



Name: _____

Date: _____

Website Familiarization

Atmospheric Research: AW1

This worksheet will help you become familiar with our Atmospheric Research Website. Using Netscape, open "hot links" and then choose "Atmospheric Research in the High School."

Browse the website, understand the structure and where to find things, then answer the following questions and identify the sources (page titles).

1. What are the 5 steps listed in the resources for doing a lab?
2. What is the device called that holds all of the instrumentation?
3. What are the key issues in Federal Regulations that apply to flying tethered balloons?
4. List at least 4 sensors that you think might be useful for atmospheric research.
5. What is a DAQ and why is it needed?
6. What is the density of helium?

7. What is GLAST and what opportunity does it provide high school students?
8. What is the Troposphere?
9. What are names of the two Empirical and the two theoretical atmospheric models?
10. The Constant Temperature Model of the Atmosphere makes several assumptions. Which is the least reasonable and why?
11. According to the USA Today link, what is Air Pressure?
12. What units of air pressure are typically used in the U.S. and what units are commonly used in the rest of the world?



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Do Research

Atmospheric Research: AW2

You will need background information to help you build upon others work.

Use the Atmospheric Research Website and its Hot Links page as well as using a search engine to find other sources. Answer the following questions and identify the sources.

1. What is the standard temperature at sea level?
2. How much can the surface temperature typically vary from this standard and under what conditions?
3. What is the standard pressure at sea level?
4. How much can the surface air pressure typically vary from this standard and under what conditions?
5. Given a temperature lapse rate of $6.50^{\circ}\text{C} / 1000 \text{ m}$, what is the formula for standard temperature at altitude h (in meters)?
6. Calculate the expected standard temperature at 1000 ft. Be sure to use Kelvin temperatures and remember that $1 \text{ m} = 3.28 \text{ ft}$.
7. Given that the standard pressure halves every 5.50 km of altitude, what is the formula for standard pressure at altitude h (in meters)?

8. Calculate the expected standard pressure (in kPa) at 1000 ft.
9. What causes the air pressure to change?
10. On a typical "nice" day, how much change should one expect in the pressure during a flight lasting 1 hour.
11. What are the 4 most common gases in the earth's atmosphere and what percent of our atmosphere is made of each?
12. What about water? Is it a gas? What percent is it?
13. What happens at about 10 km? What characteristics are found below this altitude vs. above it.
14. In which portion of our atmosphere does the Space Shuttle orbit?
15. Most gases are very well mixed and their relative concentration does not vary throughout our atmosphere. However, 3 gases do vary substantially. Which are these and why is this important?



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Get Ideas

Atmospheric Research: AW3

No matter how much knowledge people accumulate there are always more and more questions to be asked. After all, the more you know about a subject the more questions you have. All questions lead to more questions. Some questions may be too general or difficult to solve at first so we look for smaller or simpler versions of these questions to answer first.

Read the "Anatomy of an Experiment" and the "Balloon Experiment Manual" on the website and then answer the following questions using full sentences and the described format. If you use other sources, please identify them.

1. Identify at least 5 things about the lower atmosphere that you would find interesting to know more about. State these things as questions. Explain why they are interesting to you and what you think is the most likely answer to each of your questions.

Format:

1. What is ...?

I think this is an interesting question because ...

I think the most likely answer is ...

2. Which of these questions is the most interesting to you?

Format:

For me, the most interesting question is ...

3. Explain at least 3 possible answers to this question.

Format:

- 1 It is possible that ...

4. What could you measure or test that will help decide between these possible answers? Explain how this would help decide.

Format:

I could measure ... If _____ this would eliminate _____.

5. What equipment, materials, & time would you need to answer this question?

Format:

In order to answer this question I would need

this equipment: ...

these materials: ...

and about this much time: ...

6. Do you think you may be capable of doing this? If not choose a different question and start over with step 2.



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Plan the Experiment

Atmospheric Research: AW4

You are going to plan your own experiment that you can fly attached to a tethered meteorological balloon.

An experiment is a test that can eliminate possibilities. It can never prove something true only that other possible explanations are false. Negative results or unexpected results are not bad. An experiment is "bad" only if its results are ambiguous.

Read the "Anatomy of an Experiment", "Sample Experimental Protocol", & "Model Expected Flight Behaviour" on the website. Review the information about sensors and DAQs and then answer the following questions using full sentences and the described format. If you use other sources, please identify them.

1. What question did you choose to answer? (from AW3)
2. What test did you decide on? (from AW3)
3. What equipment, materials, & time are required? (from AW3)
4. What results do you expect and will they answer the question? What do you hope that your experiment will prove? How will it prove this?
5. What sensors or other measuring devices will you need?
6. Estimate the total weight of your instrumentation?
7. What kind of balloon and how much helium will you need?
8. How long will you need to be collecting data?
9. How often do you need to collect data?
10. How many different measurements will you make each time?
11. How many total data points will be collected?
12. Write an experimental protocol in the same format as the sample given in the website.



Research Proposal

Atmospheric Research: AP

You are going to formally describe your proposal for an experiment that you can fly attached to a tethered meteorological balloon. Consider this a report that your boss (department manager, for example.) has asked from you. It is your opportunity to impress him or her not only to justify funds needed to support your proposed experiment but also with your ability and value to the organization. A career advancement may be in your immediate future.

Carefully write out your proposal using the following format. Use the Bold titles for each section. Check your use of spelling and grammar. Be sure that it is well written (typed if possible), makes sense and is completely explained and supported. Your work on AW4 is the basis for this proposal.

Atmospheric Research Proposal

1. **Title:** Name of experiment, your name, short description
2. **Research:** Describe the fundamental question that your experiment is designed to address.
 - a. Why is this an important question?
 - b. How will your experiment address this question?
 - c. What are the expected results and what will they mean or prove about your experiment?
 - d. What about negative results? What other results might be possible and what would they mean?
3. **Equipment:** Describe the experimental equipment clearly. Specify what equipment, materials, money, & time you will need and why you feel this is achievable within our time limitations and budget.
4. **Protocol:** Attach your protocol from AW4
5. **Analysis:** After collecting data according to your protocol:
 - a. How will you analyze it?
 - b. How will you know if it is appropriate and the equipment is measuring what you intended?
 - c. What would you need to find in your data to consider the experiment a success, in other words, for the results to clearly answer your question?