Relative Humidity Problem Set 1 KEY

RH = Relative Humidity (How full is the air, always a %)

SH = Specific Humidity (Amount of H2O in the air)

C = Capacity (Maximum amount of H2O the air *could* hold)

Relative Humidity = Specific Humidity ÷ Capacity x 100

# 1. You discover that there is 10 g/m3 of water vapor in the air, and the air’s capacity happens to be 25 g/m3, what is the relative humidity of the air? Please show your work.

RH = SH/C so.. RH = 10/25 = 40%

1. What will the relative humidity of the air in Example 1 do if the capacity
   1. Drops to 20 g/m3? RH = 10/20 = 50%
   2. Rises to 30 g/m3? RH = 10/30 = 30%
2. What is the relative humidity of air which is at **dew point**? How do you know this?

100% = totally full of H2O … SH=C at dew point.

1. There is 16 g/m3 water vapor in the air which is at a temperature of 30 ⁰C.
   1. What is the relative humidity of the air?

RH = SH/C so… 16/30.4 = 52.6% if you got 53.3 you’re not doing it right! The denominator should be the CAPACITY, not the temperature.

* 1. What would the RH be if the temperature dropped to 20 ⁰C?

RH = SH/C so… 16/17.3 = 92.5%

* 1. What would the RH be if the temperature increased to 37 ⁰C?

RH = SH/C so… 16/44 = 36%

1. It’s raining, and the air temperature is 25 ⁰C. About how much water vapor is present in the air, in g/m3?

23 g/m3

Hint: ITS RAINING! The RH is 100% when its raining. That means the SH = C… find the C at 25⁰C.

1. The air has 13 g/m3 of water vapor in it. The thermometer outside your window says the air temperature is 28⁰C. If the amount of water vapor in the air does NOT change, how will the air temperature need to change in order for it to start raining? How do you know?

At about 15.5⁰C, the capacity is 13 g/m3

28⁰C – 15.5⁰C = 12.5 ⁰C

1. How many g/m3 of water vapor can be in the air
   1. when the air temperature is 0 ⁰C? Maximum amount = 4.85 g/m3
   2. when the air temperature is 30 ⁰C? Maximum amount = 30.4 g/m3
2. You got your very own sling psychrometer for your birthday from Aunt Sue! Your very first measurements are: dry bulb temp = 30 ⁰C, wet bulb temp = 22 ⁰ C.
   1. What’s the relative humidity of that air? 49%
   2. How much water vapor, in g/m3, does that amount to? In other words, what is the specific humidity?

Capacity at 30⁰C is 30.4 g/m3

SH = RH\*C so… 0.49 \* 30.4 = 14.9 g/m3

* 1. How would the relative humidity of the air change if the air temperature were to drop to 20 ⁰C?

Capacity at 20⁰C is 17.3 g/m3

RH = SH/C so… 14.9/17.3 = 86%

1. Your wet bulb temperature reads 16 ⁰C and the relative humidity of the air you are measuring is 66%.
   1. What is the air temperature (also known as the “dry bulb” temperature)? 20⁰C
   2. Approximately what amount of water vapor, in g/m3, is in this air? (Specific humidity)

Capacity at 20⁰C is 17.3 g/m3

SH = RH\*C so … 0.66\*17.3 = 11.4 g/m3

* 1. The air temperature increases by 5 ⁰C. What is the approximate relative humidity now?

Capacity at 25⁰C is 23 g/m3

Specific Humidity is the same as part b, 11.4 g/m3.

RH = SH/C so.. 11.4/23 = 49.5%