

Teacher Survey

Instructions: Please complete the following evaluation.

1. Did you make any adjustments to the learning module? If so, what did you change or omit?

2. From your observations, are the students more interested in atmospheric science?

3. What part of the lesson was most effective or interesting to them?

4. What concept did the students have most trouble understanding or applying?

Student Survey

Please distribute this survey to the students before and after completing the module.

Instructions: Circle the answer that best describes your feelings about science.

1. I like science.
 - a. I strongly disagree.
 - b. I disagree.
 - c. I am indifferent or unsure.
 - d. I agree.
 - e. I strongly agree.

2. How often do you talk to your *family* about what you do in science class?
 - a. Never
 - b. Rarely (less than once a week)
 - c. Once a week
 - d. A few times a week
 - e. Every day

3. How often do you talk to your *friends* about what you do in science class?
 - a. Never
 - b. Rarely (less than once a week)
 - c. Once a week
 - d. A few times a week
 - e. Every day

4. I think science will be useful when I am older.
 - a. I strongly disagree.
 - b. I disagree.
 - c. I am indifferent or unsure.
 - d. I agree.
 - e. I strongly agree.

5. I would like to be a scientist when I am older.
 - a. I strongly disagree.
 - b. I disagree.
 - c. I am indifferent or unsure.
 - d. I agree.
 - e. I strongly agree.

Effectiveness Assessment

Part 1: Pre- and Post-Assessment (Student Evaluation)

Instructions: Please distribute and score the **Student Evaluation** for each student before and after completing the module. Each question is worth 1 point.

Student Evaluation

Instructions: After completing the lesson on atmospheric measurements, please have the students answer the following questions.

1. If you were a meteorologist trying to measure the air pressure which of the following instruments would you use?
 - a. Thermometer
 - b. Barometer**
 - c. Anemometer
 - d. Psychrometer

2. What does a rawinsonde measure?
 - a. Air temperature
 - b. Humidity
 - c. Wind speed
 - d. Pressure
 - e. All of the above**

3. There are _____ main satellite channels used in meteorology.
 - a. 2
 - b. 3**
 - c. 4
 - d. 5
 - e. 7

4. What is the name of the device used to loft rawinsondes into the atmosphere?
 - a. Weather balloon**
 - b. Hot air balloon
 - c. Airplane
 - d. Satellite

5. A _____ precisely measures the amount of rainfall.
- radar
 - satellite
 - rainometer
 - rain gauge**
 - none of the above
6. An anemometer determines the wind direction. T **F**
7. Doppler radar can be used to detect tornadoes. **T** F
8. Satellites were first used to study hurricanes. T F
9. Radar is an extremely useful instrument used to detect the intensity and location of precipitation. Briefly describe how a radar detects precipitation (drawing a sketch may be helpful).

Radar sends out a powerful pulse of electromagnetic radiation that travels away from the radar at the speed of light. When this radiation hits a raindrop, an echo is produced as the pulse reflects off the raindrop. The echo travels back to the radar, where it is measured.

10. The freezing point of water occurs at 273.15 K. What is the freezing point in degrees Fahrenheit? Please show your work.

Temperature Conversions $^{\circ}\text{C} = (^{\circ}\text{F} - 32)/1.8$ $\text{K} = ^{\circ}\text{C} + 273.15$
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$$273.15\text{K} = ^{\circ}\text{C} + 273.15$$

$$^{\circ}\text{C} = 0^{\circ}\text{C}$$

$$0^{\circ}\text{C} = (^{\circ}\text{F} - 32) / 1.8$$

$$(0^{\circ}\text{C} \times 1.8) + 32 = ^{\circ}\text{F}$$

$$^{\circ}\text{F} = \mathbf{32^{\circ}\text{F}}$$

- 0°F
- 32°F**
- 134°F
- 237.15°F
- 510.3°F

Part 2: Math & Science Proficiency (Take Home Assignment: Part 3)

Please score **Take Home Assignment: Part 3** for each student using the rubric below. This problem is aligned with the following academic standard:

<u>CCSS.MATH.CONTENT.7.NS.A.1.c.d</u>
Grade 7: The Number System: Apply properties of operations as strategies to add, subtract, multiply, and divide rational numbers.

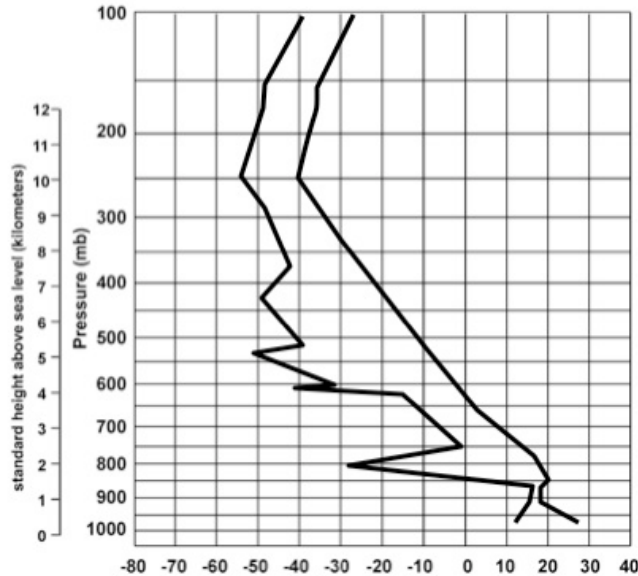
Scoring Rubric

Questions	Score (0 – 3)
Did the student show all of their work?	
Did the student correctly identify temperatures on the sounding (Q1 and Q3)?	
Did the student demonstrate knowledge of using order of operations in their calculation (Q2)?	
Did the student demonstrate the ability to read charts (Q4 and Q5)?	
Did the student interpolate between temperature values correctly (Q4 and Q5)?	

- 0 – Incomplete*
- 1 – Completed with incorrect answer*
- 2 – Complete with small errors*
- 3 – Complete with correct answer*

Part 3. Calculations

Instructions: Use the atmospheric sounding below to answer the following questions. Don't forget to include units in your answer.



1. From the sounding, determine the air temperature at the surface in degrees Celsius.

27°C

2. Convert the air temperature at the surface from Celsius to degrees Fahrenheit. Show your work.

$$^{\circ}\text{C} = (^{\circ}\text{F} - 32) / 1.8$$

$$27^{\circ}\text{C} = (^{\circ}\text{F} - 32) / 1.8$$
$$(27 \times 1.8) + 32 = \mathbf{80.6^{\circ}\text{F}}$$

3. From the sounding, determine the dewpoint temperature at the surface.

12°C

4. Remember that the air temperature is equal to the dry-bulb temperature. Using your answers from Questions 1 and 3, determine the difference between the wet-bulb and dry-bulb temperatures (Dry-Bulb Depression) from Table 1. Show your work.

From Question 1: **Dry-Bulb = Air Temperature = 27°C**

From Question 3: **Dewpoint Temperature = 12°C**

Use Table 1 to read across from dry-bulb temperature between 26 and 28°C until values for dewpoint temperature are approximately 12°C (between 11 and 14°C). Read up to the dry-bulb depression of 9°C.

Dry-Bulb Depression = 9°C

Dewpoint Temperatures (°C)

Dry-Bulb Temperature (°C)	Difference Between Wet-Bulb and Dry-Bulb Temperatures (C°)															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
-20	-20	-33														
-18	-18	-28														
-16	-16	-24														
-14	-14	-21	-36													
-12	-12	-18	-28													
-10	-10	-14	-22													
-8	-8	-12	-18	-29												
-6	-6	-10	-14	-22												
-4	-4	-7	-12	-17	-29											
-2	-2	-5	-8	-13	-20											
0	0	-3	-6	-9	-15	-24										
2	2	-1	-3	-6	-11	-17										
4	4	1	-1	-4	-7	-11	-19									
6	6	4	1	-1	-4	-7	-13	-21								
8	8	6	3	1	-2	-5	-9	-14								
10	10	8	6	4	1	-2	-5	-9	-14	-28						
12	12	10	8	6	4	1	-2	-5	-9	-16						
14	14	12	11	9	6	4	1	-2	-5	-10	-17					
16	16	14	13	11	9	7	4	1	-1	-6	-10	-17				
18	18	16	15	13	11	9	7	4	2	-2	-5	-10	-19			
20	20	19	17	15	14	12	10	7	4	2	-2	-5	-10	-19		
22	22	21	19	17	16	14	12	10	8	5	3	-1	-5	-10	-19	
24	24	23	21	20	18	16	14	12	10	8	6	2	-1	-5	-10	-18
26	26	25	23	22	20	18	17	15	13	11	9	6	3	0	-4	-9
28	28	27	25	24	22	21	19	17	16	14	11	9	7	4	1	-3
30	30	29	27	26	24	23	21	19	18	16	14	12	10	8	5	1

Table 1. Dewpoint Temperature

5. Using your answer from Question 4 and Table 2, determine the relative humidity. Show your work.

From Question 1: **Dry-Bulb = Air Temperature = 27°C**

From Question 4: **Dry-Bulb Depression = 9°C**

Use Table 2 to read across from dry-bulb temperature between 26 and 28°C and read down from the difference between wet-bulb and dry-bulb temperatures (Dry-Bulb Depression) at 9°C to where they intersect (between 39 and 42%).

Relative Humidity = 40%

Relative Humidity (%)

Dry-Bulb Temperature (°C)	Difference Between Wet-Bulb and Dry-Bulb Temperatures (C°)															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
-20	100	28														
-18	100	40														
-16	100	48														
-14	100	55	11													
-12	100	61	23													
-10	100	66	33													
-8	100	71	41	13												
-6	100	73	48	20												
-4	100	77	54	32	11											
-2	100	79	58	37	20	1										
0	100	81	63	45	28	11										
2	100	83	67	51	36	20	6									
4	100	85	70	56	42	27	14									
6	100	86	72	59	46	35	22	10								
8	100	87	74	62	51	39	28	17	6							
10	100	88	76	65	54	43	33	24	13	4						
12	100	88	78	67	57	48	38	28	19	10	2					
14	100	89	79	69	60	50	41	33	25	16	8	1				
16	100	90	80	71	62	54	45	37	29	21	14	7	1			
18	100	91	81	72	64	56	48	40	33	26	19	12	6			
20	100	91	82	74	66	58	51	44	36	30	23	17	11	5		
22	100	92	83	75	68	60	53	46	40	33	27	21	15	10	4	
24	100	92	84	76	69	62	55	49	42	36	30	25	20	14	9	4
26	100	92	85	77	70	64	57	51	45	39	34	28	23	18	13	9
28	100	93	86	78	71	65	59	53	47	42	36	31	26	21	17	12
30	100	93	86	79	72	66	61	55	49	44	39	34	29	25	20	16

Table 2. Relative Humidity