Classroom Meteorologists: An Experiential Approach to Learning about Seasons and Weather

Grade Level or Special Area: Kindergarten
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Length of Unit: Seven lessons, 19 days with 30-45 minutes per day, six days with 20 minutes per day and five-ten minutes per day for four months)

I. ABSTRACT

At the beginning of the school year, the weather concepts of wind, clouds, precipitation and temperature are introduced along with various tools to measure the weather. Then, for a month during each of three seasons, students record daily observations. Students interpret results and draw conclusions from their yearlong study. The unit ends with an exploration of Earth's three climate zones and offers an optional discussion of why seasons happen.

II. OVERVIEW

A. Concept Objectives
   1. Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations. (Colorado State Science Standard #1)
   2. Students understand the general characteristics of the atmosphere and fundamental processes of weather. (Colorado State Science Standard #4.2)
   3. Students understand characteristics of the four seasons. (Colorado State Science Standard #4.4)
   4. Students understand how to use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems. (Colorado State Mathematics Standard #5)

B. Content from the *Core Knowledge Sequence*
   1. Seasons and Weather (page 20)
      a. The four seasons
      b. Characteristic local weather patterns during different seasons
      c. The sun: source of light and warmth
      d. Daily weather changes
         i. Temperature: thermometers are used to measure temperature
         ii. Clouds
         iii. Rainfall: how the conditions of the ground varies with rainfall; rainbows
         iv. Thunderstorms: lightning and thunder, hail, safety during thunderstorms
         v. Snow and snowflakes, blizzard

C. Skill Objectives (all based on Colorado Content Standards for students K-4)
   1. Students will identify observable patterns in their lives and predict future events based on those patterns.
   2. Students will state predictions (hypotheses) that can be addressed through scientific investigation.
   3. Students will create and use a simple device to gather data related to an investigation that addresses an everyday problem or task.
   4. Students will make observations and describe existing weather conditions by collecting and recording weather data.

5. Students will use approximate measures of familiar objects to develop a sense of measurement.
6. Students will use appropriate standard and non-standard units of measurement in problem-solving situations.
7. Students will describe existing weather conditions by collecting and recording weather data on cloud cover and wind.
8. Students will examine, describe and compare clouds in terms of common properties (shape, color, size and texture).
9. Students will use length measurements in centimeters.
10. Students will construct, read and interpret displays of data using charts and graphs.
11. Students will generate, analyze and make predictions based on data obtained from devices.
12. Students will name the four seasons and describe what the weather is mostly like in each season.

III. BACKGROUND KNOWLEDGE

A. For Teachers
   1. *What Your Kindergartener Needs to Know* by E.D. Hirsch Jr.
   2. *Core Knowledge: Teacher Handbook, Grade K*
   3. *Core Knowledge Sequence*

B. For Students – Not Applicable

IV. RESOURCES

A. *Cloudy with a Chance of Meatballs* by Judi Barrett (Lesson One)
B. *Wind* by Marion Dane Bauer (Lesson Two)
C. *The Cloud Book* by Tomie de Paolo (Lesson Three)
D. *Snow* by Marion Dane Bauer (Lesson Four)
E. *Rain* by Marion Dane Bauer (Lesson Four)
F. *Why Does It Rain?* by Marian B. Jacobs (Lesson Four)
G. *When a Storm Comes Up* by Allan Fowler (Lesson Four)
H. *Snow is Falling* by Franklyn Branley (Lesson Four)
I. *Snowflake Bentley* by Jacqueline Briggs Martin (Lesson Four)
J. *Flask, Crash, Rumble and Roll* by Franklyn Branley (Lesson Four)
K. *On the Same Day in March: A Tour of the World's Weather* by Marilyn Singer (Lesson Seven)

V. LESSONS

Lesson One: What Is Weather? (one day, 45 minutes)

A. *Daily Objectives*
   1. Concept Objective(s)
      a. Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.
      b. Students understand the general characteristics of the atmosphere and fundamental processes of weather.
   2. Lesson Content
      a. Characteristic local weather patterns during different seasons
   3. Skill Objective(s)
      a. Students will identify observable weather patterns in their lives and predict future weather based on those patterns.

B. *Materials*
   1. *Cloudy With a Chance of Meatballs* by Judi Barrett
   2. Chart paper and marker
   3. Student science journals (8 ½ x 11 notebook works well), one for each student
   4. Coloring utensils like markers, crayons and colored pencils

C. *Key Vocabulary* (definitions taken from Core Knowledge Kindergarten Handbook or dictionary.com)
   1. *Weather* is the condition of the atmosphere.
   2. The *atmosphere* is the air in our world.
   3. A *meteorologist* is a scientist who studies the weather.

D. *Procedures/Activities*

Lessons One-Five should be taught as early in the school year as possible (August/September) to introduce the yearlong study of weather.

   1. Have students get seated on the carpet.
   2. Ask students to tell you what the word weather means to them.
   3. Record their answers on chart paper.
   4. Show students the cover of *Cloudy with a Chance of Meatballs*.
   5. Tell them that this is a story about weather, but there is something funny about it.
   6. Tell them it is their job to figure out what the funny thing is and tell you at the end.
   7. Read *Cloudy with a Chance of Meatballs* aloud.
   8. Ask students what was so funny about the weather.
   9. Ask them to tell how the weather in the story was different from the weather in their world.
   10. Introduce the definition of weather as the condition of the atmosphere. Explain that the atmosphere is the air in our world.
   11. Have students say each term and its definition with you.
   12. Tell students that this year, it is their job to become a special kind of scientist called a meteorologist.
   13. Say the definition of a meteorologist (a scientist who studies the weather). Have students say the word meteorologist a few times.
   14. Tell students that meteorologists have to make observations and measurements of the world around them to describe the weather. In the next few days, they will learn how to do things like meteorologists.
   15. Before they become meteorologists, explain to the students that you want to see everything they already know about weather.
   16. Ask them to think about the types of weather in our world. Give them at least 30 seconds.
   17. Tell them their job is to:
       a. find the next blank page in their science notebook;
       b. write and draw every kind of weather they can remember happening; and
       c. turn their page to the back and draw and/or write their guess or prediction about what the weather will be like tomorrow.
   18. Send students back to their seats to work and circulate to ensure everyone understood directions. Allow at least 15 minutes of work time and encourage students who finish quickly to add more detail or think of more types of weather.

E. *Assessment/Evaluation*
   1. Use your chart paper record and students' writings/drawings to assess what they already know about weather and whether they can predict from what they know.

Lesson Two: Wind (two days spread apart by a week, 45 minutes each day; a few minutes from each daily allotted recess time; one additional 20 minute read aloud time)

A. *Daily Objectives*

1. Concept Objective(s)
   a. Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.
   b. Students understand the general characteristics of the atmosphere and fundamental processes of weather.
   c. Students understand how to use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.
2. Lesson Content
   a. Daily weather changes
3. Skill Objective(s)
   a. Students will state predictions (hypotheses) that can be addressed through scientific investigation.
   b. Students will create and use a simple device to gather data related to an investigation that addresses an everyday problem or task.
   c. Students will make observations and describe existing weather conditions by collecting and recording weather data.
   d. Students will use approximate measures of familiar objects to develop a sense of measurement.
   e. Students will select and use appropriate standard and non-standard units of measurement in problem-solving situations.

B. *Materials*

1. Wind sock, kite and/or flag
2. Wooden block and a few other objects that will not move in the wind
3. Screwdriver, pliers, measuring cup and/or other "tools"
4. Chart paper and marker
5. Box of materials for creating own windsocks/kites/flags – should include various scraps of fabric and various tools to use as handles along with a variety of other materials (this type of box is great to keep around all year long, you can throw in all kinds of scraps and little bits – paper towel rolls, toothpicks, spoons, broken toy pieces (non-dangerous), scraps of all kinds of materials, etc.)
6. Tape, glue, string and any other materials that can be used for sticking things together
7. Scientific Method Chart (Appendix A)
8. Weather Measurement Chart (Appendix B, page 1)
9. Science journals, one for each student
10. *Wind* by Marion Dane Bauer

C. *Key Vocabulary*

1. *Weather* is the condition of the atmosphere.
2. The *atmosphere* is the air in our world.
3. A *meteorologist* is a scientist who studies the weather.
4. *Wind* is moving air.

D. *Procedures/Activities*

Day One:

1. Have students find their places on the carpet.
2. Remind them that this year they will be acting like meteorologists.
3. Say the term and definition together a couple times.
4. Tell them the first type of weather they will learn to measure is wind.

5. Explain that wind is moving air.
6. Ask students if they have felt wind, tell them to describe their experiences to you.
7. Take a few responses.
8. Tell them as meteorologists, it is their job to measure the wind every day.
9. In order to measure the wind, they first have to answer the question, "What kind of tools are best for measuring wind?" (Write this question as part of the Scientific Method Chart; see Appendix A.)
10. Show students the wind sock/kite/flag, the wooden block and other heavy objects and the tools.
11. Ask them to each make a hypothesis or guess about which object will be best for measuring the wind. Record each child's hypothesis next to their name on the chart paper. Also, encourage students to answer in complete sentences. You might want to model the first response.
12. Tell students the next job they have is to do a test to find out if their hypothesis is true. In order to do this, tell them you will all go outside in a minute. When they get outside, it is their job to take turns with the objects and decide which one they would use to measure wind. Tell them that when they are measuring wind, they should think about two things: 1) how hard is it blowing and 2) which way is it coming from.
13. Have students line up and take them outside. Give them about 10 minutes to try holding up each object in the air.
14. Return to the classroom and ask each student if they found out that their hypothesis was true or if they want to change which tool they think is best for measuring wind. Record results on the Scientific Method Chart (see example in Appendix A) that you already started.
15. Discuss how light things move in the wind and heavier things do not.
16. Encourage students to work with these objects more during recess times and record the results that they find on a Weather Measurement Chart (Appendix B, page 1) which they can keep in their journals. Do this for at least five days. If you have time, you can keep a large class chart as well so students can see what their results should have been.

Day Two:

17. Have students join you on the carpet.
18. Review your experiment from Day One and remind students of the results they found.
19. Tell them that today, their job as meteorologists is to build their own wind measuring tool.
20. Ask them to look closely at the best tools they have worked with for measuring wind. Have them describe the parts of the tool. (*For a flag, they should say it has a handle and a light piece of cloth on the end, a windsock has a hook to hold and light fabric on the end, etc.*)
21. Encourage them to include a handle and something that will blow in the wind to make their own windsocks.
22. Show students the box of materials they can use and be sure to provide choices for sticking materials together like tape, glue and string.
23. Tell students that when you call them they should: 1) pick three materials and one sticky thing, 2) go back to their seat and try to make a wind sock, and 3) come back for different materials if necessary. Tell them they should keep working for the whole time to make their very best wind measuring object.

24. Allow students 15-20 minutes to work. Let them know when they are down to five minutes. If any students insist they have done their best and are finished, you can allow them to make a second windsock design.
25. Have all students stop working, clean up their messes and bring their windsocks to the carpet.
26. When everyone is ready, tell them they will have five minutes to go outside and take a measurement with their windsock.
27. Explain that they can also compare their creation to the objects from the previous day to see if their windsock is working.
28. Remind them that they must look for two things: 1) how hard is the wind blowing and 2) which way is it coming from because they will each record their findings on your Weather Measurement Chart (see Appendix B, page 1 for an example of how to make the Weather Measurement Chart on chart paper but instead of numbering days, write each student's name down the left side).
29. You can bring the Weather Measurement Chart outside with you for them to record their findings or you can have them record findings when you return inside (as a whole group or taking turns one by one while the others are doing something else).
30. Go outside and allow five minutes for measuring.
31. Once students have recorded their answers to the two questions: 1) how hard is the wind blowing and 2) which way is it coming from, discuss the results of the experiment. Tell them what the windsock reading was for the day, and explain that if all their tools are working and being used correctly, they should have all gotten the same answers.
32. You may want to allow time at centers or other times for students to improve their windsocks. Those who did not get accurate measurements may need coaching on how to make their windsock and/or on how to measure the wind when outside. (You could do the coaching, or have students work with partners so struggling students can be matched with students who understand.)
33. You can continue to measure the wind daily while students learn about other concepts and keep a class chart or have each student keep their own chart in their science journal to show what they observe each day. Either chart can be similar to Appendix B, page 1.
34. **Supplementary Activity:**
    a. On another day or at another time of day, you should read a book that explains how wind works such as *Wind*. Be sure to ask or discuss with students what makes wind (when some air gets hotter than other air from the sun heating different areas).
    b. You should also make a variety of weather books available in the classroom library for students.

E. *Assessment/Evaluation*

1. **Day One:** Look at student's hypotheses and results to determine if they understand what kinds of things the wind can blow and also to see if they effectively used the testing time to see whether their hypothesis was true.
2. **Day Two:** Look at students' recordings on your Weather Measurement Chart to determine if student's windsocks are working and if they understand how to answer the two questions about wind strength and direction. Also, watch when students are making their observations to see if some students copy others or ask for help from others.

3. **Ongoing:** Watch each individual student's daily data recordings about the wind and determine their accuracy. Students who regularly have inaccurate measurements should continue to be peer or teacher coached.

Lesson Three: Clouds (two days spread apart by a week, 30 minutes each day. A few minutes daily at recess time)

A. *Daily Objectives*
   1. Concept Objective(s)
      a. Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.
      b. Students understand the general characteristics of the atmosphere and fundamental processes of weather.
   2. Lesson Content
      a. Daily weather changes: Clouds
   3. Skill Objective(s)
      a. Students will state predictions (hypotheses) that can be addressed through scientific investigation.
      b. Students will describe existing weather conditions by collecting and recording weather data on cloud cover and wind.
      c. Students will examine, describe and compare clouds in terms of common properties (shape, color, size and texture).

B. *Materials*
   1. *The Cloud Book* by Tomie de Paolo
   2. Scientific Method Chart (Appendix A)
   3. Weather Measurement Chart (Appendix B, page 1), add one more column titled Clouds where students can draw a picture of the clouds they see
   4. Science journals, one for each student
   5. Coloring utensils
   6. Chart paper and markers

C. *Key Vocabulary*
   1. A *cloud* is a visible mass of water vapor that is suspended in the air.
   2. *Weather* is the condition of the atmosphere.
   3. The *atmosphere* is the air in our world.
   4. A *meteorologist* is a scientist who studies the weather.
   5. *Cirrus* clouds are thin, high white clouds.
   6. *Stratus* clouds are low and gray clouds.
   7. *Cumulus* clouds are fluffy like cotton balls.

D. *Procedures/Activities*

Day One:

   1. Have students join you on the carpet.
   2. Ask them what you call a person who studies weather.
   3. Practice saying the word meteorologist with them a few times.
   4. Tell them that now that they know how to measure wind, it is time to learn to describe another type of weather, the clouds.
   5. Ask students, "Do clouds always look the same? Describe how they look." Write this question on a Scientific Method Chart (Appendix A).
   6. Have each student make a hypothesis about how they think clouds look. Encourage students to add details if they say clouds do not always look the same. Also, encourage students to answer in complete sentences. You might want to model the first response.

7. Once every student has made a hypothesis, explain that you are going to test this hypothesis for the next five days by going outside and drawing a picture of how the clouds looks.
8. Show students how to create a chart by making one on chart paper. You may also want to show a sample observation of clouds so students understand how to draw the outline of something that is white. Then, have students return to their seats to make their own chart in their journals. (The chart should be the same as Appendix B, page 1 except add a column for Clouds in addition to Wind Speed and Direction).
9. When everyone is finished creating their charts, take them outside for their first observation and give them around 10 minutes. Help any students who are having trouble with their first drawing.
10. For the next five days, take students outside at recess time and have them draw the clouds before they come back inside. This is a good time to continue observing the wind as well. Add cloud drawings and wind measurements to your large class chart when you come back inside if you are keeping one.

Day Two:

11. Have students join you on the carpet.
12. Tell them you are impressed with their cloud observations and record the results of your experiment together.
13. Then show them *The Cloud Book*.
14. Tell them that this book tells about all the kinds of clouds that you can see in the sky. Also, tell them that when you finish reading the story, you will label the large chart of observations you have been keeping all week with the names for the different kinds of clouds. Encourage students to try to remember the names of the kinds of clouds on the chart.
15. Read *The Cloud Book* aloud.
16. When finished, remind students that the three main types of clouds are cirrus, stratus and cumulus. Draw and label a chart of these three kinds using students' help. Tell them these are the three they will use to label observations.
17. Ask students to look back at the chart of observations you made all week. Have students take turns labeling your chart with the word cirrus, stratus or cumulus for each day.
18. Finally, have students go back to their seats and label their own charts from the past week.
19. Supplementary Activity: You should make a variety of weather books available in the classroom library for students. *Snow* and *Rain* are two books that students might be able to read themselves.

E. *Assessment/Evaluation*

1. **Day One and that week:** Look at each child's hypothesis to see if they understand how to make a hypothesis. Look at children's drawings of the clouds to see if they accurately record what the clouds look like. Assign a peer to or spend some time with any student having difficulty making accurate observations.
2. **Day Two:** Look at each student's labels for the clouds in their observations. See if they applied the terms learned from reading correctly to their direct observations and look to see if they made accurate observations.

Lesson Four: Precipitation: Rain, Sleet, Snow and Hail (three days, 45 minutes per day; a few minutes daily at recess; two optional additional 20 minute read aloud times)

A. *Daily Objectives*
   1. Concept Objective(s)
      a. Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.
      b. Students understand the general characteristics of the atmosphere and fundamental processes of weather.
      c. Students understand how to use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.
   2. Lesson Content
      a. Daily weather changes
         i. Rainfall: how the conditions of the ground varies with rainfall
         ii. Thunderstorms: lightning and thunder, hail
         iii. Snow and snowflakes, blizzard
   3. Skill Objective(s)
      a. Students will use a simple device to gather data related to an investigation that addresses an everyday problem or task.
      b. Students will make observations and describe existing weather conditions by collecting and recording weather data.
      c. Students will use length measurements in centimeters.
      d. Students will use appropriate standard and non-standard units of measurement in problem-solving situations.

B. *Materials*
   1. Five large coffee cans (or enough to give one to each group of four students)
   2. Five centimeter rulers (preferably plastic so they can get wet without being ruined) (or enough to give one to each group of four students)
   3. Other objects that would not make good measuring devices such as wooden blocks, sponges, paint brushes, pliers, etc.
   4. Chart paper and markers
   5. Weather Measurement Chart (Appendix B, page 2)
   6. Scientific Method Chart (Appendix A)
   7. Science journals, one for each student
   8. *Snow* by Marion Dane Bauer
   9. *Rain* by Marion Dane Bauer
   10. *Why Does It Rain?* by Marian B. Jacobs
   11. *When a Storm Comes Up* by Allan Fowler
   12. *Snow is Falling* by Franklyn Branley
   13. *Snowflake Bentley* by Jacqueline Briggs Martin
   14. *Flask, Crash, Rumble and Roll* by Franklyn Branley

C. *Key Vocabulary*
   1. *Weather* is the condition of the atmosphere.
   2. The *atmosphere* is the air in our world.
   3. A *meteorologist* is a scientist who studies the weather.
   4. *Precipitation* is water that falls to the earth as rain, sleet, snow or hail.
   5. A *centimeter* is a unit of measure.

D. *Procedures/Activities*

   <u>Day One:</u>
   1. Have students join you on the carpet.
   2. Ask students what you call a person who studies the weather.

3. Say meteorologist with them a few times.
4. Ask students, what is weather?
5. Remind them that it is the condition of the atmosphere, or the way the air is around us.
6. Ask students to tell you the two types of weather they have learned about so far (*wind and clouds*).
7. Tell students that today they will learn about a new type of weather called precipitation.
8. Have students say precipitation with you a few times.
9. Tell them it means water that falls to the earth and that it can be rain, snow, sleet or hail.
10. Ask students to tell about their experiences with precipitation. Take a few responses.
11. Tell them you have a story that tells about all the kinds of precipitation and the kinds of storms that happen too.
12. Read the story *When a Storm Comes Up* to help them understand the different words for precipitation.
13. After pages seven, eight, nine and ten, ask students what kind of storm this is (*drizzle, shower, rainstorm, thunderstorm respectivel*y). Ask if this storm has precipitation (*yes*). Ask what kind (*rain*).
14. After pages 13 and 15, ask students to name the storm (*snowstorm, blizzard respectively*). Ask if the storm has precipitation (*yes*). Ask what kind (*snow*).
15. After page 17, ask what kind of precipitation was in this storm (*sleet*).
16. After page 19, ask the name of the storm (*hailstorm*), if there is precipitation (*yes*) and what kind (*hai*l).
17. After page 23, ask students to name the kind of storm (*hurricane*), tell if it has precipitation (*yes*) and tell what kind (*rai*n).
18. After page 25, ask students to name the storm (*tornado*) and to tell if it has precipitation (*no*).
19. Tell them that it will be their job to measure the precipitation that falls to the playground and that you need to select the right tools for doing this as a class.
20. Ask students what kind of tool they might use to catch precipitation. Take a few responses.
21. Hold up a variety of objects that would not hold water. Ask students to give you a thumbs up if this would measure precipitation and a thumbs down if it would not.
22. Last, hold up a coffee can. Students should give you a thumbs up.
23. Tell them that each group (you can use groups by table or make your own groups) will get their own coffee can. It will be their job to place their can somewhere outside that they think it will collect rain well. Encourage students not to place cans in places where many children play since they might get knocked over.
24. Tell them that they will use these cans to see how much precipitation falls, and that they will also have to tell what type of precipitation fell and what happened to the ground afterwards.
25. Model an example recording for their charts on a large chart you create on chart paper (Appendix B, page 2).
26. Take students outside and give each group their can. Give students five minutes to place their cans before returning inside.

27. Once back inside, return to the carpet with another coffee can filled partially with water. Ask students how they will know how much precipitation falls in a can. Show them your can and ask how much is in this can. Take a few responses.
28. Explain that there are many ways to measure how much of something. For example, you can measure how much by placing snap cubes together and telling how many snap cubes high the water is. Or, you can stick your hand in and measure how high the water comes on your hand. Tell them that one way people have all decided to measure is using a centimeter.
29. Show them a centimeter on a ruler and tell them that a centimeter is always the exact same size.
30. Tell students that centimeters are used to measure lots of things, like how long or tall something is. Demonstrate with a few objects.
31. Next, demonstrate how to measure the level of the water in centimeters.
32. Leave this can and a few other objects out at a center for students to practice measuring independently.
33. You may need to take extra time to re-teach this concept on another occasion, perhaps in Math.
34. Have students prepare a chart in their notebooks for their weather measurements. You can draw a large example on chart paper (follow Appendix B, page 2).
35. Take students outside each day during recess and allow them to measure precipitation type/amount/what happens to the ground, wind speed/direction and clouds. Have them empty their cans each day to measure the next day's precipitation.

Day Two:

36. Have students join you on the carpet.
37. Ask students what you call a person who studies the weather.
38. Say meteorologist with them a few times.
39. Ask students, what is weather?
40. Remind them that it is the condition of the atmosphere, or the way the air is around us.
41. Ask students to tell you the three types of weather they have learned about so far (*wind, clouds and precipitation*).
42. Ask students to remind you how wind happens (*when the sun heats air more in one place than in another so the air moves to even out how hot it is*).
43. Ask students if they have any idea how clouds and precipitation happen.
44. Take a few responses.
45. Tell them that you have a story to read that explains how clouds and precipitation happen.
46. Read *Why Does It Rain?*
47. As you read and when you finish, take some time to discuss these difficult concepts with the class.
48. If possible, take students to a kitchen and have them observe as you boil a small amount of water in a pan.
49. Watch the steam rise and tell students that it is water vapor.
50. Hold the lid of the pan over the steam until water droplets collect, show this to students and tell them that this is condensation.
51. Explain that when water is heated by the sun outside and rises as water vapor, it does not stick to a pot lid but to dust and other tiny things in the air, and that is what makes it look like a cloud.
52. If you cannot boil water, you can have students look at their breath on a cold day and explain that they see water vapor. Then have them breathe onto a window

and show them how the water condenses in droplets onto the window. Explain that when water is heated by the sun outside and rises as water vapor, it does not stick to a window but to dust and other tiny things in the air, and that is what makes it look like a cloud.

Day Three:

53. Have students join you on the carpet.
54. Ask students to remind you how precipitation happens (*the sun heats water, which makes it into water vapor that attached to dust to make clouds in the sky; when clouds get heavy, they drop the water as precipitation*).
55. Tell them that sometimes precipitation comes in the form of storms. When you have storms, you often have things like lightning and thunder.
56. Tell students you are going to read the book *Flash, Crash, Rumble and Roll* and hold it up.
57. Tell them the book will explain how lightning and thunder happen and how to stay safe in a storm.
58. Tell them when you finish reading, you are going to ask them to tell you how to stay safe in a storm.
59. Read *Flash, Crash, Rumble and Roll* out loud.
60. Ask students to tell you how to stay safe in a thunderstorm (*get out of water, go inside, stay away from TVs and phones, stay away from metal things and the bathroom, don't stand under a tree, stay in your car if that is where you are*).
61. If you want to give students more practice, open a few books to pages with pictures of people doing different things. Ask students to tell you what each person in the picture should do if a thunderstorm starts.
62. Ask students to return to their seats and draw a picture in their science journal of all the ways they can think of to stay sage in a thunderstorm.
63. **Supplementary Activity:**
    a. Other good read aloud books for these topics are *Snowflake Bentley* and *Snow Is Falling*. You might want to wait until winter to read these.
    b. You should make a variety of weather books available in the classroom library for students. *Snow* and *Rain* are two books that students might be able to read themselves.
    c. Look at each student's journal drawing of ways to stay safe in a thunderstorm to make sure they understood the concepts.

E. *Assessment/Evaluation*

1. **Day One:** Write down the name of any student who does not give a thumbs up when you hold up the coffee can. Meet with them one-on-one to do another explanation or demonstration of what will hold water.
2. **Day Two and ongoing:** Look to see that each student's recording of precipitation type and amounts are accurate. Check each group's measurements when there is a storm to see if they can use a centimeter ruler properly. Have students take turns showing you how to measure the precipitation in the can. Provide coaching to those struggling.

Lesson Five: Temperature (three days, 30 minutes per day; a few minutes daily at recess)

A. *Daily Objectives*

1. Concept Objective(s)
    a. Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.
    b. Students understand the general characteristics of the atmosphere and fundamental processes of weather.

c. Students understand how to use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.

2. Lesson Content
   a. Daily Weather Changes: Temperature: thermometers are used to measure temperature
   b. The sun: source of light and warmth
3. Skill Objective(s)
   a. Students will state predictions (hypotheses) that can be addressed through scientific investigation.
   b. Students will create and use a simple device to gather data related to an investigation that addresses an everyday problem or task.
   c. Students will make observations and describe existing weather conditions by collecting and recording weather data.
   d. Students will use approximate measures of familiar objects to develop a sense of measurement.
   e. Students will select and use appropriate standard and non-standard units of measurement in problem-solving situations.

B. *Materials*
1. Types of Weather Chart (Appendix C)
2. Chart paper and markers
3. Various thermometers and enough of one kind for pairs of students to share a thermometer
4. Sets of three cups of water for each pair of students or table of students and an extra set for yourself (in each set, one cup should be cold water and labeled with blue, one should be hot water marked with red, and one should be lukewarm and left white or plain)
5. Scientific method chart (Appendix A) drawn on chart paper
6. Weather Measurement Chart (Appendix B, page 3)
7. Computer lab with the weather.com 36-hour forecast page pulled up on each computer so students can see the forecasted highs and lows (or video tape of a weather forecast)
8. Science journals, one for each student

C. *Key Vocabulary*
1. *Weather* is the condition of the atmosphere.
2. The *atmosphere* is the air in our world.
3. A *meteorologist* is a scientist who studies the weather.
4. *Precipitation* is water that falls to the earth as rain, sleet, snow or hail.
5. A *cloud* is a visible mass of water vapor that is suspended in the air.
6. *Wind* is moving air.
7. *Temperature* is a measure of how hot or cold the air is.
8. A *thermometer* is a tool used to measure the temperature.
9. *Degrees* are how we measure temperature.

D. *Procedures/Activities*

Day One:

1. Before starting, prepare three cups of water for each pair of students or each table of four students (one icy cold, one lukewarm and one hot (but not boiling)). Also, make an extra set of three cups to use for demonstration. Label hot cups with red, cold cup with blue and leave lukewarm cups white or plain.

2. Show students the chart of how wind forms and chart of how water gets into clouds to make rain, snow, sleet and hail (Appendix C, pages 1 and 2, Types of Weather Diagrams).
3. As you explain the charts, emphasize the sun as the starting point and the changes in temperature.
4. Ask students to tell you what makes weather. If they explain hot and cold air, ask how does air get hotter and colder? What makes our earth hot some days (*Sun*)?
5. Tell students that the sun is what makes the weather. It provides light and heat, and that heat makes weather happen.
6. Tell students that one way we measure the heat from the sun is using a thermometer.
7. Have students say the word thermometer.
8. Show the students a few kinds of thermometers.
9. Ask the question, "How will the red line in the thermometer move when something is hotter?" and record this question on a Scientific Method Chart drawn on chart paper as shown in Appendix A.
10. Record each student's hypothesis.
11. Tell students their job is to: 1) share a thermometer with a partner, 2) show them that cold water is blue, medium is plain and hot water is red; tell them to start in the cold cup, then move to medium and then to hot letting the thermometer sit for a while in each cup, 3) decide with their partner what the red line is doing as they move to hotter and hotter water, and 4) repeat if they have time.
12. Give students 10 minutes to work.
13. Call them to clean up and return to the carpet.
14. Record student's results on the Scientific Method Chart you already started on the chart paper as shown in Appendix A.
15. You should discuss the fact that when things get hotter, the red line in the thermometer moves up higher.
16. Next, point out the numbers on the thermometer. For example, point to and say zero degrees Fahrenheit and ask students if zero degrees would be hot or cold. Or, point to 100 degrees Fahrenheit and ask would this be hot or cold.
17. Using one of the thermometers read the temperature and show students how to record the number of degrees on their thermometer in their chart. Tell them that when you are writing degrees you can write the big word DEGREES or you can just put a small o near the top and that means the same as writing the whole word.
18. Tell students that today they measured water temperatures but you can also measure air temperatures. It will be their job to measure the temperature now when they go outside in addition to measuring wind, clouds and precipitation.
19. Have students prepare a chart in their notebooks for their weather measurements. You can draw a large example on chart paper (follow Appendix B, page 3).
20. Give students daily times at recess (preferably at the same time of day every day) to do their weather measurements.

Day Two:

21. Have students join you on the carpet.
22. Congratulate students on becoming meteorologists.
23. Tell them that they have learned how to measure weather and are doing a great job.
24. Ask students to tell you the kinds of weather they know how to measure (*wind, clouds, precipitation, and temperature*).

25. Tell them that you have a question about temperature. The question is, "Is the temperature the same all day long?"
26. Record this question on a Scientific Method Chart on chart paper (as shown in the example in Appendix A).
27. Ask students to give their hypotheses one by one and record these on the Scientific Method Chart as well.
28. Tell students that in order to test this hypothesis, they will measure temperature three times a day for the next week (you can also do two times a day depending on time available).
29. For the next week, take students outside three times a day or place a large thermometer outside a classroom window so you can read it without taking everyone outside.
30. (Note: You will have to go out at least one of the times so students can take their other weather readings. Students can record this one measurement in journals. Other temperature measurements can be kept on a large class chart.)
31. Each of the three times you read the temperature, have a different student take a turn reading the thermometer and recording the temperatures on a Temperature Chart drawn on chart paper (as shown in Appendix D).

Day Three:

32. At the end of the week, gather students back on the carpet.
33. Look at the results of your temperature readings from the week.
34. Fill in the Results section of your Scientific Method Chart that you started earlier in the week.
35. Tell students that every day the temperature changes and we call the coolest temperature the low and the hottest temperature the high.
36. Tell students to look for highs and lows (either in the video or on the web page) in the weather forecast.
37. Bring students to a computer lab and look at highs and lows on the weather.com 36 hour forecast page. If this is not possible, you can watch a video tape of a weather forecast during which the forecaster discusses highs and lows.
38. After looking at the web page (or watching the video), tell students that the high usually happens in the afternoon and the low is usually in the night time. Tell the students that your class will always measure the temperature at the same time of day (recess). That way you will not get the low one day and the high another day.

E. *Assessment/Evaluation*

1. Watch students each day when they record temperature and give a partner to or coach any students having difficulty.
2. Look at students' hypotheses and results to see if they understand how to make a hypothesis and how to use data to draw conclusions about the results.

Lesson Six: Local Weather Patterns Across The Seasons (daily for three months of the school year (one month in fall, one in winter, one in spring), five minutes per day plus two 45 minute lessons per month, one at the beginning and one at the end and at least one 20 minute read aloud per month)

A. *Daily Objectives*

1. Concept Objective(s)
   a. Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.
   b. Students understand the general characteristics of the atmosphere and fundamental processes of weather.

c. Students understand characteristics of the four seasons.
d. Students understand how to use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.

2. Lesson Content
   a. Seasons and Weather
      i. The four seasons
      ii. Characteristic local weather patterns during different seasons
      iii. The sun: source of light and warmth
      iv. Daily weather changes
         a) Temperature: thermometers are used to measure temperature
         b) Clouds
         c) Rainfall: how the conditions of the ground varies with rainfall; rainbows
         d) Thunderstorms: lightning and thunder, hail
         e) Snow and snowflakes, blizzard

3. Skill Objective(s)
   a. Students will compare knowledge gained from direct experience to knowledge gained indirectly.
   b. Students will state predictions (hypotheses) that can be addressed through scientific investigation.
   c. Students will use a simple device to gather data related to an investigation that addresses an everyday problem or task.
   d. Students will make observations and describe existing weather conditions by collecting and recording weather data.
   e. Students will use approximate measures of familiar objects to develop a sense of measurement.
   f. Students will use appropriate standard and non-standard units of measurement in problem-solving situations.
   g. Students will construct, read and interpret displays of data using charts and graphs.
   h. Students will generate, analyze and make predictions based on data obtained from devices.

B. *Materials*
   1. Weather measurement materials from previous lessons: coffee cans and rulers, home-made windsocks and thermometers for each student or group of students
   2. Weather Measurement Chart (Appendix B, page 3)
   3. Science journals, one for each student
   4. Blown-up or re-produced set of pages from Appendix E to use for class discussion
   5. Enough copies of each graph type for each group member to get one copy (Appendix E, pages 2-7)
   6. Coloring utensils

C. *Key Vocabulary*
   1. *Weather* is the condition of the atmosphere.
   2. The *atmosphere* is the air in our world.
   3. A *meteorologist* is a scientist who studies the weather.
   4. *Precipitation* is water that falls to the earth as rain, sleet, snow or hail.
   5. A *cloud* is a visible mass of water vapor that is suspended in the air.
   6. *Wind* is moving air.

7. *Temperature* is a measure of how hot or cold the air is.
8. A *thermometer* is a tool used to measure the temperature.

D. *Procedures/Activities*

Day One:

1. At the beginning of each of the three months, have students meet you on the carpet.
2. Ask them to tell you the four seasons of the year and tell them the seasons if they need help (*summer, fall, winter, spring*).
3. Tell students that they will have three Meteorologist Months in the school year. One will be in the fall, one in the winter and one in the spring. Even though each season lasts three months, they will use their data from one month to show what the weather is like during fall, winter and spring.
4. Tell students it is their job to predict what the weather during the month will mostly be like.
5. Tell students that starting on the 1st day of this month (September or October, January or February, April or May) they will record weather data every day.
6. Write the question, "What is the weather mostly like in the fall (or winter or spring, depending which time of year you are doing)?" on a Scientific Method Chart on large chart paper (example in Appendix A).
7. Encourage students to include predictions about wind, clouds, precipitation and temperature.
8. Have each student make a hypothesis and record the hypotheses on the chart paper.
9. Allow students five to ten minutes during their daily recess to record weather data.
10. Keep a flashlight and prism on hand, so that if your class sees a rainbow on any of their observations, you can explain that rainbows happen when sunlight shines through water droplets. It can also happen when light shines through glass.
11. If no rainbows occur during your observations, take a few minutes to discuss what rainbows are and encourage children to look for them at the end of rainstorms.

Day Two:

12. At the end of the month, have students join you on the carpet again.
13. Tell students that it is time to figure out what the weather was mostly like for the month.
14. Read the hypotheses they made at the beginning of the month to refresh their memories.
15. Explain that one way to look at data is to look at the charts you have been keeping, but sometimes it is easier to use something called a graph.
16. Tell students that each table/group will make a graph for one type of weather measured that month. So table/group one might make a graph about Wind, table/group two about clouds, table/group three about precipitation and table/group four about temperature.
17. Note: you do not have to graph every aspect of the weather the first time.
18. Tell them that each student will make their own graph using the data they gathered, but the friends at their table will be working on the same graph so they can help each other.
19. Show students your sample data chart (Appendix E, page 1) and your sample graph pages for Wind (Appendix E, pages 2 and 3).

20. Show them how to color a box on the graph for each day of the month. If the wind was strong, they color the column with the word strong, if there was no wind, they color a box in the column with the word none, etc.
21. Next show students the sample graph page for Clouds (Appendix E, page 3) and show them how to color in a box for each day of the month, under the column for whichever of the three cloud types they saw (cumulus, stratus or cirrus).
22. Model how to color the graphs for Precipitation and Temperature in the same way (Appendix E, pages 4, 5, 6 and 7).
23. Send groups back to their tables with the correct graph and allow 15 minutes to work.
24. Walk around and make sure students understand how to complete their graph.
25. Tip: Groups that include all levels of students will allow group members to help one another.
26. Students who finish early can be encouraged to help others at their table.
27. When all students are finished, ask them to clean up and return to the carpet with their graphs.
28. Explain that now that they made graphs, it is much easier to see what the weather was mostly like during the month.
29. Hold up the graphs one by one starting with each Wind graph.
30. Ask all the students to look at the graph and think in their head what this graph says the Wind was mostly like for the month.
31. Call on the student who made the graph to tell you what they thought the wind was mostly like.
32. Do the same for each student's graph.
33. Record all answers in the Results section of the Scientific Method Chart that you started at the beginning of the month.
34. Keep this chart.
35. Tell students that next month is also part of the same season; ask them to predict what the weather will be likely. Record their predictions.
36. **Supplementary Activity:** Read at least one seasonal book of your choice for each Meteorologist Month. Ask students in discussion or in a drawing/writing response to compare the weather described in the book to the results of the data they collected from the same season.
37. Repeat the entire set of procedures for each of the three Meteorologist Months.
38. The second and third times, you can have the students write on the back of their graph or circle what the weather was mostly like for the month before you discuss the results as a group.
39. Before moving on to Lesson Seven, you should also do a few read alouds preparing for summer and ask students to describe what the weather in summer is like.

E. *Assessment/Evaluation*

1. When each student tells what their aspect of weather was mostly like for the month, record their answer under the Results section of the Scientific Method Chart you are using. Collect the graphs at the end of the discussion. Later, look to see if they answered correctly by comparing their graph with their answer.
2. For the second and third months, you can collect students' graphs on which they wrote on the back or circled which type of weather happened most. Use these to assess if students are accurately interpreting and communicating the results of their investigations.
3. Each month, collect and check students' weather logs. Note any areas where students are still struggling and follow-up with those students. You should be

keeping your own weather log so that you know what the students should have recorded for each day.

4. Use student's predictions of what the weather should be like next month to determine if they are using the data to make logical predictions.
5. During discussions of monthly read alouds or after collecting written/drawn responses to read alouds, assess whether students are comparing the book to the data accurately. If not, follow-up with those students.

Lesson Seven: Seasons and Climates (one day, 60 minutes or break into two days of 30 minutes)

A. *Daily Objectives*
   1. Concept Objective(s)
      a. Students understand characteristics of the four seasons.
   2. Lesson Content
      a. The four seasons
      b. Characteristic local weather patterns during the different seasons
   3. Skill Objective(s)
      a. Students will name the four seasons and describe what the weather is mostly like in each season.

B. *Materials*
   1. Pre-made sunshine books (Appendix F), one for each student
   2. Coloring and writing utensils
   3. One globe
   4. *On the Same Day in March* by Marilyn Singer
   5. Instructional Masters 30 and 31 from the *Core Knowledge: Teacher Handbook, K* (optional)

C. *Key Vocabulary*
   1. *Climate* is the average weather pattern of a region over long periods of time; characterized by temperature and precipitation.
   2. *Temperate* is the climate in most of the United States, in which there are 4 distinct seasons and variable weather conditions.

D. *Procedures/Activities*
   1. Ask students to think back over the three Meteorologist Months they conducted. Show them the results of each month.
   2. Tell them that today, they get to show what they have learned about the seasons. Even though they have only gotten to observe three seasons, they have read about the fourth, summer.
   3. Show them the sunshine book templates.
   4. Tell them their job is to: 1) write their name next to the word "By" on the cover, 2) complete a drawing of what the weather is mostly like during each season and 3) write words on each page describing all the kinds of weather they measured during each season.
   5. Give students 30 minutes to work. Circulate around the room to make sure students understand their task.
   6. When all the students are finished, ask them to hand in their books, clean up and return to the carpet.
   7. Tell them that we found out that the weather here is different in all four seasons. Or, read a few of the students' books aloud. Tell students that when a place has four different seasons, we say it has a temperate climate. Have students say temperate climate with you.

8. Explain that not every place has the same climate. In some places, it is hot all year and that is called a tropical climate. In other places, it is cold all year and that is called a polar climate. These are the three climates on our planet Earth: temperate, tropical and polar.
9. (Stop here if splitting into two days)
10. Show students the book *On the Same Day in March*.
11. Tell students that this book tells about how the seasons and climates are different around the world.
12. Tell students that the book is about the month of March, which happens during the season called spring.
13. Ask them what the weather is like for them in spring. Tell them to look for places with the same weather and places with different weather.
14. Read *On the Same Day in March* aloud. Point to places on a map or globe as you read about the weather there.
15. When you finish invite children to share places they noticed that had the same or different weather.

E. *Assessment/Evaluation*
1. Collect each child's book. Look through the pages and assess their understanding of the seasons. Be sure to make notes to yourself if you help any child during their work time so you can consider this in your assessment.
2. You can also use Instructional Masters 30 and 31 to assess students understanding of the seasons.

VI. CULMINATING ACTIVITY

A. You could set up a field trip to meet a local meteorologist and have him/her show the students some of the things they use to measure the weather.

B. You may want to explain why the Seasons happen the way they do. Use a globe and a flashlight to act as the sun. Turn off the lights in the room. Have one student hold the sun in the middle. Take the globe and tilt it slightly. Show how the Earth spins every day, which explains the sun's rise and set. Then show how the Earth goes around the Sun to make a year. Tell students the most important things that makes seasons is the way the Earth tilts. Tell students that when we are tilted closest to the Sun, we have summer and when we are tilted farthest, we have winter. Spring and fall are when we are not at either end of the tilt. Demonstrate how the earth moves a few times and let students try too.

VII. HANDOUTS/WORKSHEETS

A. Appendix A: Scientific Method Chart
B. Appendix B: Weather Measurement Charts
C. Appendix C: Types of Weather Charts
D. Appendix D: Temperature Data Chart
E. Appendix E: Sample Data and Weather Graph Pages
F. Appendix F: Sunshine Book Template

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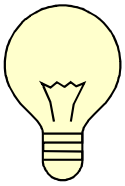
Appendix A

Scientific Method Chart

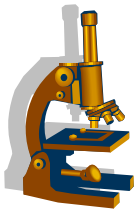
(This should be reproduced on chart paper using any symbols you choose. Then as you do each step you can record the information on the chart paper.)

?

Question



Hypothesis



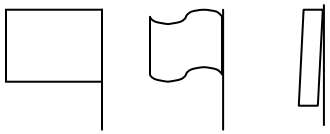
Test

Results

Appendix B, page 1

Weather Measurement Chart

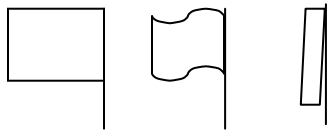
(to be drawn on large chart paper and in student journals; you do not have to write the words and draw the pictures under each heading, but they are there to give you an idea of what to record in each column)

Day (you can number the days, write days of the week or write dates depending on what your students are working on)	**Wind Strength** 	**Wind Direction** Use North, South, East and West if students know these terms. If not, teach them the terms or use terms for your playground (i.e. wind coming from the field, the trees, behind the building, etc.)
1		
2		
3		
4		
5		

Appendix B, page 2

Weather Measurement Chart

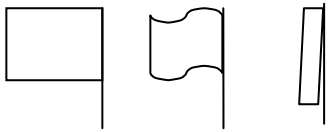
(to be drawn on large chart paper and in student journals; you do not have to write the words and draw the pictures under each heading, but they are there to give you an idea of what to record in each column)

Day (you can number the days, write days of the week or write dates depending on what your students are working on)	**Precipitation** (Type, Amount and What Happened to Ground, Example, Rain, 1 centimeters, ground wet and hard)	**Clouds** (Cirrus, Stratus, and/or Cumulus)	**Wind Strength and Direction** (North, South, East and West) 
1			
2			
3			
4			
5			

Appendix B, page 3

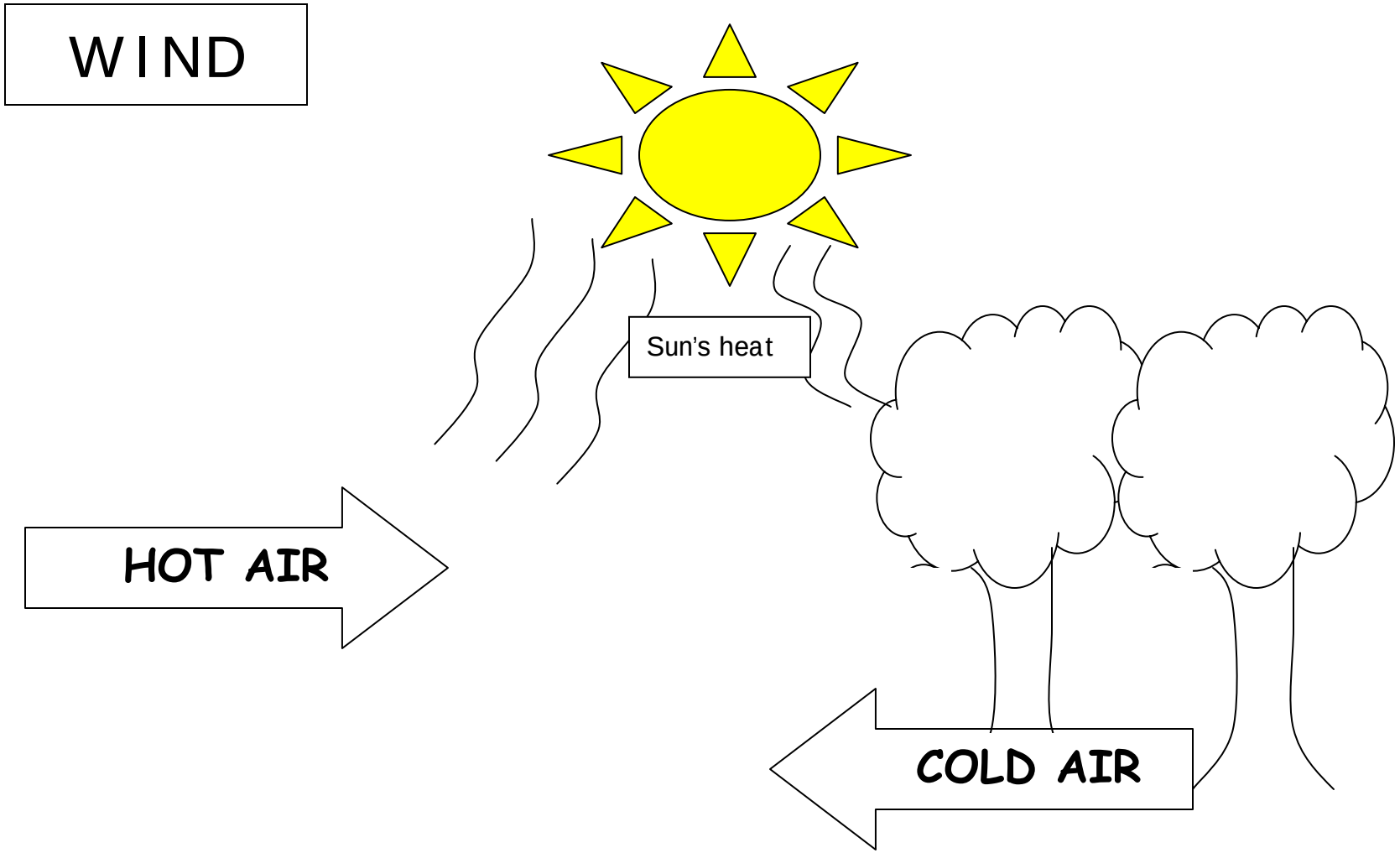
Weather Measurement Chart

(to be drawn on large chart paper and in student journals; you do not have to write the words and draw the pictures under each heading, but they are there to give you an idea of what to record in each column)

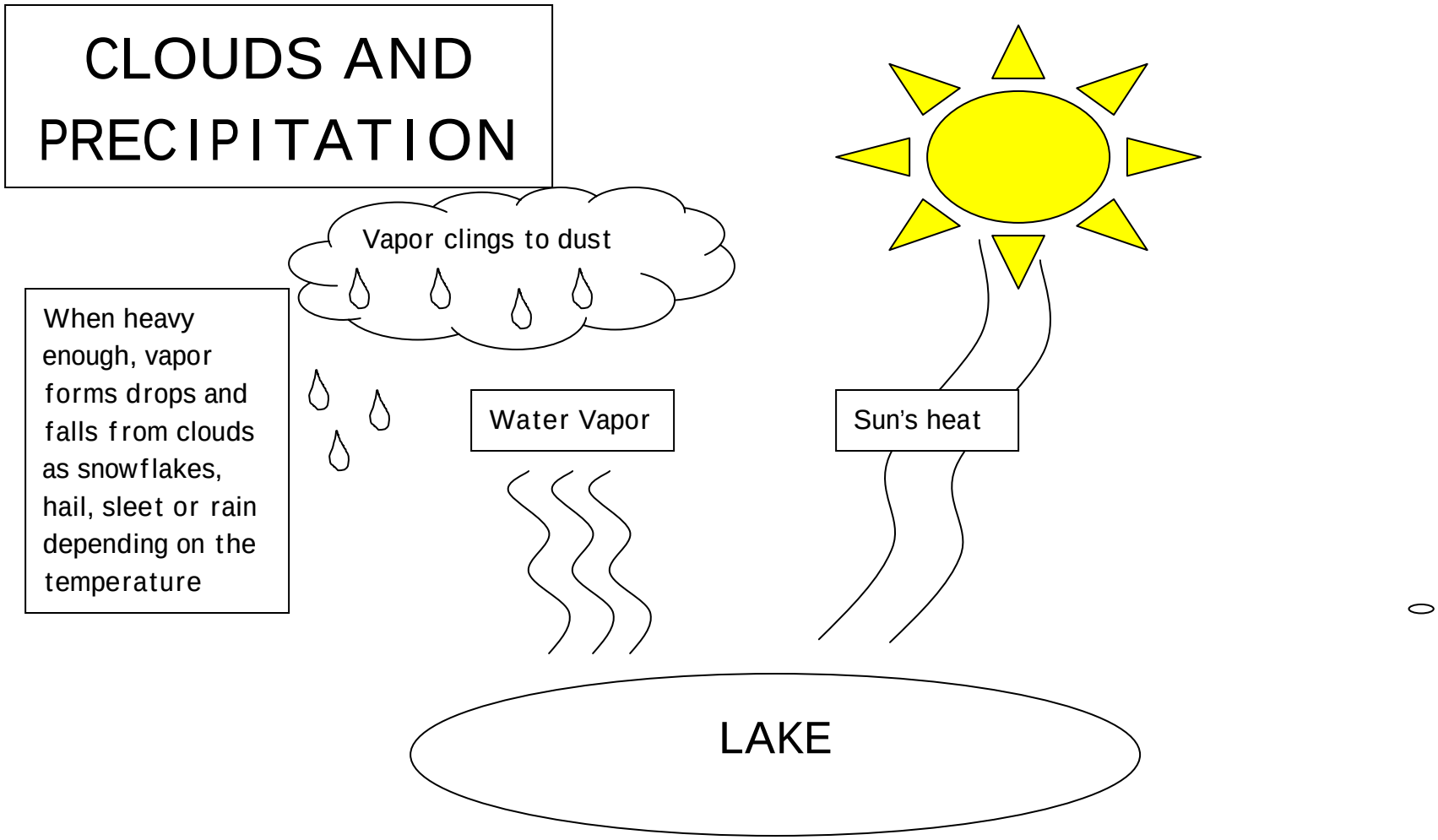
Day (you can number the days, write days of the week or write dates depending on what your students are working on)	**Temperature** (measure in degrees Fahrenheit)	**Precipitation** (Type, Amount and What Happened to Ground, Example, Rain, 1 centimeters, ground wet and hard)	**Clouds** (Cirrus, Stratus, and/or Cumulus)	**Wind Strength and Direction** (North, South, East and West) 
1				
2				
3				
4				
5				

Appendix C, page 1

Types of Weather Chart, Wind



Types of Weather Chart, Clouds and Precipitation



Appendix D

Temperature Chart

Day (can use dates, numbers or days of week)	**Morning**	**Lunchtime**	**End of School**
1			
2			
3			
4			
5			

Appendix E, page 1

Sample Data for a Month

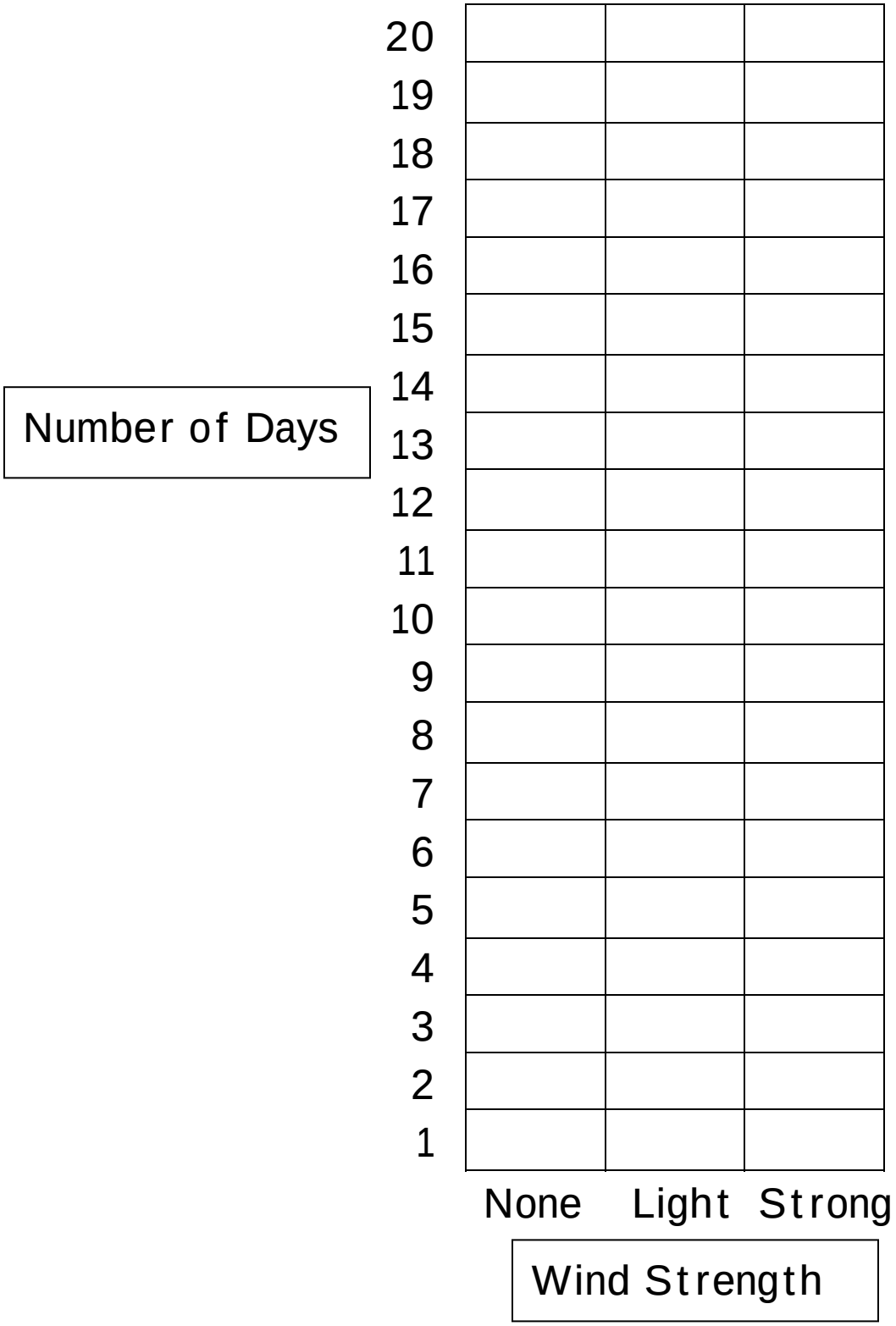
(Note: You can enlarge chart or re-produce on chart paper so all students can see. You can add drawing and symbols as you see fit.)

Days	Temperature	Precipitation	Clouds	Wind Strength and Direction
1	80^0 F	None	cumulus	Strong, West
2	80^0 F	None	cumulus	Strong, West
3	80^0 F	None	cirrus	Light, West
4	80^0 F	None	cirrus	Light, West
5	79^0 F	None	cumulus	Light, West
6	75^0 F	None	cumulus	None
7	82^0 F	None	None	Strong, West
8	89^0 F	None	cumulus	Strong, West
9	72^0 F	None	cumulus	Strong, West
10	71^0 F	None	cirrus	None
11	75^0 F	None	cumulus	Strong, West
12	78^0 F	None	cumulus	Strong, West
13	80^0 F	None	None	Strong, West
14	80^0 F	None	cumulus	Light, West
15	85^0 F	None	cumulus	Strong, West
16	86^0 F	Rain, ½ cm., ground wet but hard	cumulus/stratus	Strong, South
17	86^0 F	Rain, 1 cm., ground wet but hard	cumulus/stratus	Light, West
18	85^0 F	None	cumulus	Light, West
19	84^0 F	None	cumulus	Strong, West
20	83^0 F	None	cumulus	Strong, West
21	82^0 F	None	cumulus	Strong, West
22	80^0 F	None	cumulus	Light, West
23	79^0 F	None	cumulus	Light, West
24	80^0 F	None	cirrus	Light, West
25	83^0 F	None	None	Strong, West
26	85^0 F	None	cumulus	Strong, West
27	87^0 F	None	cumulus	Strong, West
28	88^0 F	Rain, 1 cm., ground wet but hard	cumulus/stratus	Strong, West
29	90^0 F	None	cumulus	None
30	87^0 F	None	cumulus	Strong, South

Appendix E, page 2

Wind Strength Graph

(Note: You can enlarge graph or re-produce on chart paper. Use 8 ½ x 11 paper to give each student a copy of their graph page.)



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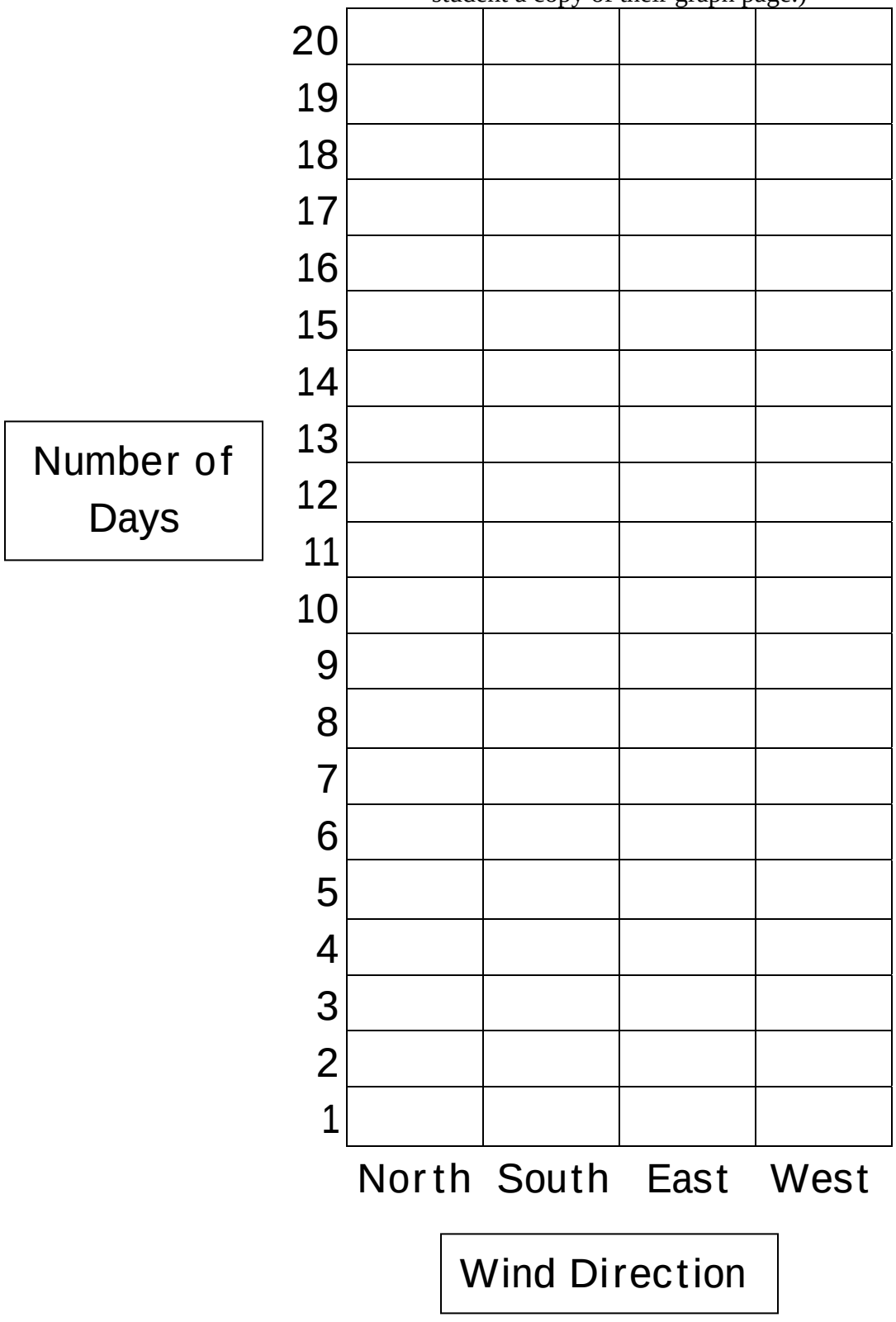
Wind Direction Graph

(Note: You can enlarge graph or re-produce on chart paper. Use 8 ½ x 11 paper to give each student a copy of their graph page.)



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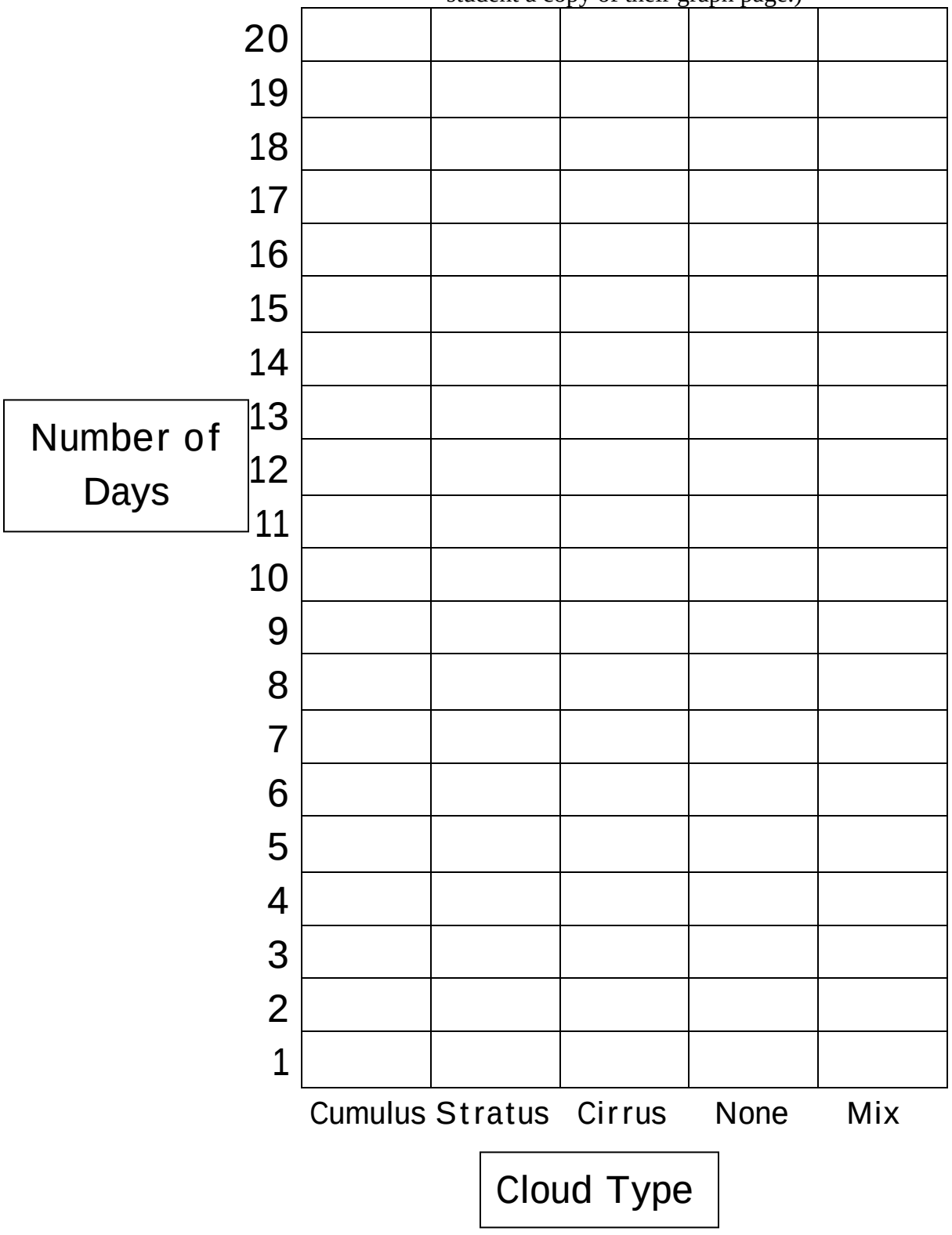
Cloud Graph

(Note: You can enlarge graph or re-produce on chart paper. Use 8 ½ x 11 paper to give each student a copy of their graph page.)



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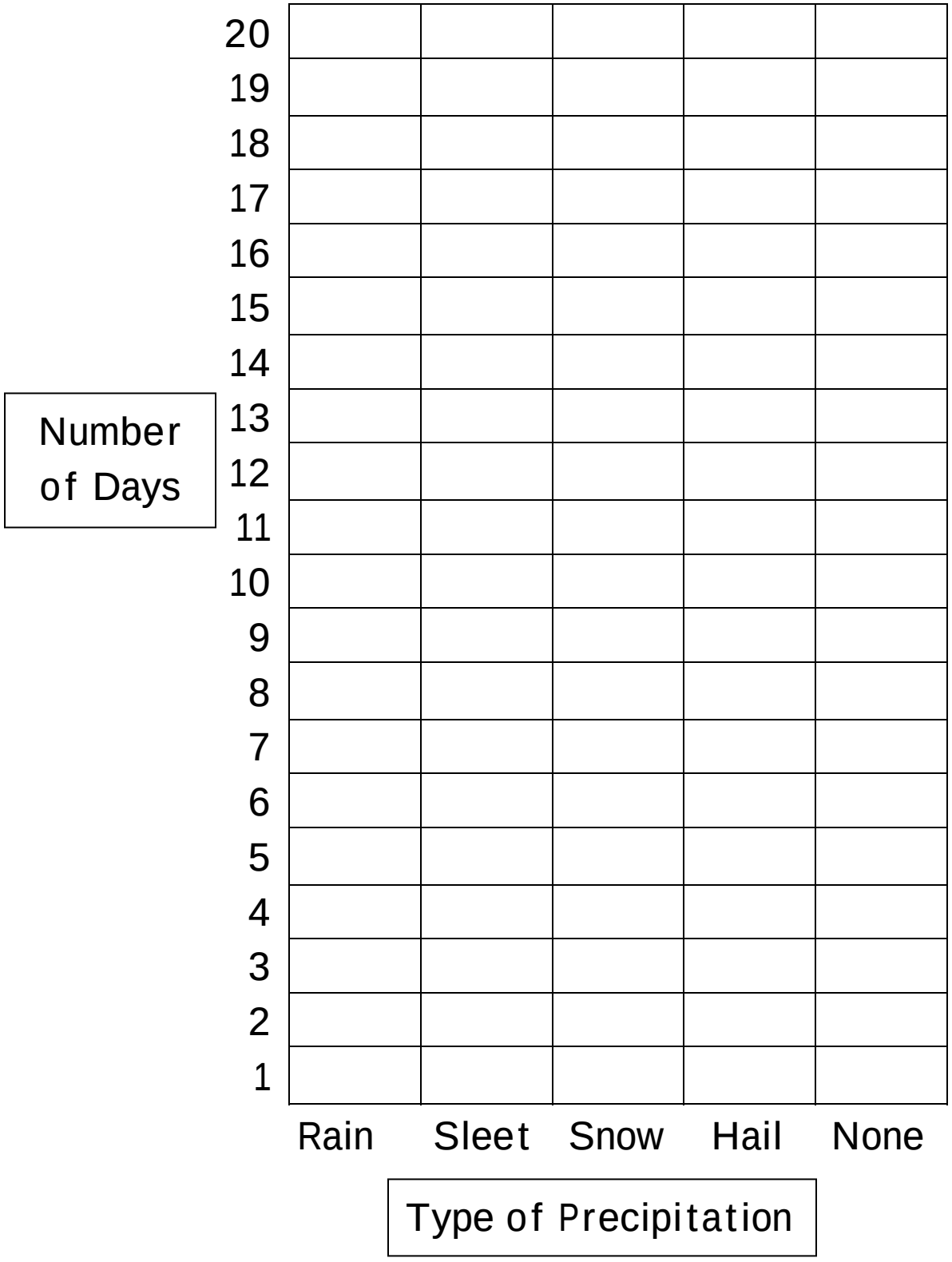
Precipitation Type Graph

(Note: You can enlarge graph or re-produce on chart paper. Use 8 ½ x 11 paper to give each student a copy of their graph page.)



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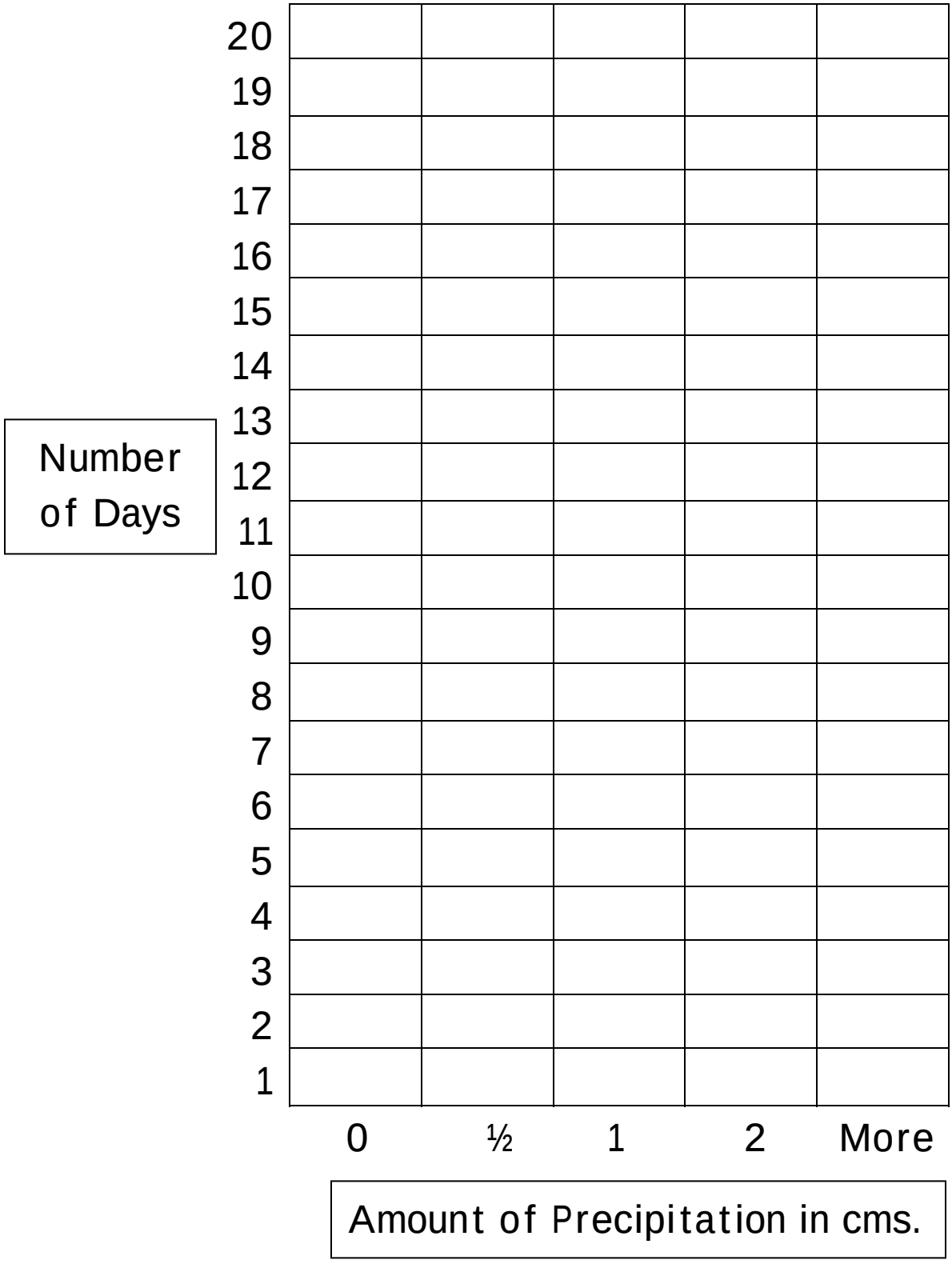
Precipitation Amount Graph

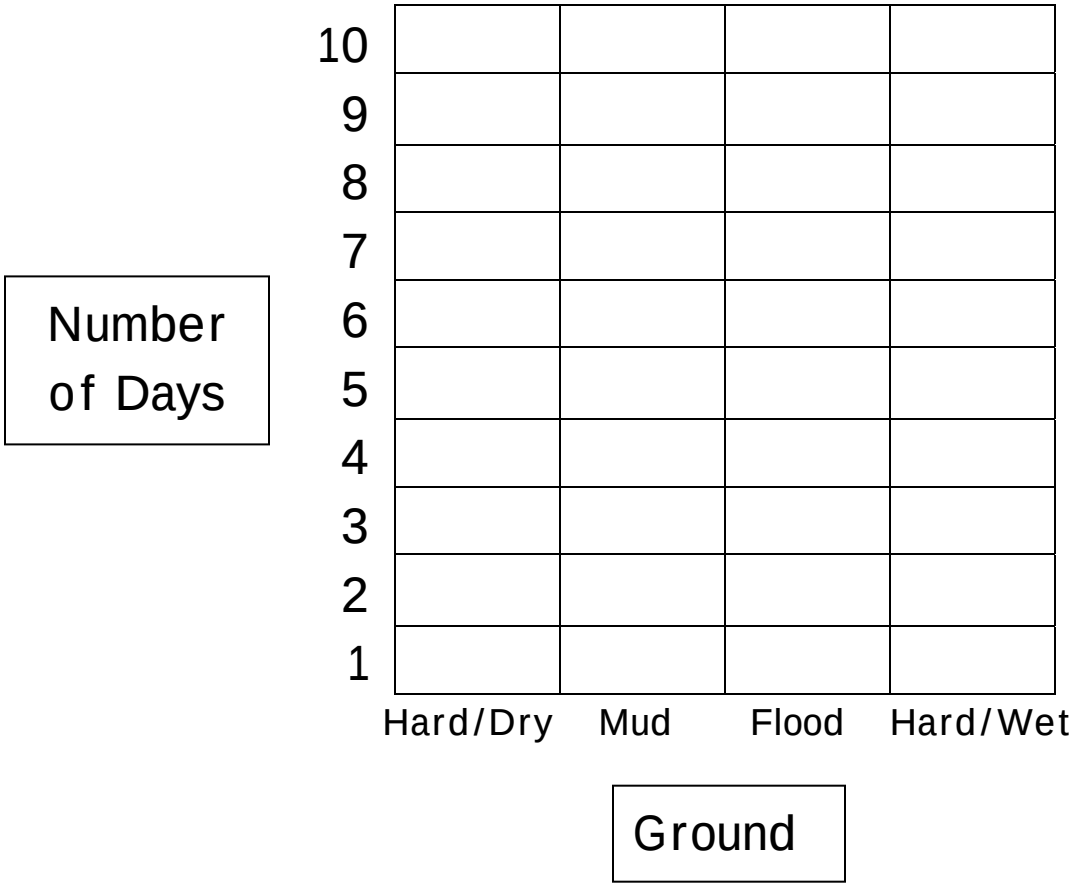
(Note: You can enlarge graph or re-produce on chart paper. Use 8 ½ x 11 paper to give each student a copy of their graph page.)



Appendix E, page 7

Ground Graph

(Note: You can enlarge graph or re-produce on chart paper. Use 8 ½ x 11 paper to give each student a copy of their graph page.)



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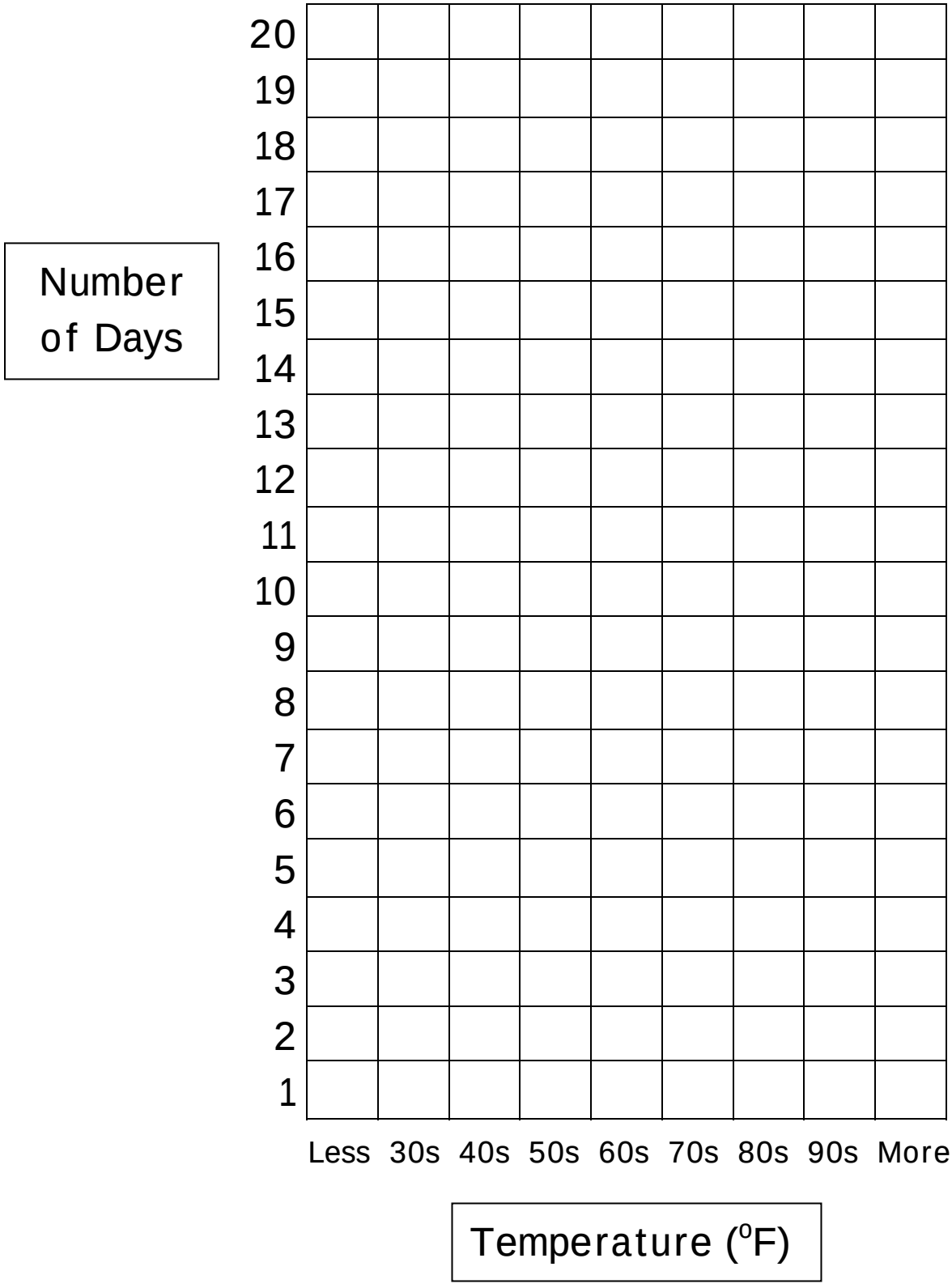
Temperature Graph

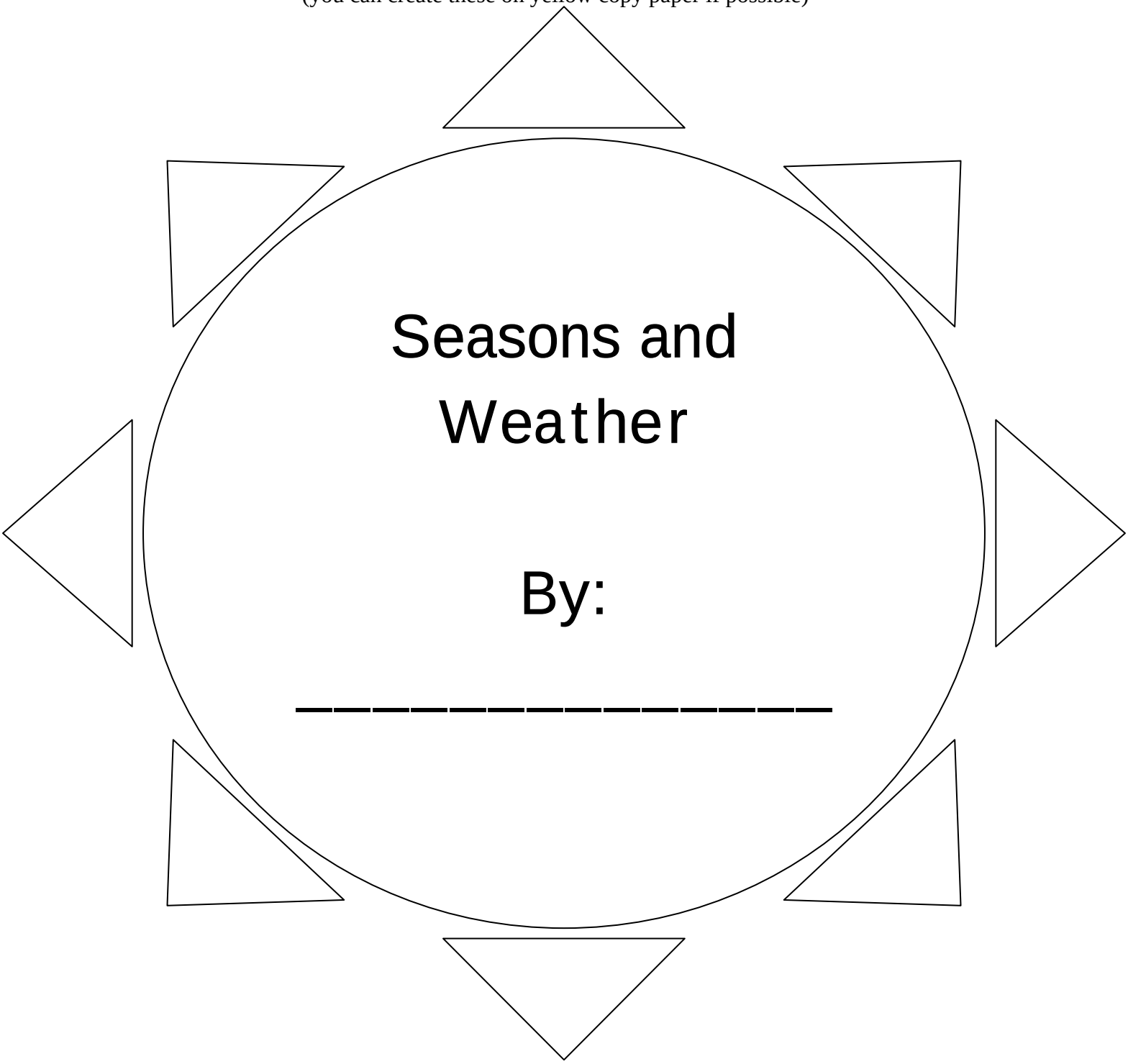
(Note: You can enlarge graph or re-produce on chart paper. Use 8 ½ x 11 paper to give each student a copy of their graph page.)



Appendix F, page 1

Sunshine Book Template – Cover

(you can create these on yellow copy paper if possible)



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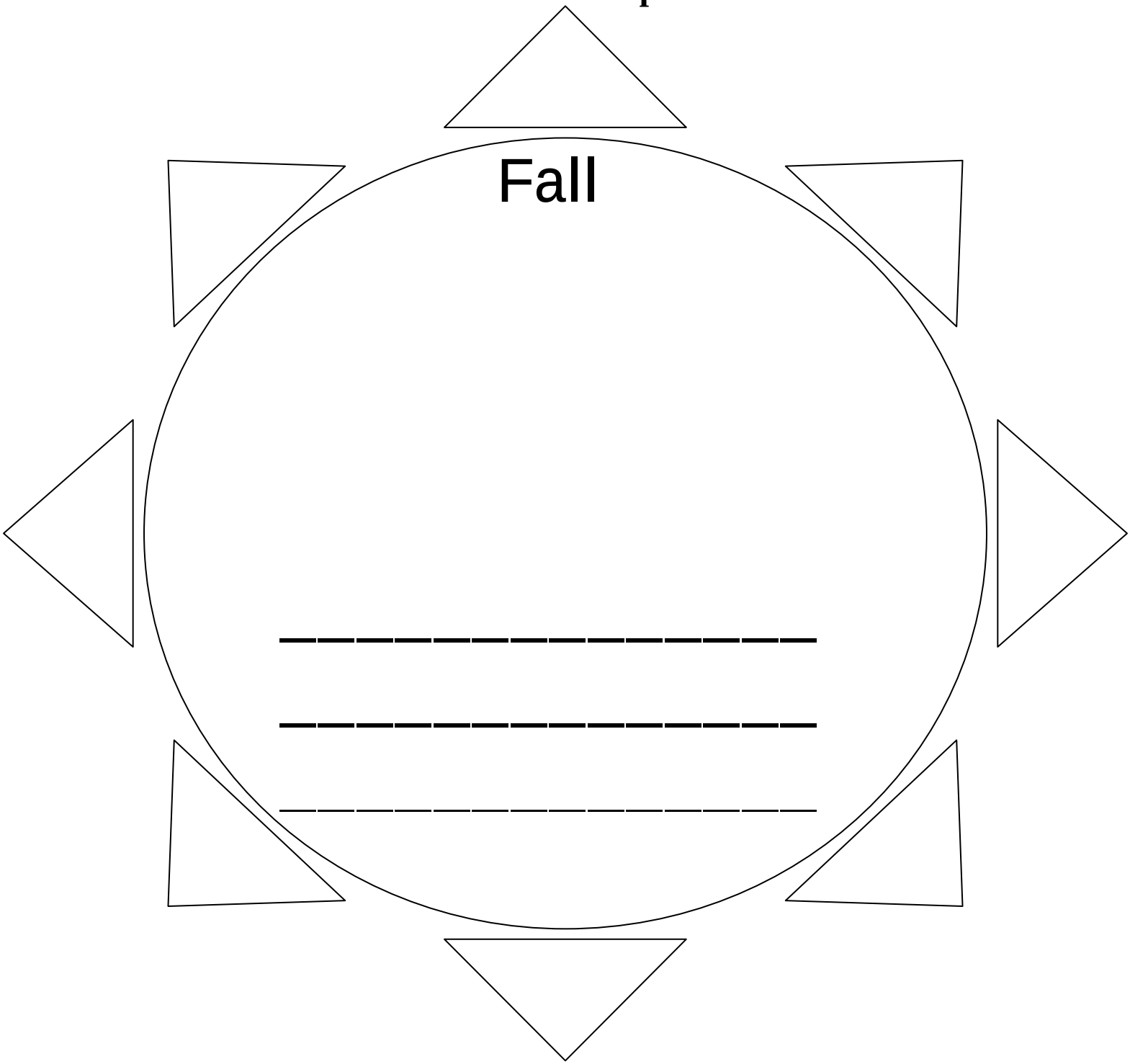
Sunshine Book Template – Fall



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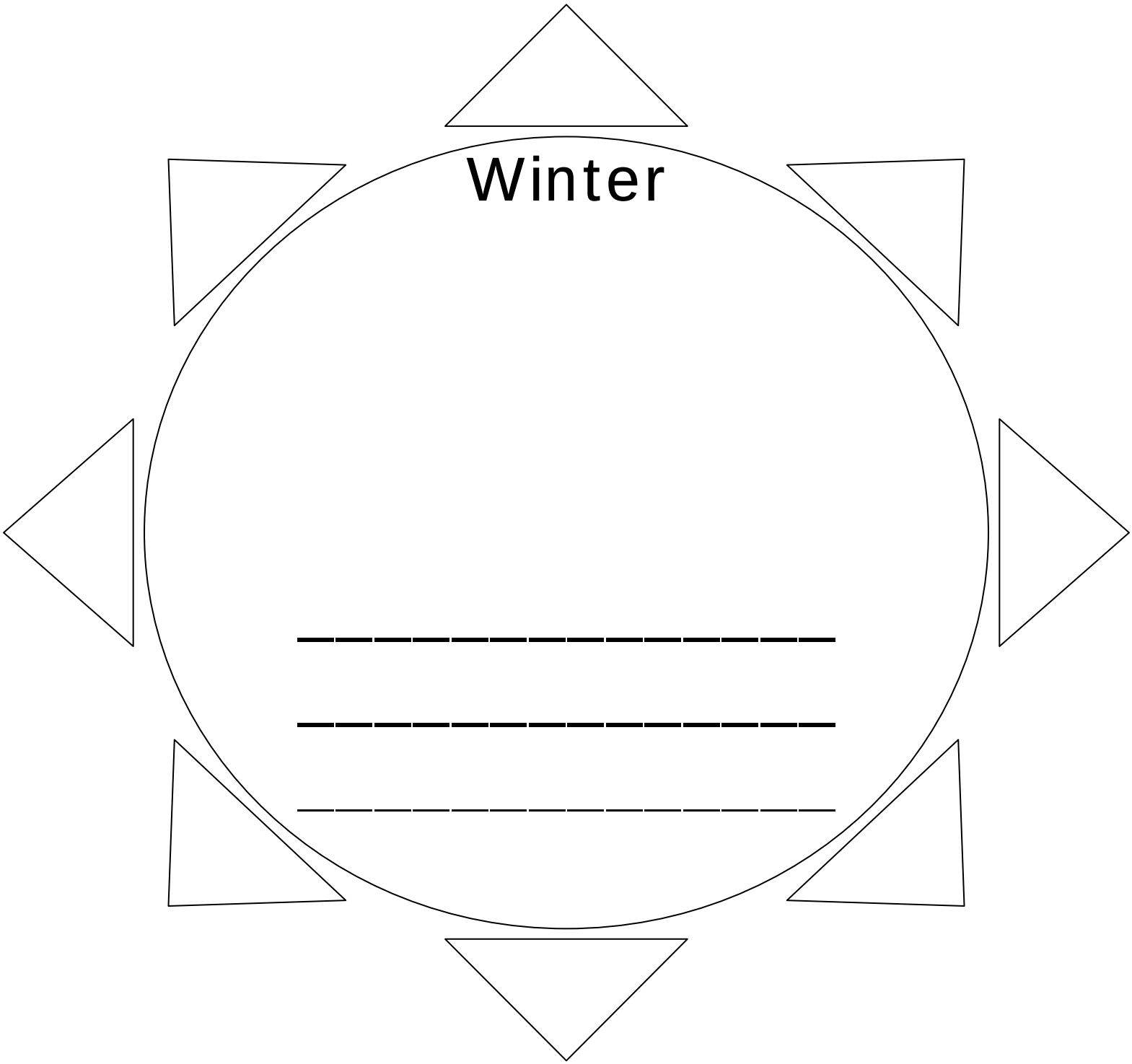
Sunshine Book Template – Winter



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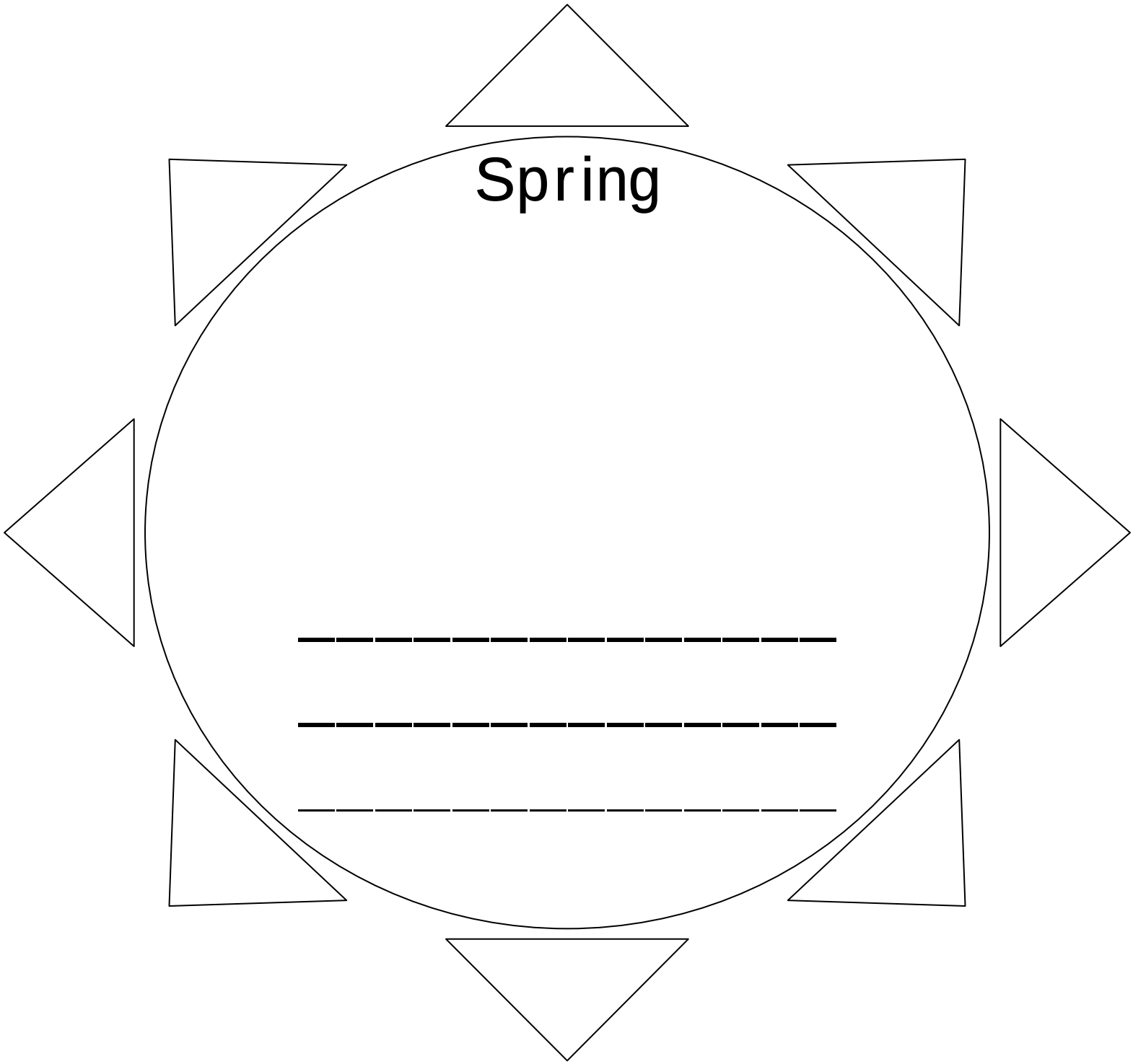
Sunshine Book Template – Spring



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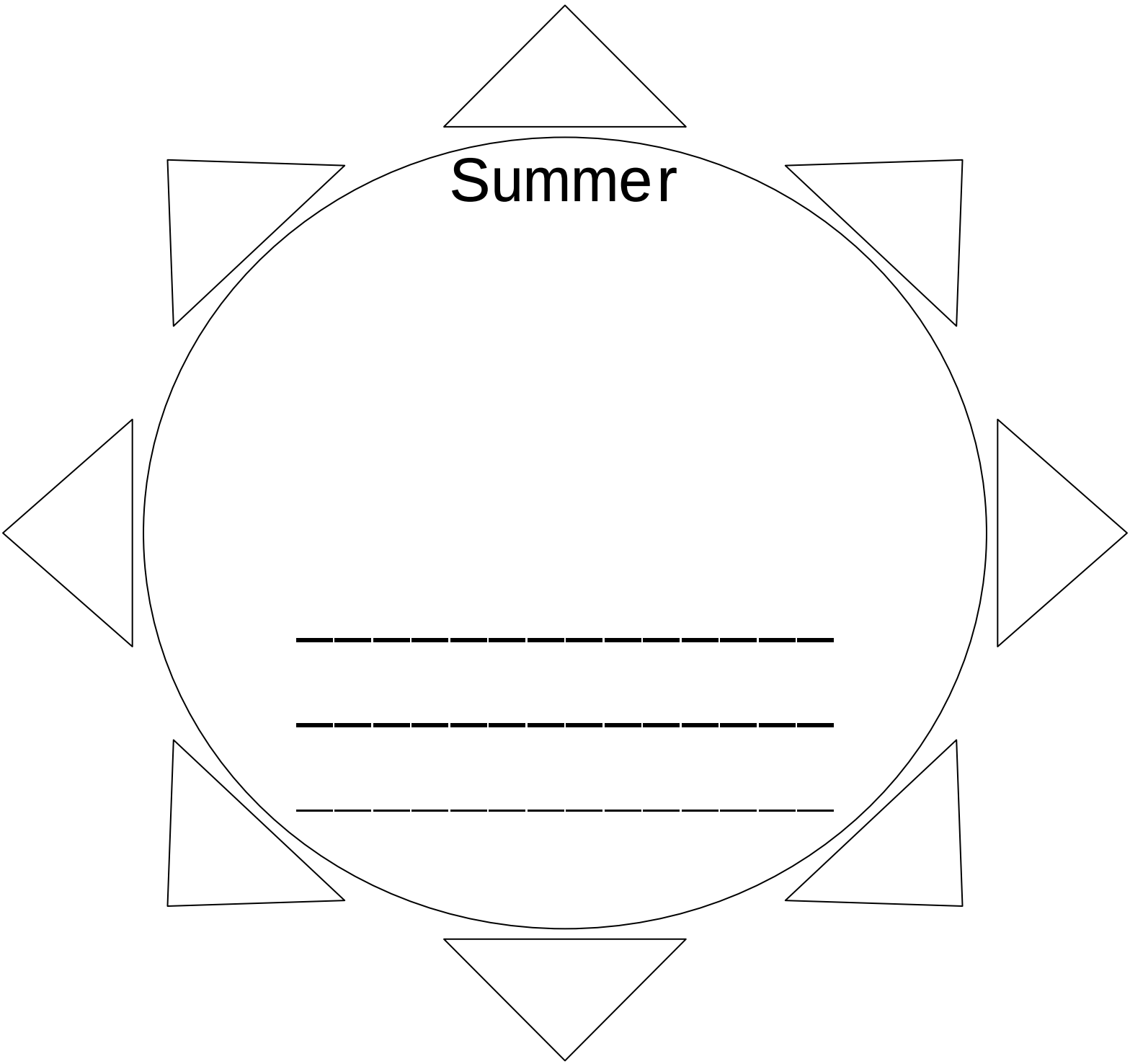
Sunshine Book Template – Summer



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Sunshine Book Template – Back Cover