ES106 LAB NAME_____

Before completing Activity 3, watch the instructional virtual lab video on use of the sling psychrometer, with demonstrated data collection, to use for answering the questions below.

The video is located at the following URL:

https://youtu.be/Yx8nzhmJu_A

Activity 3: Measuring humidity using a psychrometer

Air is *saturated* when it has reached its water vapor capacity and contains all the water vapor that it can hold at a particular temperature. **In saturated air, the water vapor content equals its capacity**. The temperature at which air is saturated is called the *dew-point temperature*. Put another way, the dew point is the temperature at which the relative humidity of the air is 100%.

A psychrometer measures humidity by measuring the drop in temperature created by evaporation of water—the drier the air, the more evaporative cooling will occur. A thermometer with a dry bulb and a thermometer with its bulb inside a wet cloth are slung through the air. Air rushing over the wet cloth causes water to evaporate, and this cools the wet-bulb thermometer. Table 6 is used to convert the temperature difference between the wet and dry bulbs into relative humidity and Table 7 can determine dew-point temperatures from temperature measurements. Refer to Tarbuck and Lutgens, Earth Science 14th ed., p. 523-524, Fig. 17.9 for illustration of sling psychrometer; instructions for use are on the next page.

To operate the sling psychrometer:

- Wet the cotton cover on one thermometer with distilled water
- Sling it to allow evaporation to lower the temperature.
- After one minute, read the temperature on the wet bulb.
- Sling it for another minute and read the temperature again. If it is the same as the first reading, record that as the 'wet bulb temperature' in Table 5.
- If it is less than before, sling it for another minute, and read the temperature again.
- Continue doing this until the wet-bulb temperature reading is the same from one minute to the next.
- Determine the relative humidity and the dew-point temperature using Tables 6 and 7, on the following page.

TABLE 5: Sling Psychrometer Data	
Dry-bulb temperature (°C)	
Wet-bulb temperature (°C)	
Difference between dry- and wet-bulb temperatures (°C) (subtract)	
Relative humidity (from Table 6)	
Dew-point temperature (from Table 7)	

Explain the principle that governs the operation of a psychrometer for determining relative humidity.

Table 6: Relative Humidity determined by Wet Bulb Temp. Depression

Relative humidity (percent).

Dry bulb (°C)	Depression of Wet-Bulb Temperature (Dry-Bulb Temperature Minus Wet Bulb Temperature = Depression of the Wet Bulb)																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
−20	28																					
−18	40																					
−16	48	0																				
−14	55	11																				
−12	61	23																				
−10	66	33	0																			
−8	71	41	13																			
−6	73	48	20	0																		
−4	77	54	32	11																		
−2	79	58	37	20	1																	
0	81	63	45	28	11																	
2	83	67	51	36	20	6																
4	85	70	56	42	27	14																
6	86	72	59	46	35	22	10	0														
8	87	74	62	51	39	28	17	6														
10	88	76	65	54	43	38	24	13	4													
12	88	78	67	57	48	38	28	19	10	2												
14	89	79	69	60	50	41	33	25	16	8	1											
16	90	80	77	62	54	45	37	29	21	14	7	1										
18	91	81	72	64	56	48	40	33	26	19	12	6	0									
20	91	82	74	66	58	51	44	36	30	23	17	11	5									
22	92	83	75	68	60	53	46	40	33	27	21	15	10	4	0							
24	92	84	76	69	62	55	49	42	36	30	25	20	14	9	4	0						
26	92	85	77	70	64	57	51	45	39	34	28	23	18	13	9	5						
28	93	86	78	71	65	59	53	45	42	36	31	26	21	17	12	8	4					
30	93	86	79	72	66	61	55	49	44	39	34	29	25	20	16	12	8	4				
32	93	86	80	73	68	62	56	51	46	41	36	32	27	22	19	14	11	8	4			
34	93	86	81	74	69	63	58	52	48	43	38	34	30	26	22	18	14	11	8	5		
36	94	87	81	75	69	64	59	54	50	44	40	36	32	28	24	21	17	13	10	7	4	
38	94	87	82	76	70	66	60	55	51	46	42	38	34	30	26	23	20	16	13	10	7	5
40	94	89	82	76	71	67	61	57	52	48	44	40	36	33	29	25	22	19	16	13	10	7

Dry-Bulb (Air) Temperature

Relative Humidity Values

* To determine the relative humidity, find the air (dry-bulb) temperature on the vertical axis (far left) and the depression of the wet bulb on the horizontal axis (top). Where the two meet, the relative humidity is found. For example, when the dry-bulb temperature is 20°C and a wet-bulb temperature is 14°C, then the depression of the wet bulb is 6°C (20°C − 14°C). From Table C-1, the relative humidity is 51 percent and from Table C-2, the dew point is 10°C.

Table 7: Dew-point temperature (C°)

Dew-point temperature (°C)

Dry bulb (°C)	(Dry-Bulb Temperature Minus Wet-Bulb Temperature = Depression of the Wet Bulb)																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
−20	−33																					
−18	−28																					
−16	−24																					
−14	−21	−36																				
−12	−18	−28																				
−10	−14	−22																				
−8	−12	−18	−29																			
−6	−10	−14	−22																			
−4	−7	−12	−17	−29																		
−2	−5	−8	−13	−20																		
0	−3	−6	−9	−15	−24																	
2	−1	−3	−6	−11	−17																	
4	1	−1	−4	−7	−11	−19																
6	4	1	−1	−4	−7	−13	−21															
8	6	3	1	2	−5	−9	−14															
10	8	6	4	1	−2	−5	−9	−14	−18													
12	10	8	6	4	1	−2	−5	−9	−16													
14	12	11	9	6	4	1	−2	−5	−10	−17												
16	14	13	11	9	7	4	1	−1	−6	−10	−17											
18	16	15	13	11	9	7	4	2	−2	5	10	−19										
20	19	17	15	14	12	10	7	4	2	−2	−5	−10	−19									
22	21	19	17	16	14	12	10	8	5	3	−1	−5	−10	−19								
24	23	21	20	18	16	14	12	10	8	6	2	−1	−5	−10	−18							
26	25	23	22	20	18	17	15	13	11	9	6	3	0	−4	−9	−18						
28	27	25	24	22	27	19	17	16	14	11	9	7	4	1	−3	−9	16					
30	29	27	26	24	23	21	19	18	16	14	12	10	8	5	1	−2	−8	−15				
32	31	29	28	27	25	24	22	21	19	17	15	13	11	8	5	2	−2	−7	−14			
34	33	31	30	29	27	26	24	23	21	20	18	16	14	12	9	6	3	−1	−5	−12	−29	
36	35	33	32	31	29	28	27	25	24	22	20	19	17	15	13	10	7	4	0	−4	−10	
38	37	35	34	33	32	30	29	28	26	25	23	21	19	17	15	13	11	8	5	1	−3	9
40	39	37	36	35	34	32	31	30	28	27	25	24	22	20	18	16	14	12	9	6	2	−2

Dry-Bulb (Air) Temperature

Dew-Point Values