Student Worksheets - Printable PDF Version

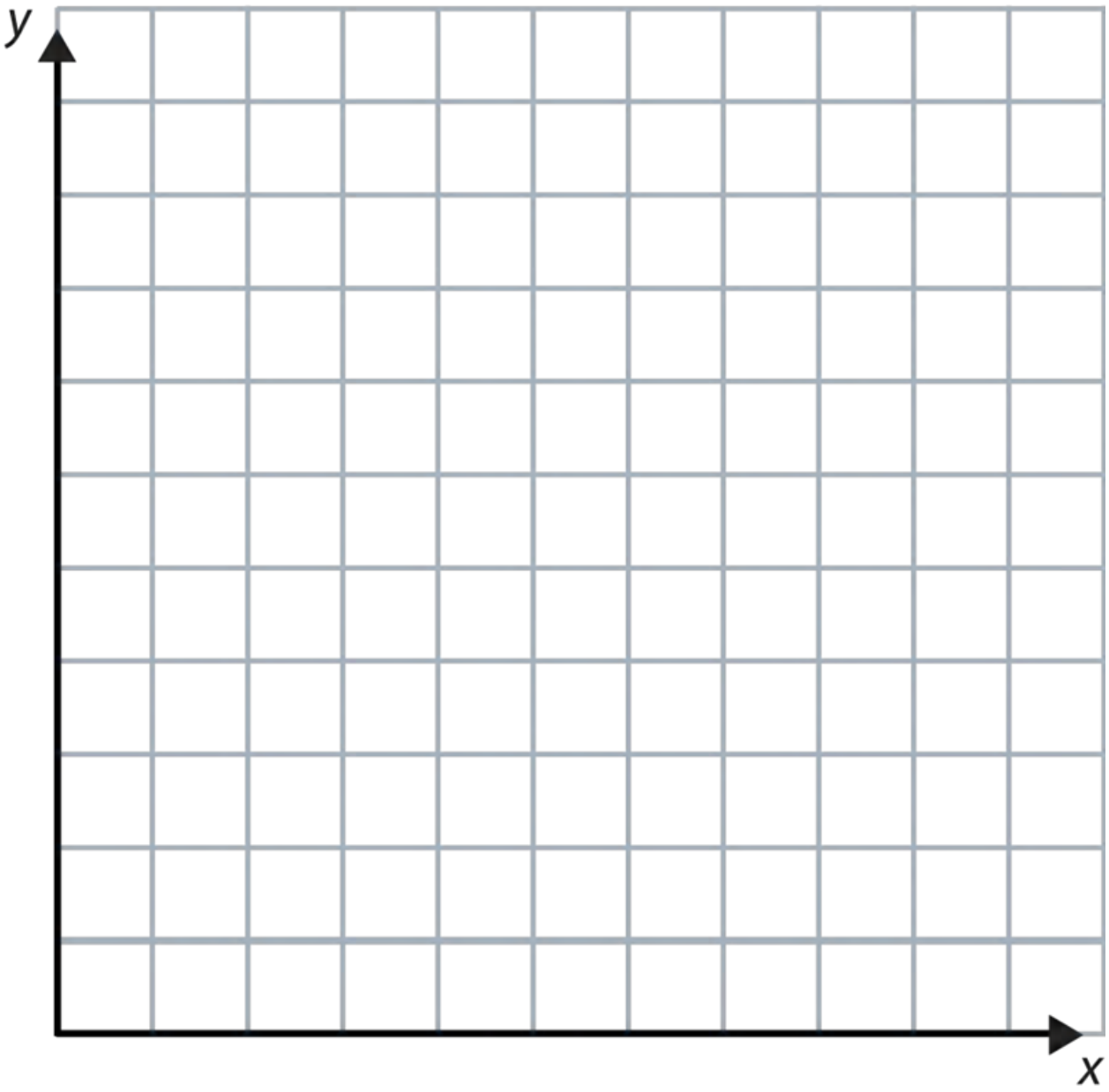
Student Worksheets

Lesson #1 - Predicting and Drawing Graphs

Name _____ **Date _____**

Lesson #1 - Predicting and Drawing Graphs **Prediction Worksheet**

Phenomenon: In the winter time there are days where the air in Utah appears cloudy or foggy all day.



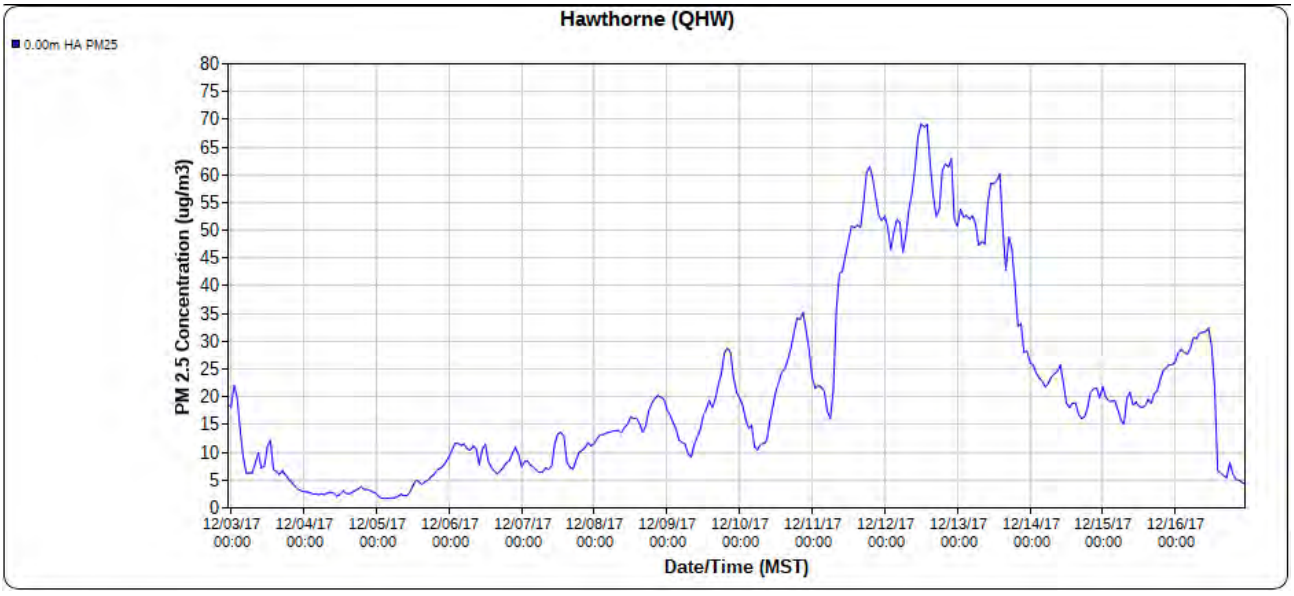
<u>Prediction</u> - draw a graph that predicts what happens to PM 2.5 concentrations during an inversion event. Be sure to label both axes with the appropriate variables and units.

Name _____ **Date** _____

Lesson #1 - Predicting and Drawing Graphs **Procedure and Analysis Worksheet**

Phenomenon: In the winter time there are days where the air in Utah appears cloudy or foggy all day.

OPTION A



1. Examine the graph. Be sure to notice the following (you are not drawing any conclusions, just making observations):
    a. Variable(s) on the X axis
    b. Variable(s) on the Y axis
    c. Title of the graph
    d. Location or Date/Time of Data
    e. General pattern in the data
    f. High and Low data points
    g. Is there anything else you notice?

2. Develop questions from the patterns you see in the data.

3. Construct an explanation for what you think could be occurring (6-8 sentences) that summarizes your findings in the graph. This summary (predictions) should include many of the observations you made in #1.

_____

_____

_____

_____

_____

_____

4. How did your prediction compare to the actual graph?

5. What was the maximum PM 2.5 concentration during this inversion event? _____

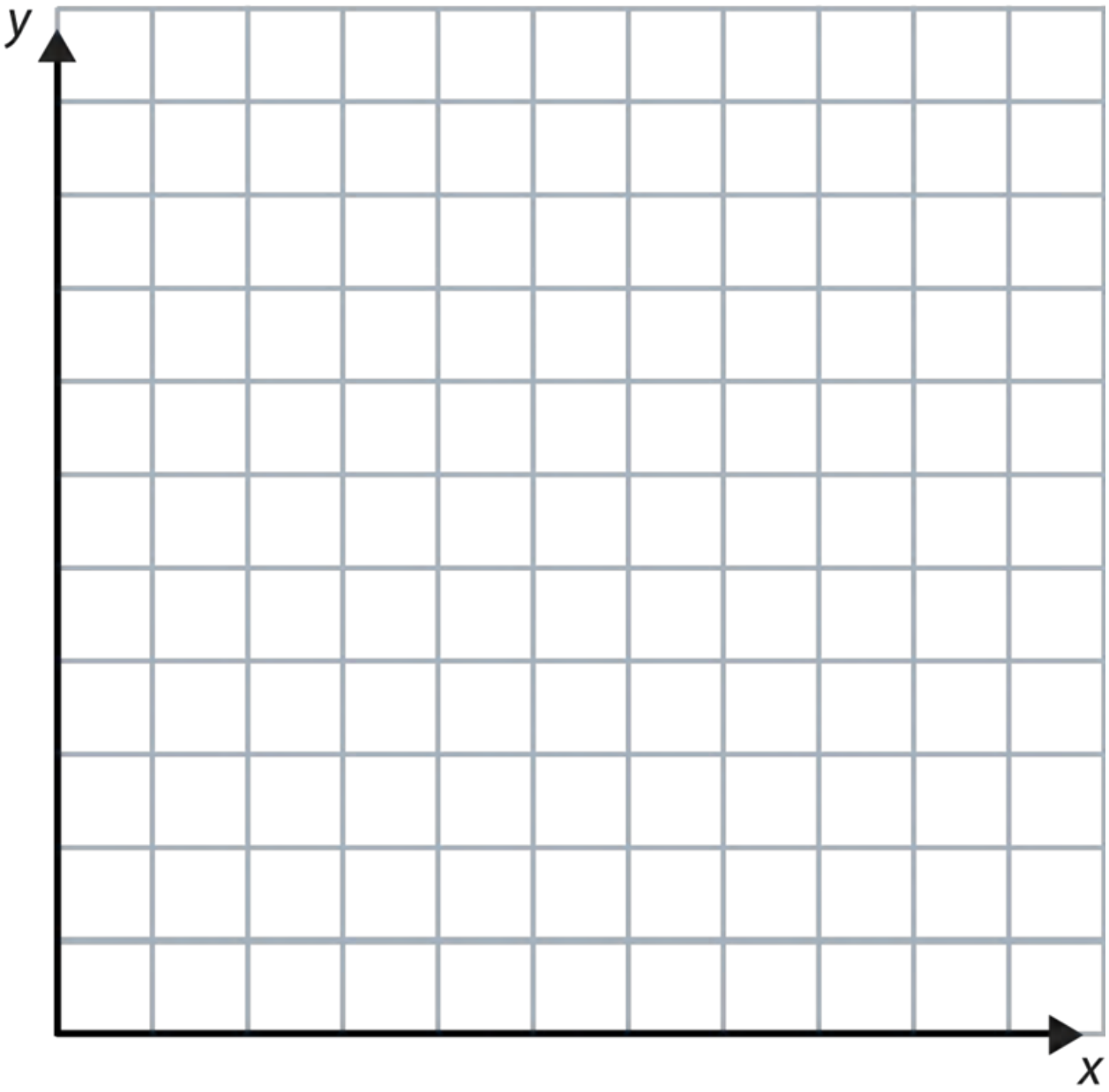
6. Look at the recess guidance tool linked here. What would schools in the valley have chosen for recess that day?

7. Over what period of time did the PM 2.5 concentrations exceed the acceptable level for all students?

8. Create an argument for evidence from your prediction verses other data.

9. This graph represents a typical inversion event in the valley. Answer the following questions to describe this event.
    a. How long did the event last? _____
    b. Over what period of time were PM 2.5 concentrations increasing? _____
    c. Over what period of time were PM 2.5 concentrations decreasing? _____
    d. How many times bigger is the max event as compared to the minimum event? _____
    e. Did PM 2.5 concentrations increase and decrease at the same rate or different rates?

10. On the graph paper below, create a graph that represents an inversion event during which students with respiratory symptoms would have been advised to stay indoors. Be sure to scale and label both axes. *Optional* to help with planning your graph, complete the prompts below.
    a. Over what period of time will your inversion event occur (what dates/times)?
    b. What will be the max PM 2.5 concentration?
    c. What will be the min PM 2.5 concentration?
    d. How long will it take for PM 2.5 to reach the max concentration?
11. With information from above and the lecture, evaluate and communicate your findings and design a set of solutions.


y
x

Name _____ **Date _____**

Lesson #1 - Predicting and Drawing Graphs **Procedure and Analysis Worksheet**

Phenomenon: In the winter time there are days where the air in Utah appears cloudy or foggy all day.

OPTION B

1. Use the data set provided by your teacher to create a graph of PM 2.5 concentration over time for this inversion event. Follow your teacher's instructions to graph this data.

2. Examine the graph. Be sure to notice the following (you are not drawing any conclusions, just making observations):
    a. Variable(s) on the X axis
    b. Variable(s) on the Y axis
    c. Title of the graph
    d. Location or Date/Time of Data
    e. General patterns in the data
    f. High and Low data points
    g. Is there anything else you notice?

3. Develop questions from the patterns you see in the data.

_____

_____

_____

_____

_____

_____

_____

4. Construct an explanation for what you think could be occurring (6-8 sentences) that summarizes your findings in the graph. This summary (predictions) should include many of the observations you made in #2.

_____

_____

_____

_____

_____

_____

_____

_____

_____

5. What was the maximum PM 2.5 concentration during this inversion event? _____

6. Look at the recess guidance tool linked here. What would schools in the valley have chosen for recess that day?

_____

_____

7. Over what period of time did the PM 2.5 concentrations exceed the acceptable level for all students?

_____

8. Create an argument for evidence from your prediction verses other data.

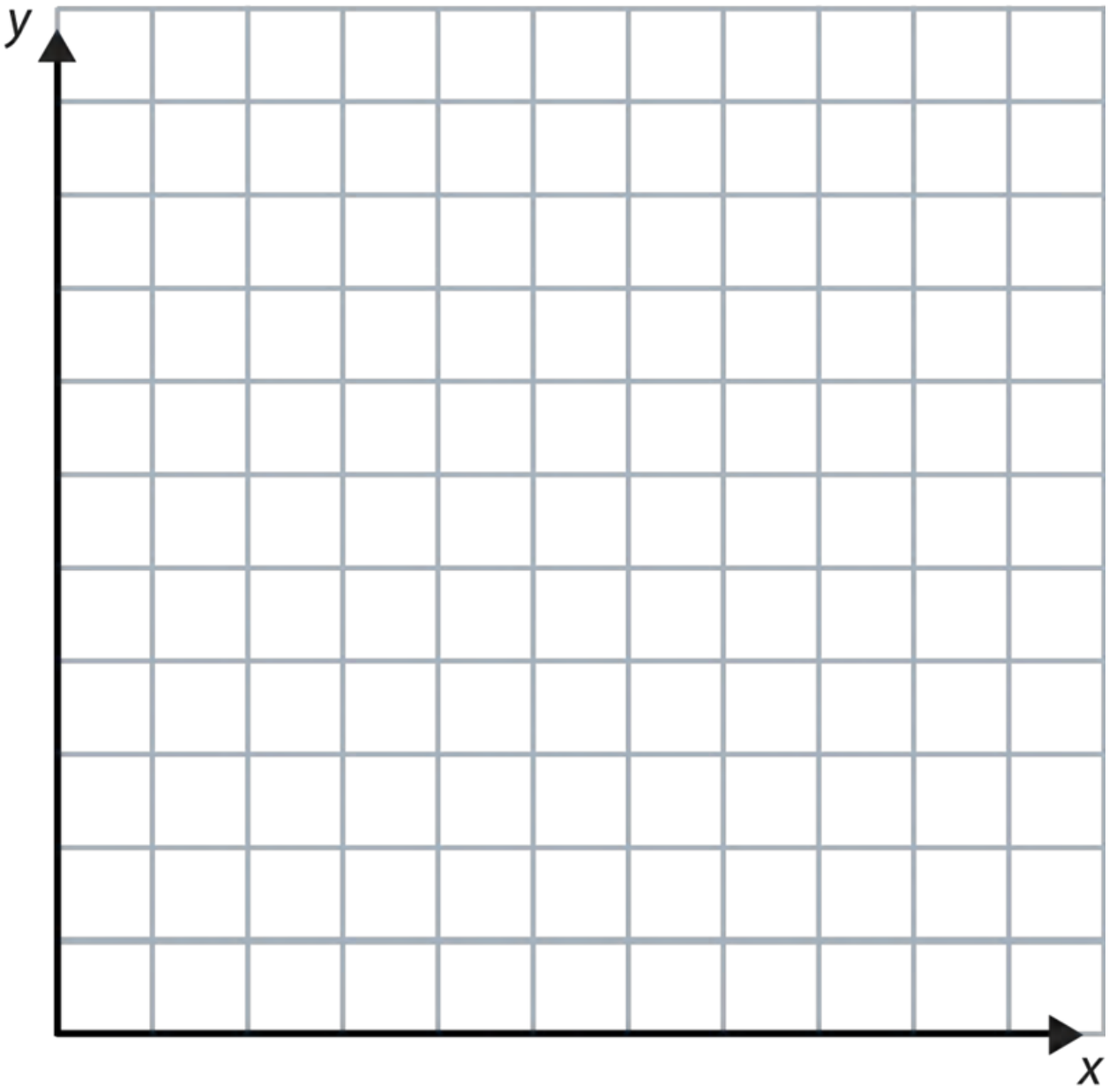
_____

_____

9. This graph represents a typical inversion event in the valley. Answer the following questions to describe this event.
    a. How long did the event last? _____
    b. Over what period of time were PM 2.5 concentrations increasing? _____
    c. Over what period of time were PM 2.5 concentrations decreasing? _____
    d. How many times bigger is the max event as compared to the minimum event?_____
    e. Did PM 2.5 concentrations increase and decrease at the same rate or different rates?

10. On the graph paper below, create a graph/model that represents an inversion event during which students with respiratory symptoms would have been advised to stay indoors. Be sure to scale and label both axes. *Optional* to help with planning your graph, complete the prompts below.
    a. Over what period of time will your inversion event occur (what dates/times)?
    b. What will be the max PM 2.5 concentration?
    c. What will be the min PM 2.5 concentration?
    d. How long will it take for PM 2.5 to reach the max concentration?

11. With information from above and the lecture, evaluate and communicate your findings and design a set of solutions.


y
x

Name _____ **Date _____**

Lesson #1 - Predicting and Drawing Graphs **Procedure and Analysis Worksheet**

Phenomenon: In the winter time there are days where the air in Utah appears cloudy or foggy all day.

OPTION C

1. Click here to open the MesoWest website.
2. Follow the steps below VERY carefully. They will walk you through how to use the MesoWest website to generate a graph of an inversion event.
    a. Zoom in on the map to find the Hawthorne Elementary sensor (QHW). It is a square on 700 East just North of the 215 Belt Route.

    b. Click on the square and then click on the QHW link at the top of the box. This will take you to the data page for that specific sensor. The Hawthorne sensor is a Department of Air Quality sensor and is the longest running sensor on the MesoWest network, which are the reasons we have chosen this sensor to work with for this activity.

    c. This page shows real time data so we now need to select the data set for the PM 2.5 event we want to examine. Click on the option in the left hand column "Change Date/Time."

    d. Choose 16 December 2017 at 23:00.

    e. Click on the option in the left hand column "Change to Graphical Display."

    f. For the time period, select "Previous 14 Days" for the variable select "PM_2.5 Concentration." Then click "Change Graph." The graph should display two lines (one for each of the two sensors on the QHW device).

3. Examine the graph. Be sure to notice the following (you are not drawing any conclusions, just making observations):
    a. Variable(s) on the X axis
    b. Variable(s) on the Y axis
    c. Title of the graph
    d. Location or Date/Time of Data
    e. General pattern in the data
    f. High and Low data points
    g. Is there anything else you notice?

4. Develop questions from the patterns you see in the data.

_____

_____

_____

5. Construct an explanation for what you think could be occurring (6-8 sentences) that summarizes your findings in the graph. This summary (predictions) should include many of the observations you made in #3.

6. What was the maximum PM 2.5 concentration during this inversion event? _____

7. Look at the recess guidance tool linked here. What would schools in the valley have chosen for recess that day?

8. Over what period of time did the PM 2.5 concentrations exceed the acceptable level for all students?

9. Create an argument for evidence from your prediction verses other data.

10. This graph represents a typical inversion event in the valley. Answer the following questions to describe this event.
    a. How long did the event last? _____
    b. Over what period of time were PM 2.5 concentrations increasing? _____
    c. Over what period of time were PM 2.5 concentrations decreasing? _____
    d. Did PM 2.5 concentrations increase and decrease at the same rate or different rates?

_____

_____

11. On the graph paper below, create a graph that represents an inversion event during which students with respiratory symptoms would have been advised to stay indoors. Be sure to scale and label both axes. *Optional:* to help with planning your graph, complete the prompts below.
    a. Over what period of time will your inversion event occur (what dates/times)?
    b. What will be the max PM 2.5 concentration?
    c. What will be the min PM 2.5 concentration?
    d. How long will it take for PM 2.5 to reach the max concentration?

12. With information from above and the lecture, evaluate and communicate your findings and design a set of solutions.

_____

_____

_____

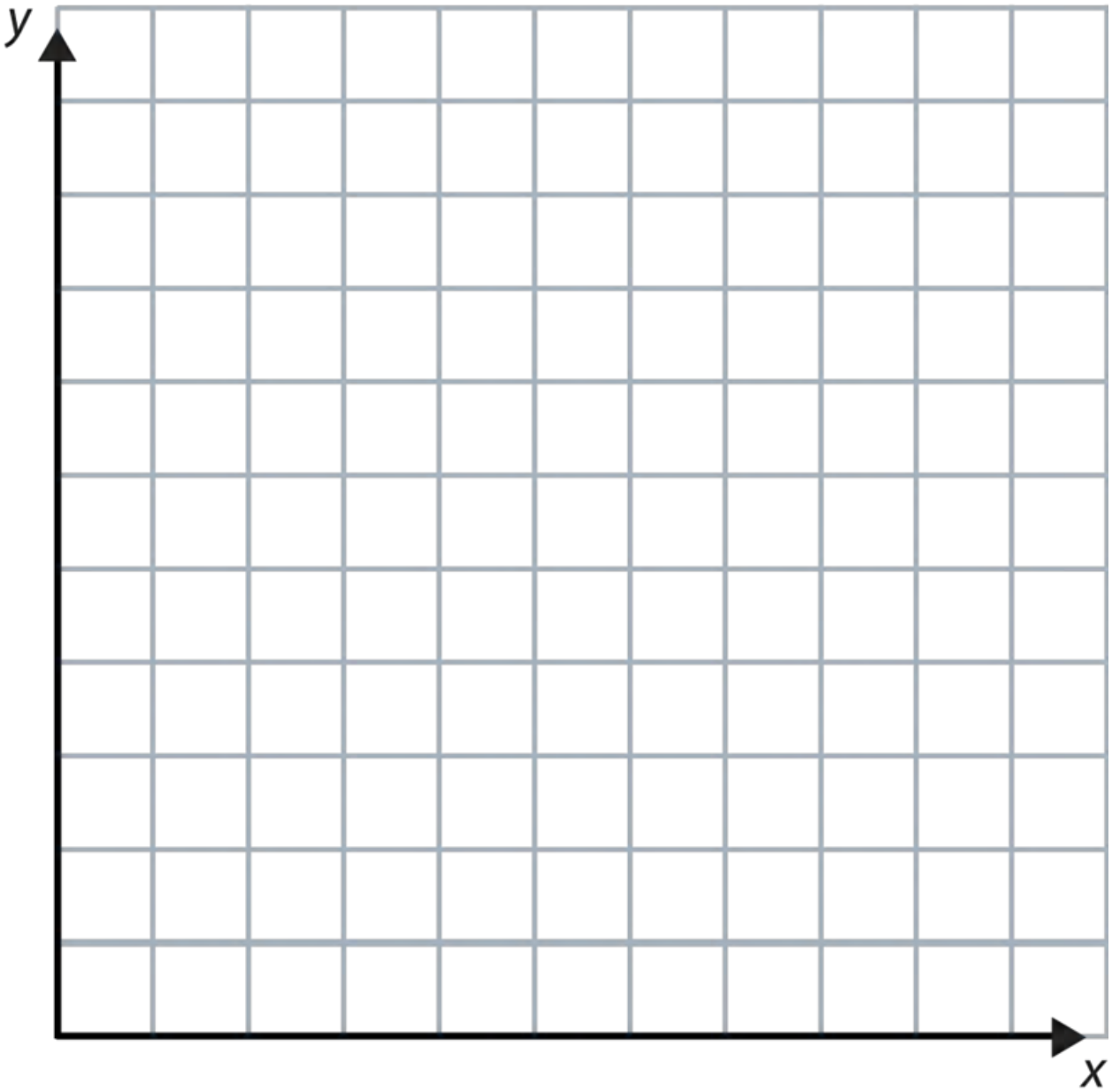
_____

_____

_____

_____

_____


y
x

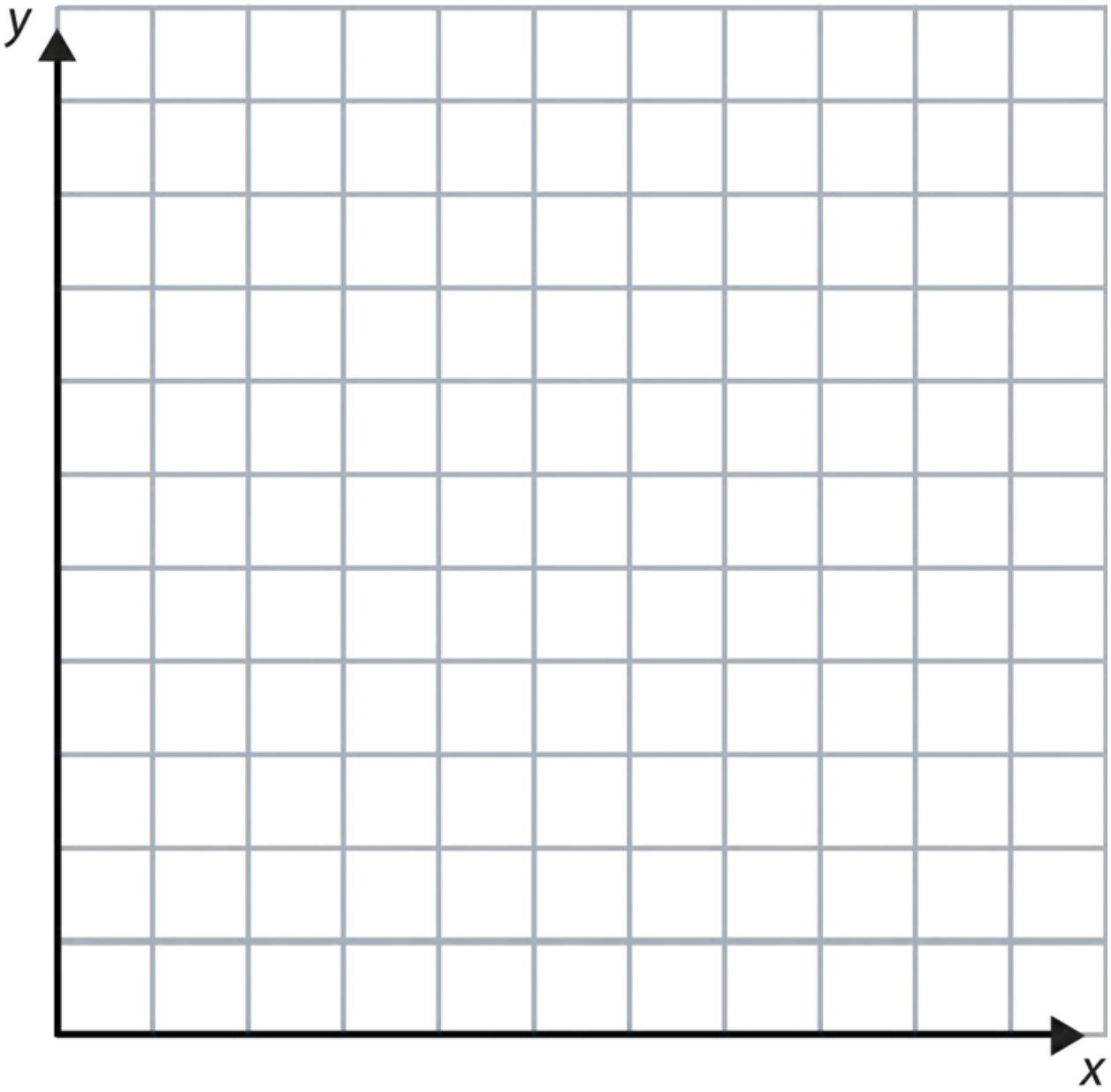
Student Worksheets

Lesson #2 - Relationships Between Two Variables

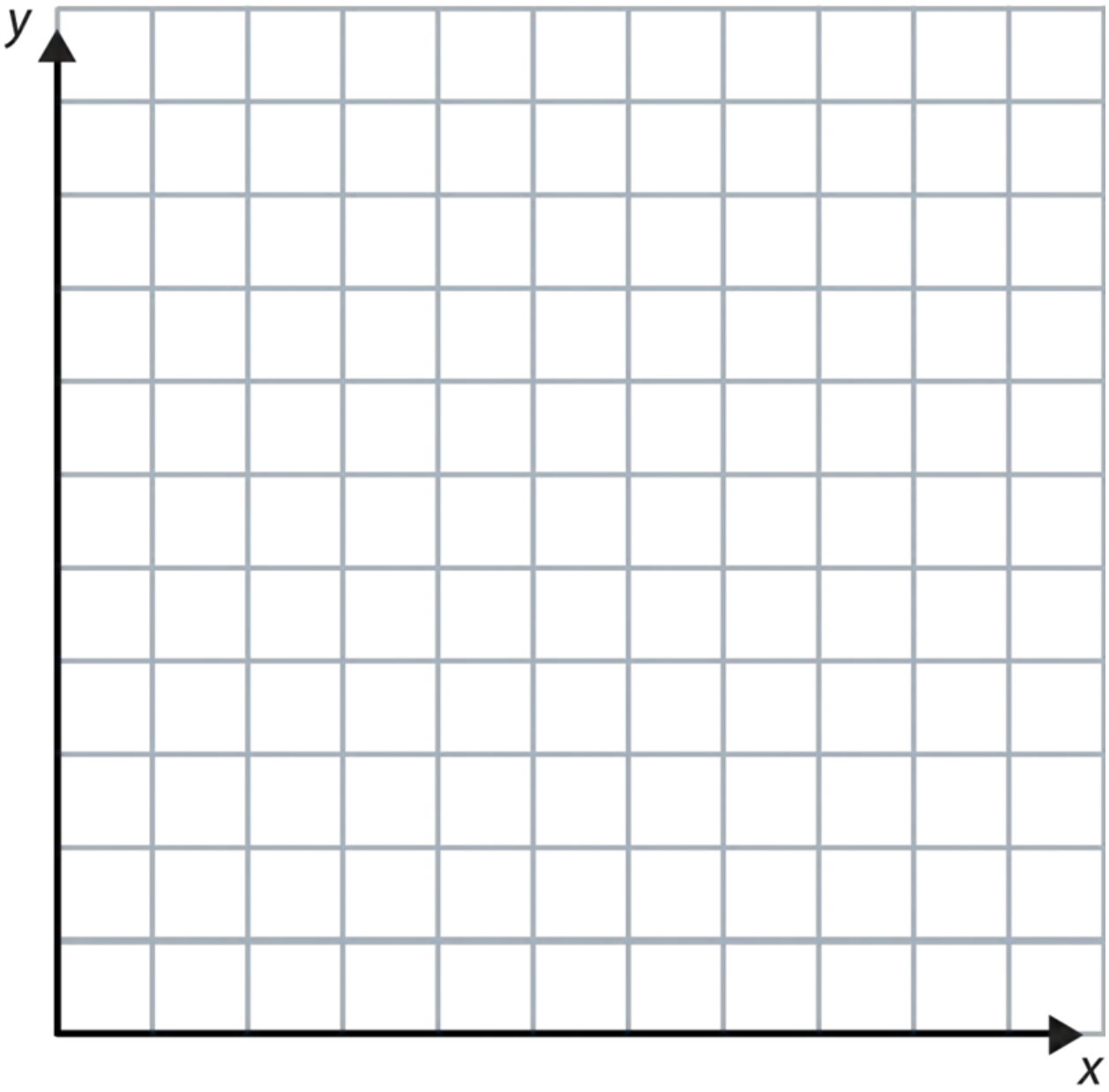
Name _____ **Date _____**

Lesson #2 - Relationships Between Two Variables **Prediction Worksheet**

Phenomenon: ‘Bad air days’ and other changes in our sky have a pattern, every winter they reoccur.



<u>Prediction</u> - draw two graphs that predict what happens to PM 2.5 concentrations and temperature before, during and after an inversion event. Use the front and back of this page.

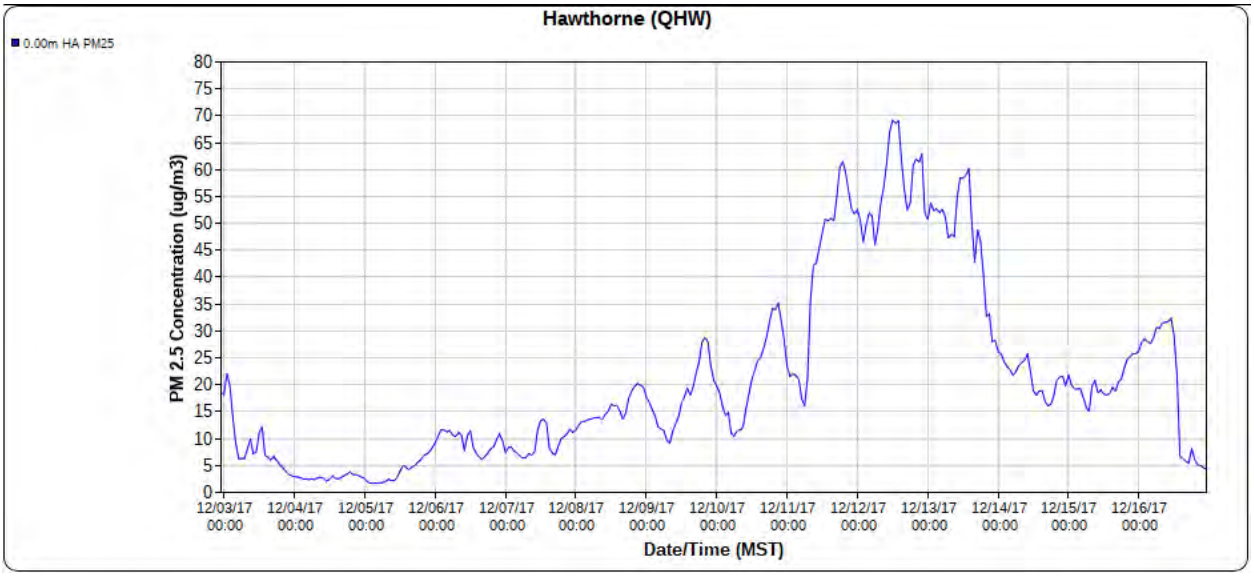

y
x

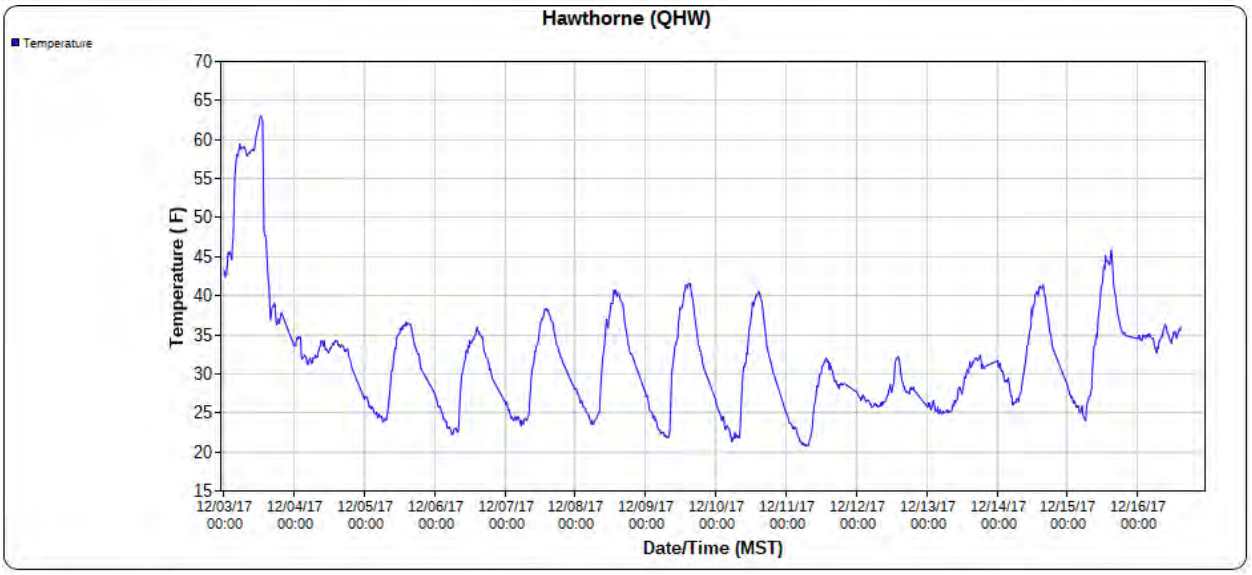
Name _____ **Date** _____

Lesson #2 - Relationships Between Two Variables **Procedure and Analysis Worksheet**

Phenomenon: 'Bad air days' and other changes in our sky have a pattern, every winter they reoccur.

OPTION A





1. Examine the graphs. Be sure to notice the following (you are not drawing any conclusions, just making observations):
    a. Variable(s) on the X axis
    b. Variable(s) on the Y axis
    c. Title of the graph
    d. Location or Date/Time of Data
    e. General pattern in the data
    f. High and Low data points
    g. Is there anything else you notice?
2. Develop questions from the patterns you see in the data.

3. Construct an explanation for what you think could be occurring (6-8 sentences) that summarizes your findings in the graph. This summary (predictions) should include many of the observations you made in #1.

4. How did your predictions compare to the actual graphs?

5. What relationship do you see between PM 2.5 and Temperature in the graphs?

6. Create an argument for evidence from your prediction.

7. Make predictions about the relationship between PM 2.5 and other variables such as humidity or wind speed.

8. With information from above and the lecture, evaluate and communicate your findings and design a set of solutions.

Name _____ **Date _____**

Lesson #2 - Relationships Between Two Variables **Procedure and Analysis Worksheet**

Phenomenon: 'Bad air days' and other changes in our sky have a pattern, every winter they reoccur.

OPTION B

1. Use the data set provided by your teacher to create two graphs, one of PM 2.5 concentration and the other for temperature over time for this inversion event. Follow your teacher's instructions to graph this data.

2. Examine the graphs. Be sure to notice the following (you are not drawing any conclusions, just making observations):
    a. Variable(s) on the X axis
    b. Variable(s) on the Y axis
    c. Title of the graph
    d. Location or Date/Time of Data
    e. General pattern in the data
    f. High and Low data points
    g. Is there anything else you notice?

3. Develop questions from the patterns you see in the data.

4. Construct an explanation for what you think could be occurring (6-8 sentences) that summarizes your findings in the graph. This summary (predictions) should include many of the observations you made in #2.

_____

_____

_____

_____

_____

_____

_____

5. How did your prediction compare to the actual graphs?

_____

_____

6. What relationship do you see between PM 2.5 and Temperature in the graphs?

7. Create an argument for evidence from your prediction.

8. Make predictions about the relationship between PM 2.5 and other variables such as humidity or wind speed.

9. With information from above and the lecture, evaluate and communicate your findings and design a set of solutions.

Name _____ **Date _____**

Lesson #2 - Relationships Between Two Variables **Procedure and Analysis Worksheet**

Phenomenon: 'Bad air days' and other changes in our sky have a pattern, every winter they reoccur.

OPTION C

1. Click here to open the MesoWest website.

2. Follow the steps below VERY carefully. They will walk you through how to use the MesoWest website to generate graphs of PM 2.5 Concentration and Temperature during an inversion event.

    a. Zoom in on the map to find the Hawthorne Elementary sensor (QHW). It is a square on 700 East just North of the 215 Belt Route.

    b. Click on the square and then click on the QHW link at the top of the box. This will take you to the data page for that specific sensor. The Hawthorne sensor is a Department of Air Quality sensor and is the longest running sensor on the MesoWest network, which are the reasons we have chosen this sensor to work with for this activity.

    c. This page shows real time data so we now need to select the data set for the PM 2.5 event we want to examine. Click on the option in the left hand column "Change Date/Time."

    d. Choose 16 December 2017 at 23:00.

    e. Click on the option in the left hand column "Change to Graphical Display."

    f. For the time period, select "Previous 14 Days" for the variable in the top graph select "PM_2.5 Concentration." Then click "Change Graph." The graph should display two lines (one for each of the two sensors on the QHW device).

    g. For the variable in the bottom graph select "Temperature." Then click "Change Graph."

3. Use the data set provided by your teacher to create two graphs, one of PM 2.5 concentration and the other for temperature over time for this inversion event. Follow your teacher's instructions to graph this data.

4. Examine the graphs. Be sure to notice the following (you are not drawing any conclusions, just making observations):
    a. Variable(s) on the X axis
    b. Variable(s) on the Y axis
    c. Title of the graph
    d. Location or Date/Time of Data
    e. General pattern in the data
    f. High and Low data points
    g. Is there anything else you notice?

5. Develop questions from the patterns you see in the data.
6. Construct an explanation for what you think could be occurring (6-8 sentences) that summarizes your findings in the graph. This summary (predictions) should include many of the observations you made in #4.

7. What relationship do you see between PM 2.5 and Temperature in the graphs?

8. Create an argument for evidence from your prediction.

9. Make predictions about the relationship between PM 2.5 and other variables such as humidity or wind speed.

10. With information from above and the lecture, evaluate and communicate your findings and design a set of solutions.

_____

_____

_____

_____

_____

_____

11. As an extension, use the MesoWest website to create graphs of relative humidity and wind speed for the same time frame and compare the results to the PM 2.5 graph.

Student Worksheets

Lesson #3 - Spatial Variation of a Variable

Name _____ **Date** _____

Lesson #3 - **Spatial Variation of a Variable** **Prediction Worksheet**

Phenomenon: On bad air days, the pollution starts from the north part of town and moves to the south, so is the air cleaner in the south?

Prediction - create a color coded map that predicts how PM 2.5 concentrations will vary across the Salt Lake Valley during an inversion event. Construct an explanation with a minimum of 4-6 sentences to justify for your prediction.

_____

_____

_____

_____

_____

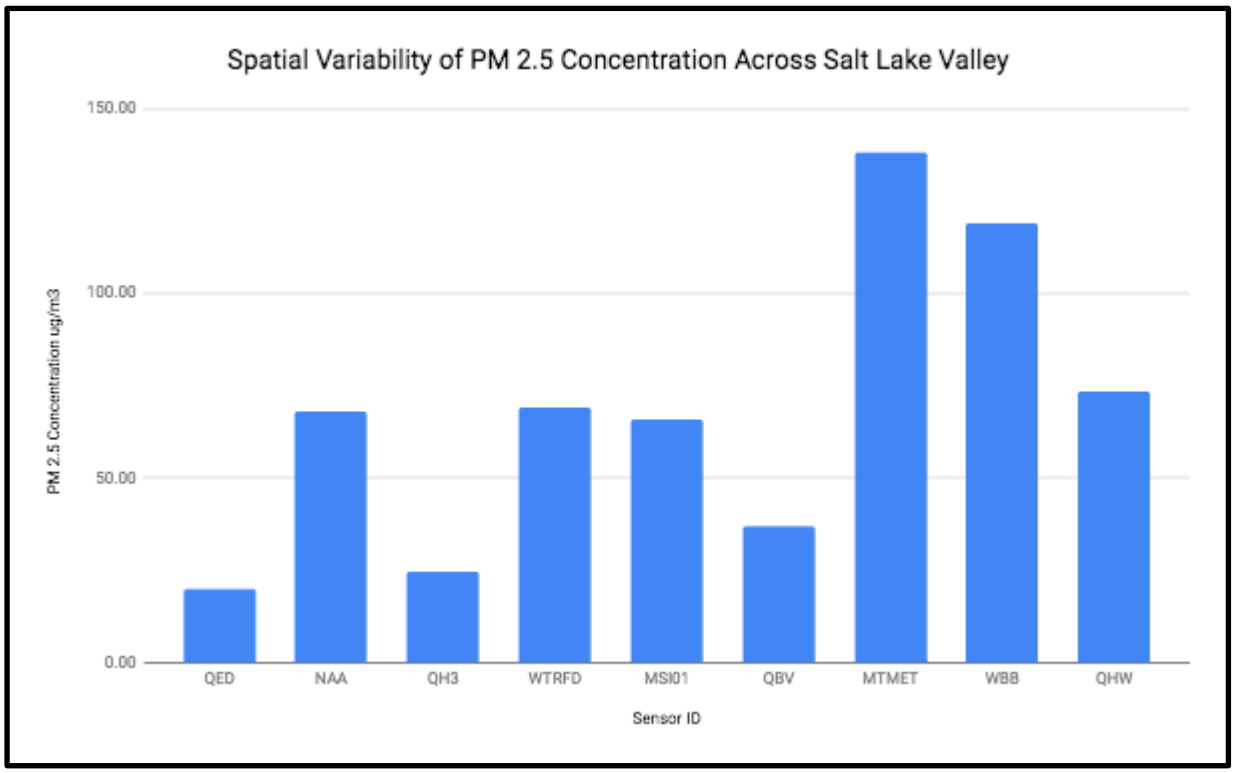
_____

Name _____ **Date** _____

Lesson #3 - Spatial Variation of a Variable **Procedure and Analysis Worksheet**

Phenomenon: On bad air days, the pollution starts from the north part of town and moves to the south, so is the air cleaner in the south?

OPTION A



1. Examine the graph. Be sure to notice the following (you are not drawing any conclusions, just making observations):
    a. Variable(s) on the X axis
    b. Variable(s) on the Y axis
    c. Title of the graph
    d. Location or Date/Time of Data
    e. General pattern in the data
    f. High and Low data points
    g. Is there anything else you notice?

2. Develop questions from the patterns you see in the data.

3. Construct an explanation for what you think could be occurring (6-8 sentences) that summarizes your findings in the graph. This summary (predictions) should include many of the observations you made in #1.

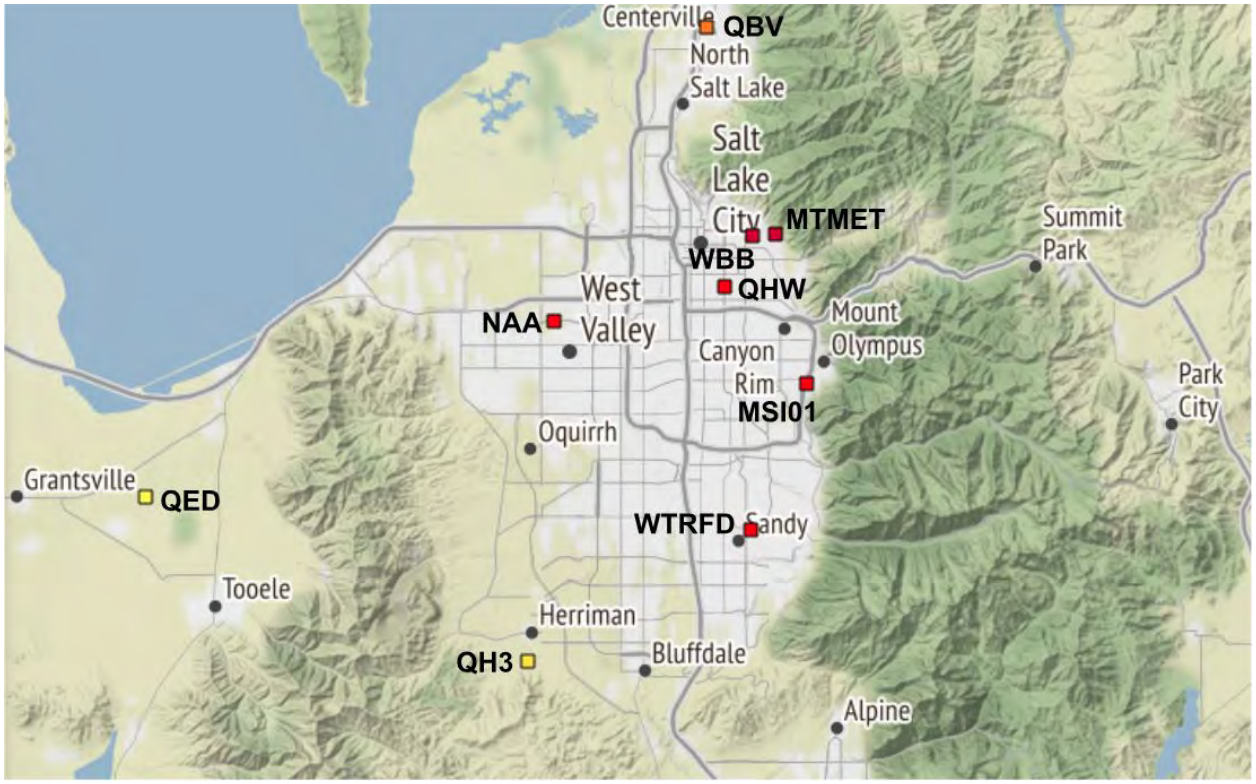
4. Look at your map template of the Salt Lake Valley. Each label represents a PM 2.5 sensor that collects data for the MesoWest website. Using your graph, write in the PM 2.5 concentration for each sensor during this particular inversion event.

5. Make a prediction about what you observe about PM 2.5 variation across the valley.

6. What relationships or factors might be responsible for the patterns we see in spatial variability of PM 2.5?

7. Create an argument for evidence from your prediction.

8. What other variables (weather, geographic, geologic, environmental, biological, etc) have predictable spatial variability across the Salt Lake Valley?



Name _____ **Date _____**

Lesson #3 - Spatial Variation of a Variable **Procedure and Analysis Worksheet**

Phenomenon: On bad air days, the pollution starts from the north part of town and moves to the south, so is the air cleaner in the south?

OPTION B

1. Use the data set provided by your teacher to create a graph of PM 2.5 concentration at different sensor locations in the Salt Lake Valley during this inversion event. Follow your teacher's instructions to graph this data.

2. Examine the graph. Be sure to notice the following (you are not drawing any conclusions, just making observations):
    a. Variable(s) on the X axis
    b. Variable(s) on the Y axis
    c. Title of the graph
    d. Location or Date/Time of Data
    e. General pattern in the data
    f. High and Low data points
    g. Is there anything else you notice?

3. Develop questions from the patterns you see in the data.

4. Construct an explanation for what you think could be occurring (6-8 sentences) that summarizes your findings in the graph. This summary (predictions) should include many of the observations you made in #2.

_____

_____

_____

_____

_____

_____

_____

_____

_____

5. Look at your map template of the Salt Lake Valley. Each label represents a PM 2.5 sensor that collects data for the MesoWest website. Using your graph, write in the PM 2.5 concentration for each sensor during this particular inversion event.

6. Make a prediction about what you observe about PM 2.5 variation across the valley.

7. What relationships or factors might be responsible for the patterns we see in spatial variability of PM 2.5?

_____

_____

_____

8. Create an argument for evidence from your prediction.

_____

_____

_____

_____

_____

9. What factors might be responsible for the patterns we see in spatial variability of PM 2.5?

_____

_____

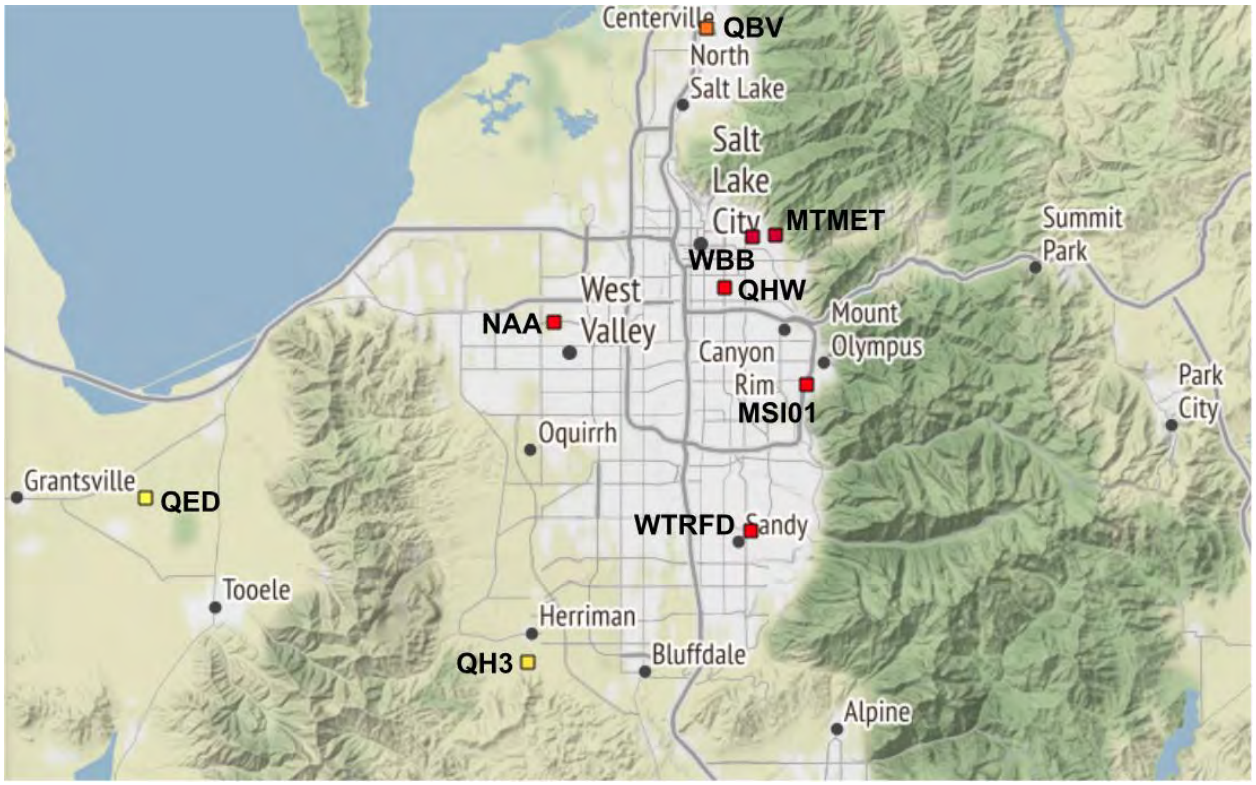
_____

_____

_____

10. What other variables (weather, geographic, geologic, environmental, biological, etc) have predictable spatial variability across the Salt Lake Valley?

_____


Centerville
QBV
North
Salt Lake
Salt
Lake
City
MTMET
WBB
QHW
Summit
Park
West
Valley
NAA
Mount
Olympus
Canyon
Rim
MSI01
Park
City
Oquirrh
Grantsville
QED
WTRFD
Sandy
Tooele
Herriman
QH3
Bluffdale
Alpine

Name _____ **Date _____**

Lesson #3 - Spatial Variation of a Variable **Procedure and Analysis Worksheet**

Phenomenon: On bad air days, the pollution starts from the north part of town and moves to the south, so is the air cleaner in the south?

OPTION C

1. Click here to open the MesoWest website.

2. Follow the steps below VERY carefully. They will walk you through how to use the MesoWest website to gather data to create a graph of PM 2.5 concentration at different sensor locations in the Salt Lake Valley during this inversion event. Follow your teacher's instructions to graph this data.

    a. the link "To view additional data, please visit our full air quality website here."

    b. At the top of the page, hover over "Air Quality Data" and then click on "Map Archive."

    c. Select the parameters for December 12, 2017 at 12:00 for PM 2.5 Concentration. Click "Update Time and Primary Options."

    d. Center the map around Salt Lake City and click the zoom button once.

    e. Notice the color coded squares, each corresponds to an air quality sensor.

    f. Click on each sensor and record the sensor label and PM 2.5 concentration in a spreadsheet. You should have data for 9 different sensors.

    g. Use this data to create a bar graph showing PM 2.5 concentration for the 9 different sensors in the Salt Lake Valley.

3. Use the data set provided by your teacher to create a graph of PM 2.5 concentration at different sensor locations in the Salt Lake Valley during this inversion event. Follow your teacher's instructions to graph this data.

4. Examine the graph. Be sure to notice the following (you are not drawing any conclusions, just making observations):
    a. Variable(s) on the X axis
    b. Variable(s) on the Y axis
    c. Title of the graph
    d. Location or Date/Time of Data
    e. General pattern in the data
    f. High and Low data points
    g. Is there anything else you notice?

5. Develop questions from the patterns you see in the data.

6. Construct an explanation for what you think could be occurring (6-8 sentences) that summarizes your findings in the graph. This summary (predictions) should include many of the observations you made in #4.

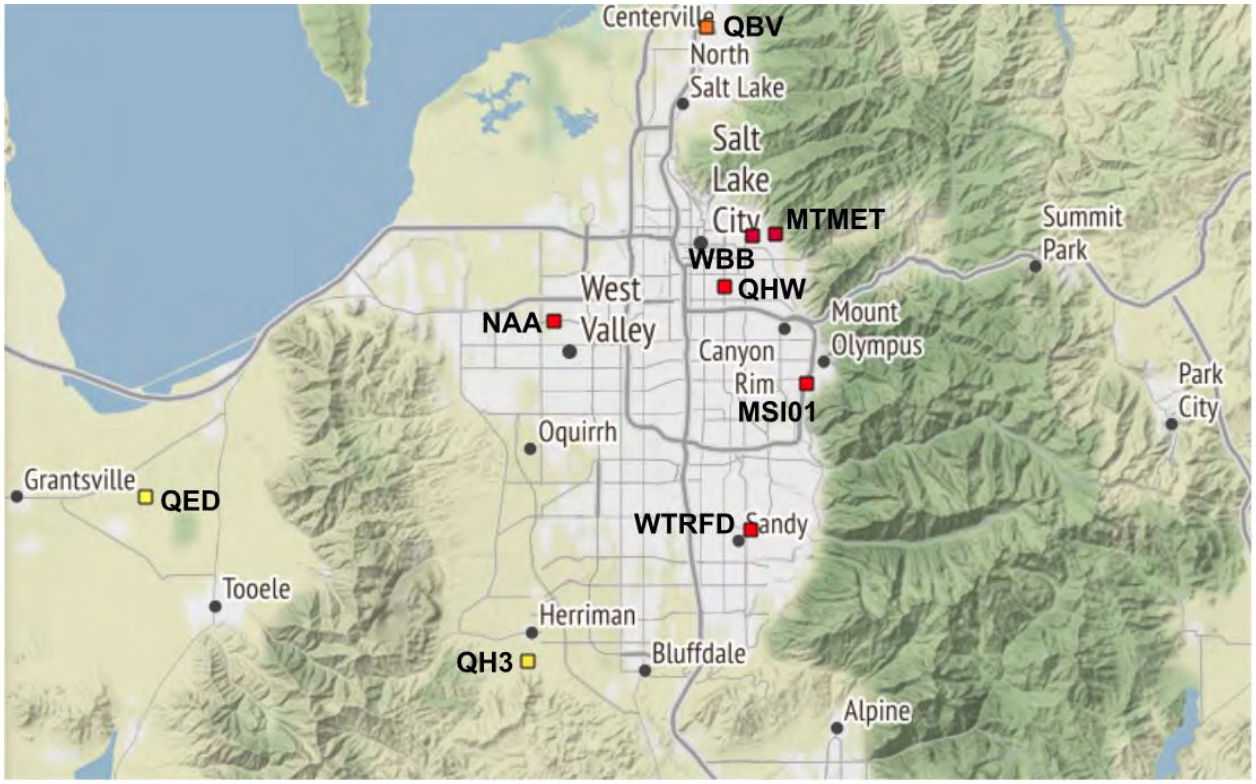
7. Look at your map template of the Salt Lake Valley. Each label represents a PM 2.5 sensor that collects data for the MesoWest website. Using your graph, write in the PM 2.5 concentration for each sensor during this particular inversion event.

8. Make a prediction about what you observe about PM 2.5 variation across the valley.

9. What relationships or factors might be responsible for the patterns we see in spatial variability of PM 2.5?

10. Create an argument for evidence from your prediction.

11. What other variables (weather, geographic, geologic, environmental, biological, etc) have predictable spatial variability across the Salt Lake Valley?


Centerville
QBV
North
Salt Lake
Salt
Lake
City
MTMET
WBB
QHW
Summit
Park
West
Valley
NAA
Mount
Olympus
Canyon
Rim
MSI01
Park
City
Oquirrh
Grantsville
QED
WTRFD
Sandy
Tooele
Herriman
QH3
Bluffdale
Alpine