my lesson sequence’s main points, being I – III, during the lecture portion; this occupied approximately twenty-five minutes of the forty-five minute period. The students seemed to understand the lecture material as determined by their participation during that portion. In the course of this lecture I asked questions of the students that related directly to the material that I was teaching and a few that required critical application of that same material to make educated guesses beyond the scope of the same. I find that these students do not seem to be that familiar with being asked questions that would require hypothesizing beyond what they have been taught explicitly, but they made a valiant effort at answering them none-the-less. I will continue this practice in future lessons when appropriate as I feel that these sorts of questions are more in line with the nature of science than rote repetition of rhetoric.

After lecture, I presented an assignment that I asked the students to complete independently and silently. These criteria had a twofold purpose: first, I wanted to see what each student’s understanding produced on its own, as most of their assignments are completed working together and so may reflect the understandings of only the most skilled; and second, this same group of students had behaved poorly by being excessively and willfully loud and disruptive the previous day, when their teacher was out for a meeting. My hope is that the removal of the cushion of their groups and the comfort that was provided by the same, being closely tied to their misbehavior, both in time and through effect, may relate the two concepts and encourage them to be more controlled for me in the future. The students did behave well for me during this class period and did visible appear to be put out by the criteria for behavior of the above assignment. We shall see if this behavioral lesson took as well as the material may.