

Lab 2 Exercise

Name: _____

Introduction to the Atmosphere


Lab Section: _____

Please show your work. If necessary please use additional paper to show work.


Weather versus Climate

You will be using several Internet sources to answer the questions below.

- For current conditions, go to <http://www.wunderground.com>. In the search box (upper right-hand corner), type in KMASALEM17. This is the identifier for the SSU's weather station located on Central campus.
- Because SSU's weather station has only existed for a few years, a station with a longer period of record should be used to examine climate. The closest observing site with the longest climate record is Logan International Airport in Boston. This is where the official observations are recorded for the city of Boston, including temperature and precipitation. To find this information, you will enter KBOS in the search area of Wunderground. Scroll down to the "Almanac" and click on the date. This will bring you to the information including averages and records for the current date. You can also change to any other date from this page.

 1. Fill in the following information on the current conditions in Salem including the proper units.

| | |
|-----------------|--|
| Date/time | |
| T | |
| T_d | |
| RH | |
| Wind speed/dir | |
| P | |
| Clouds: | |
| Current weather | |

 2. Weather also includes the recent past and near future. Find the following information regarding the maximum and minimum temperatures as well as precipitation information.

| | Date | Min T | Max T | Precip. |
|-----------|------|-------|-------|---------|
| Yesterday | | | | |
| Today | | | | |
| Tomorrow | | | | |

✍ 3. For yesterday, today and tomorrow, using the directions above, find the following climate information (for Boston).

| | Yesterday | | Today | | Tomorrow | |
|--------|-----------|--------|---------|--------|----------|--------|
| | Average | Record | Average | Record | Average | Record |
| Min T | | | | | | |
| Max T | | | | | | |
| Precip | | | | | | |

✍ 4. How do the weather conditions for yesterday, today, and tomorrow compare with the climate information (averages and records)? For instance, is the maximum temperature above, near, or below average? Are there any records that are close to or being broken? Are there any extreme events taking place in the area (to see a map with current NWS advisories visit:

<http://www.weather.gov>). Write a paragraph summarizing your findings and highlighting the differences between weather and climate.

✍ 5. Why might it be important to have information about extreme events and records become a part of the climate record for a location? Explain.

The structure of the atmosphere

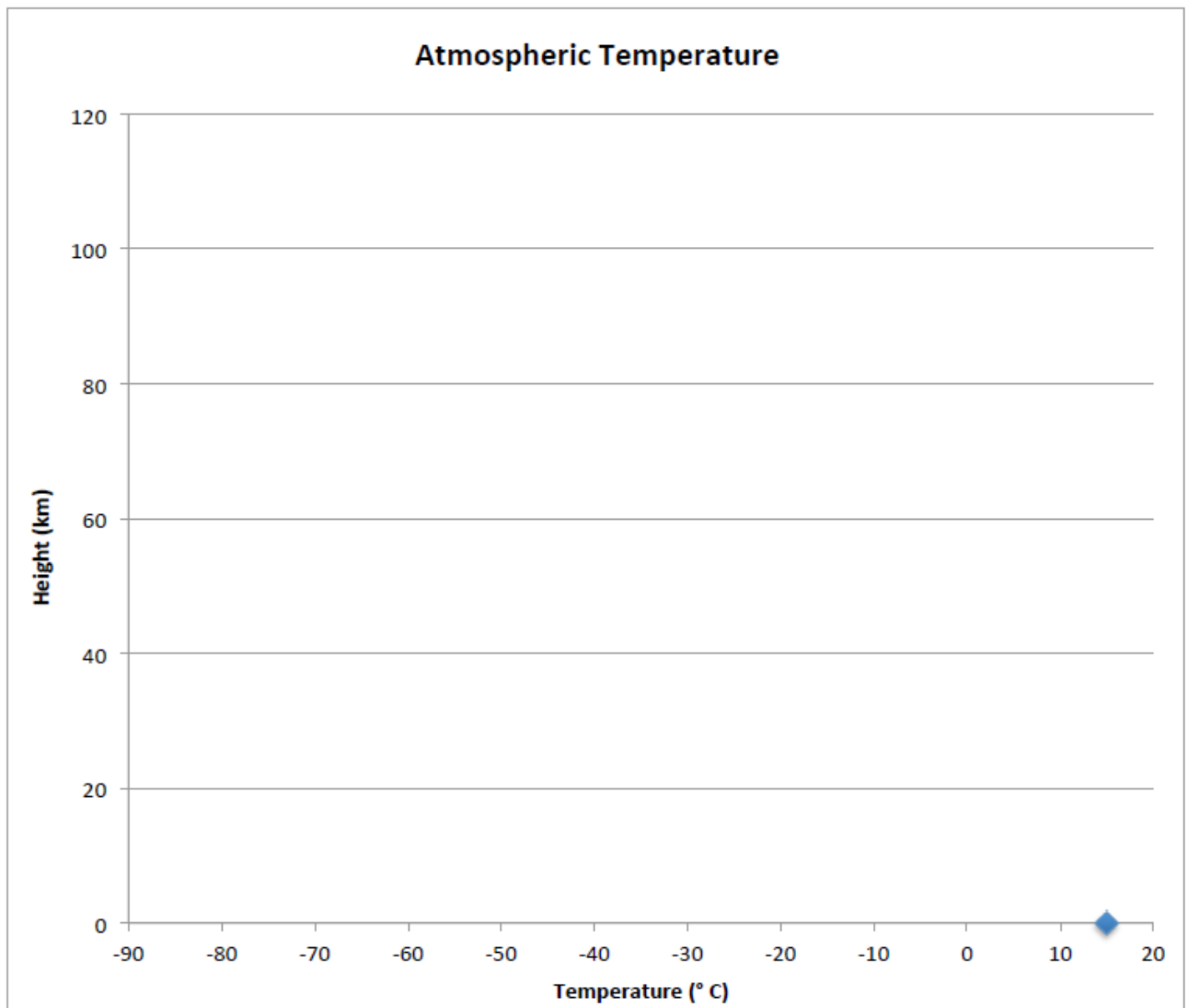
✍ 6. Using a pencil, plot the following information on the graph provided on the next page. Connect the points to form a line. The first point has been plotted for you.


| Height (km) | Temperature (°C) |
|-------------|------------------|
| 0 | 15.0 |
| 5 | -17.5 |
| 11 | -56.5 |
| 15 | -56.5 |
| 20 | -56.5 |
| 25 | -51.5 |
| 30 | -46.5 |
| 35 | -36.1 |
| 40 | -22.1 |
| 45 | -8.1 |
| 47 | -2.5 |
| 55 | -13.7 |
| 60 | -27.7 |
| 65 | -41.7 |
| 70 | -55.7 |
| 75 | -66.5 |
| 80 | -76.5 |
| 85 | -86.2 |
| 90 | -90 |
| 95 | -90 |
| 100 | -84 |
| 105 | -70 |
| 110 | -42 |
| 115 | -30 |
| 120 | 0 |

✍ 7. Draw horizontal lines to separate the four layers of the atmosphere based on temperature. Use the descriptions of the layers from the lab introduction to help you.

✍ 8. Label each layer and its boundary, for example: troposphere and tropopause.

✍ 9. There are two places where the atmosphere is “isothermal” meaning that temperature stays the same with height. Draw arrows to point to these regions.



 10. Based on the data provided, calculate the lapse rate for the troposphere. Recall the lapse rate is the decrease in temperature with altitude. Follow the instructions below.

a. Find the total temperature change from the surface to the tropopause:

b. Find the total distance from the surface to the tropopause:

c. Divide your answer from (a) by (b). This is your lapse rate in °C/km.

✍ 11. The lapse rate can be used to estimate temperatures above the surface in the troposphere. Suppose today you decide to take a trip from Salem to Mt. Washington in New Hampshire. Based on the current temperature in Salem, you could predict what the temperature at the top of the mountain will be. The elevation of Mt. Washington is 6289 ft (1917 m). Using the current temperature in Salem and the lapse rate, what would be the temperature on the top of Mt. Washington? Salem has an elevation of 26 ft (8 m). Hint: make sure to keep an eye on your units where $^{\circ}\text{C} = (^{\circ}\text{F}-32)/1.8$.

✍ 12. Visit www.mountwashington.org. What is the current temperature at the summit of Mt. Washington? Compare this to your answer for 11 above. What might be a reason for any differences between these two values?

Weather Site Data for 1/30/18, 1/31/18, and 2/1/18, to complete Lab 2

Recent Cities
[Boston, MA](#) [Boston, MA](#) [Salem, MA](#) [Biddeford, ME](#)

Elev 36ft 42.5 °N, 70.89 °W

Salem, MA

16° CENTRAL CAMPUS STATION | [REPORT](#) | [CHANGE](#)

- TODAY**
- HOURLY
- 10-DAY
- CALENDAR
- HISTORY
- WUNDERMAP

© 6:01 AM EST on January 31, 2018 (GMT -0500) | Updated 21 minutes ago

33° | 27°
16° F
FEELS LIKE 16°

Clear
 Wind **NW**

RADAR SATELLITE

WEBCAMS [WUNDERMAP](#) | [NEXRAD](#)

Today is forecast to be **WARMER** than yesterday.

| | | |
|--|---|---|
| TODAY WED 01/31 HIGH 33 ° F 0% Precip. / 0 Mostly Sunny. High 33F. Winds W at 10 to 15 mph. | TONIGHT WED 01/31 LOW 27 ° F 50% Precip. / 0 in Snow Showers Late. Low 27F. Winds SSW at 10 to 20 mph. | TOMORROW THU 02/01 HIGH 44 30 ° F 40% Precip. / 0.02 in Snow to Rain. High 44F. Winds SSW at 10 to 15 mph. |
|--|---|---|

Get your forecast in your email!

| | | | |
|---|-----------------------|--|--|
| PRECIPITATION 0% Dry conditions will continue. | POLLEN None | AIR QUALITY Good Air Quality Index 33 | UV INDEX Low Daytime UV 2 |
|---|-----------------------|--|--|



Recent Cities

Boston, MA Boston, MA Salem, MA Biddeford, ME

Elev 36ft 42.5 °N, 70.89 °W

Salem, MA



16° CENTRAL CAMPUS STATION | REPORT | CHANGE

ADDITIONAL CONDITIONS

| | |
|------------|-----------------|
| Pressure | 30.12 in |
| Visibility | 10 miles |
| Clouds | Clear |
| Dew Point | 7 °F |
| Humidity | 58% |
| Rainfall | 0 in |
| Snow Depth | 1.8 in |

METAR KBYV 311053Z AUTO 31007KT 10SM
 CLR M08/M15 A3010 RMK A02 SLP193
 T10831150

ASTRONOMY

| SUN | RISE | SET |
|-------------------------|---|----------------|
| Actual Time | 6:59 AM | 4:56 PM |
| Civil Twilight | 6:29 AM | 5:26 PM |
| Nautical Twilight | 5:56 AM | 6:00 PM |
| Astronomical Twilight | 5:23 AM | 6:33 PM |
| Length of Visible Light | 10 h 56 m | |
| Length of Day | 9 h 56 m | |
| Tomorrow will be | 2 minutes 20 seconds longer | |

KBYV STATION HISTORY

Almanac for January 31, 2018

FORECAST AVERAGE * RANGE *

Temperature

| | | | |
|------|--------------|--------------|--------------------|
| High | 33 °F | 32 °F | 19 to 62 °F |
| Low | 27 °F | 16 °F | 9 to 37 °F |

Precipitation

| | | | |
|------|---|----------------|------------------------|
| Rain | - | 0.07 in | 0.00 to 0.33 in |
| Snow | - | | - |

Dew Point

| | | | |
|------|---|--------------|--------------------|
| Low | - | 7 °F | -9 to 21 °F |
| High | - | 29 °F | 7 to 57 °F |

Almanac for January 30, 2018

KBYV ACTUAL AVERAGE * RECORD

Temperature

| | | | |
|------|----------------|--------------|---------------------|
| High | 29.9 °F | 36 °F | 48 °F (2006) |
| Low | 19.4 °F | 21 °F | 9 °F (2005) |

JANUARY CALENDAR VIEW

TODAY'S EXTREMES

Weather History for KBOS – January 30, 2018

Change the Weather History Date:

Tuesday, January 30, 2018

[« Previous Day](#)

[Next Day »](#)

| |
|-------------------------|
| Daily |
| Weekly |
| Monthly |
| Custom |

| | Actual | Average | Record |
|-----------------------------------|-----------|---------|----------------|
| Temperature | | | |
| Mean Temperature | 26 °F | 29 °F | |
| Max Temperature | 31 °F | 36 °F | 63 °F (1914) |
| Min Temperature | 20 °F | 22 °F | -5 °F (1873) |
| Degree Days | | | |
| Heating Degree Days | 40 | 36 | |
| Month to date heating degree days | 1078 | 1076 | |
| Since 1 July heating degree days | 2962 | 3070 | |
| Cooling Degree Days | 0 | 0 | |
| Month to date cooling degree days | 0 | 0 | |
| Year to date cooling degree days | 0 | 0 | |
| Moisture | | | |
| Dew Point | 14 °F | | |
| Average Humidity | 68 | | |
| Maximum Humidity | 88 | | |
| Minimum Humidity | 35 | | |
| Precipitation | | | |
| Precipitation | 0.23 in | 0.10 in | 1.01 in (1939) |
| Month to date precipitation | 5.00 | 3.25 | |
| Year to date precipitation | 5.00 | 3.25 | |
| Sea Level Pressure | | | |
| Sea Level Pressure | 29.94 in | | |
| Wind | | | |
| Wind Speed | 15 mph () | | |
| Max Wind Speed | 25 mph | | |
| Max Gust Speed | 35 mph | | |
| Visibility | 5.5 miles | | |
| Events | Snow | | |

T = Trace of Precipitation, MM = Missing Value

Source: Averaged Metar Reports

Weather History for KBOS – January 31, 2018

Change the Weather History Date:

Wednesday, January 31, 2018

[« Previous Day](#)

[Next Day »](#)

[Daily](#)

[Weekly](#)

[Monthly](#)

[Custom](#)

| | Actual | Average | Record |
|-----------------------------------|------------|---------|----------------|
| Temperature | | | |
| Mean Temperature | 20 °F | 29 °F | |
| Max Temperature | 21 °F | 36 °F | 62 °F (1913) |
| Min Temperature | 19 °F | 23 °F | -8 °F (1920) |
| Degree Days | | | |
| Heating Degree Days | 45 | 36 | |
| Month to date heating degree days | | 1112 | |
| Since 1 July heating degree days | | 3110 | |
| Cooling Degree Days | 0 | 0 | |
| Month to date cooling degree days | | 0 | |
| Year to date cooling degree days | | 0 | |
| Moisture | | | |
| Dew Point | 5 °F | | |
| Average Humidity | 52 | | |
| Maximum Humidity | 54 | | |
| Minimum Humidity | 50 | | |
| Precipitation | | | |
| Precipitation | 0.00 in | 0.11 in | 1.02 in (1914) |
| Month to date precipitation | | 3.36 | |
| Year to date precipitation | | 3.36 | |
| Sea Level Pressure | | | |
| Sea Level Pressure | 30.08 in | | |
| Wind | | | |
| Wind Speed | 11 mph () | | |
| Max Wind Speed | 17 mph | | |
| Max Gust Speed | 32 mph | | |
| Visibility | 10.0 miles | | |
| Events | | | |

T = Trace of Precipitation, MM = Missing Value

Source: Averaged Metar Reports

Weather Almanac for KBOS – February 1, 2018

Change the Weather History Date:

Thursday, February 1, 2018

[« Previous Day](#)

[Next Day »](#)

| |
|-------------------------|
| Daily |
| Weekly |
| Monthly |
| Custom |

| | Average | Record |
|-----------------------------------|---------|----------------|
| Temperature | | |
| Mean Temperature | 30 °F | |
| Max Temperature | 36 °F | 66 °F (1989) |
| Min Temperature | 23 °F | -7 °F (1920) |
| Degree Days | | |
| Heating Degree Days | 35 | |
| Month to date heating degree days | | 35 |
| Since 1 July heating degree days | | 3145 |
| Cooling Degree Days | 0 | |
| Month to date cooling degree days | | 0 |
| Year to date cooling degree days | | 0 |
| Moisture | | |
| Dew Point | | |
| Average Humidity | | |
| Maximum Humidity | | |
| Minimum Humidity | | |
| Precipitation | | |
| Precipitation | 0.11 in | 1.14 in (2008) |
| Month to date precipitation | | 0.11 |
| Year to date precipitation | | 3.47 |
| Wind | | |
| Wind Speed | | |
| Max Wind Speed | | |
| Max Gust Speed | | |

T = Trace of Precipitation, MM = Missing Value

Source: NWS Daily Summary

HIKERS WANTED! +

18TH ANNUAL HIKE-A-THON

JULY 20-21, 2018

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peak

OUR MISSION

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SUMMIT CONDITIONS

TEMPERATURE -11°F
WIND 62 MPH
DIRECTION 310°(NW)

GUST 72 MPH
WIND CHILL -50°F
LAST UPDATED WEDNESDAY,
JANUARY 31 2018 5:57 AM

