Lightning: Teacher Led Lesson Plan

Subject/Strand/Topic: Science – Electricity – Lightning
Grade(s) / Course(s): 9 / SNC 1D
Ontario Expectations: PH3.03D

Key Concepts: lightning, positive charge, negative charge, streamer, step leader, positive lightning


Required Materials: Pre-assessment Quiz/Answer Key, Teacher Led Handout/Answer Key, Post-assessment Quiz/Answer Key, Data Projector and Internet Connection

Before Starting: Ensure you have the latest Adobe Flash Player installed for the learning object to play

Introduction and Pre-Assessment Quiz (~10 min)
1. Introduce the learning object (electricity can be a very powerful force, this activity will look how lightning is created and the power it can generate)
2. Distribute Pre-assessment quiz and allow 5 min to complete; collect

Student Activity Sheet Explanation
1. Distribute Activity sheet to students
2. Have students read the introductory paragraphs of the first page of the Activity sheet
3. Students will be completing questions from their Activity sheet throughout the learning object – present the material related to the section and then allow students time to complete the associated questions

Use of Learning Object with Activity Sheet (15-20 min)

Note on using the links within the website: a rotating globe may appear when opening the National Geographic website – this advertisement link can be closed by selected the navy blue X box in the upper right hand corner directly beside the globe
1. Show the Lightning video. This can be found by opening the learning object link, then selecting the Lightning Video from the Related Topics box on the right hand side
   *Teacher may choose to show this video at the end of the activity
2. Select the Make Lightning Strike link (green bar) in the Lightning Can Strike Twice purple learning object box to access the learning object
3. Follow each section of the learning object in order

When Lightning Strikes:
- Click on the House, Tree, Car, Person to show lightning striking these objects; a text box appears with a brief description of the damage that will be caused

Anatomy of a Thundercloud:
- Point out the negative and positive regions of a thundercloud and that lightning may occur within a cloud or between a cloud and the ground, read text

Charging Up:
- Read the text and refer to the animation

Lightning Bolts:
- Point out the charges, step leader, and streamers, read text

Positive Lightning:
- Show how positive lightning is formed with the help of the animation, read text

Consolidation and Post-Assessment Quiz (~10 min)
1. Select the link in the green box Lightning Safety Tips and read the safety tips to protect from lightning strikes; discuss why although lightning strikes for only a fraction of a second, it is extremely dangerous
2. Distribute Post-assessment quiz and allow 5 min to complete; collect
3. Activity sheet may be taken up as a class or collected and marked.
Lightning
Teacher-Led Pre-Assessment

Name: ____________________________

Birthday: ____________________

1. What is lightning caused by? [1 mark]

2. An individual inside a car or house would be protected if lightning were to strike. What do these two structures have in common that protect the occupants inside? [1 mark]

3. For lightning to occur within a cloud, how do the charges have to be distributed? [1 mark]

4. What is the difference in charges between a step leader and a streamer in a lightning bolt? [2 marks]
Name: **Answer Key**

1. **What is lightning caused by?** [1 mark]

   Lightning is caused by an imbalance between charges.

2. **An individual inside a car or house would be protected if lightning were to strike. What do these two structures have in common that protect the occupants inside?** [1 mark]

   They are both grounded and allow the negative charges to pass to the ground.

3. **For lightning to occur within a cloud, how do the charges have to be distributed?** [1 mark]

   The top portion is positively charged while the bottom portion is negatively charged.

4. **What is the difference in charges between a step leader and a streamer in a lightning bolt?** [2 marks]

   A step leader is a negative charge racing downward while a stream is a positive charge coming from the ground.
What is lightning?

“This enormous electrical discharge is caused by an imbalance between positive and negative charges. During a storm, colliding particles of rain, ice, or snow increase this imbalance and often negatively charge the lower reaches of storm clouds. Objects on the ground, like steeples, trees, and the Earth itself, become positively charged, creating an imbalance that nature seeks to remedy by passing current between the two charges.

A step-like series of negative charges, called a stepped leader, works its way incrementally downward from the bottom of a storm cloud toward the Earth. Each of these segments is about 150 feet (46 meters) long. When the lowermost step comes within 150 feet (46 meters) of a positively charged object it is met by a climbing surge of positive electricity, called a streamer, which can rise up through a building, a tree, or even a person. The process forms a channel through which electricity is transferred as lightning. Some types of lightning, including the most common types, never leave the clouds but travel between differently charged areas within or between clouds. Other rare forms can be sparked by extreme forest fires, volcanic eruptions, and snowstorms. Ball lightning, a small, charged sphere that floats, glows, and bounces along oblivious to the laws of gravity or physics, still puzzles scientists.

Lightning is extremely hot. A flash can heat the air around it to temperatures five times hotter than the sun’s surface. This heat causes surrounding air to rapidly expand and vibrate, which creates the pealing thunder we hear a short time after seeing a lightning flash.

Lightning is not only spectacular, it’s dangerous.

About 2,000 people are killed worldwide by lightning each year. Hundreds more survive strikes but suffer from a variety of lasting symptoms, including memory loss, dizziness, weakness, numbness, and other life-altering ailments.”

WHEN LIGHTNING STRIKES

1. Why are homes and cars generally considered safe places to be in case of a lightning strike? Hint: Identify the protective feature do have in common. [2 marks]

ANATOMY OF A THUNDERCLOUD

2. What is lightning caused by? [1 mark]

3. Identify where the positive and negative regions of a cloud are. [1 mark]
4. Lightning occurs between positive and negative charges. Name two ways the imbalance can occur. [2 marks]

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CHARGING UP

5. How is an electrical imbalance created during a storm? [1 mark]

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6. How is the imbalance corrected? [1 mark]

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LIGHTNING BOLTS

7. Draw and label a diagram of a charged cloud, charged ground, step leader (include charges), and streamers (include charges). [4 marks]

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8. Explain how a lightning bolt strikes. Be sure to explain the role of charges in your answer. [2 marks]
**POSITIVE LIGHTNING**

9. What is positive lightning? [1 mark]

10. Draw a diagram of a charged cloud and draw lightning that is created
    a. within the cloud [1 mark]
    b. between the cloud and the ground [1 mark]
    c. positive lightning [1 mark]
What is lightning?

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WHEN LIGHTNING STRIKES

1. Why are homes and cars generally considered safe places to be in case of a lightning strike? Hint: Identify the protective feature do have in common. [2 marks]

Homes and cars are both grounded. When lightning strikes them, the charge is carried harmlessly to the ground.

ANATOMY OF A THUNDERCLOUD

2. What is lightning caused by? [1 mark]

Lightning is caused by an imbalance between charges.

3. Identify where the positive and negative regions of a cloud are. [1 mark]

The positive region is on the upper portion of a cloud and the negative region on the lower portion.
4. Lighting occurs between positive and negative charges. Name two ways the imbalance can occur. [2 marks]

The imbalance in charges can occur within a cloud itself or between a cloud and the ground.

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**CHARGING UP**

5. How is an electrical imbalance created during a storm? [1 mark]

An electrical imbalance is created by particles colliding, causing friction and becoming charged.

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6. How is the imbalance corrected? [1 mark]

The imbalance is corrected through a lightning strike.

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**LIGHTNING BOLTS**

7. Draw and label a diagram of a charged cloud, charged ground, step leader (include charges), and streamers (include charges). [4 marks]

![Diagram of lightning bolt](image)

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8. Explain how a lightning bolt strikes. Be sure to explain the role of charges in your answer. [2 marks]

Negative charges race down toward the ground and when they meet with the positive charges of a streamer, an electric current flows that races down through the bolt to the ground.
9. What is positive lightning? [1 mark]

Positive lightning is created in the positive region of a cloud where the charge flow is reversed in the bolt.

10. Draw a diagram of a charged cloud and draw lightning that is created
   a. within the cloud [1 mark]
   b. between the cloud and the ground [1 mark]
   c. positive lightning [1 mark]

Circles in the diagrams below indicate where lightning strikes should be drawn.
Lightning
Teacher-Led Post-Assessment

Name: ____________________________  Birthday: __________________

1. What is lightning caused by? [1 mark]

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3. For lightning to occur within a cloud, how do the charges have to be distributed? [1 mark]

4. What is the difference in charges between a step leader and a streamer in a lightning bolt? [2 marks]
Name: Answer Key

1. What is lightning caused by? [1 mark]

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2. An individual inside a car or house would be protected if lightning were to strike. What do these two structures have in common that protect the occupants inside? [1 mark]

They are both grounded and allow the negative charges to pass to the ground.

3. For lightning to occur within a cloud, how do the charges have to be distributed? [1 mark]

The top portion is positively charged while the bottom portion is negatively charged.

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