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EDUCATOR GUIDE

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Insect Swarms Might Electrify the Sky

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About this Guide

Large swarms of insects could produce as much electricity as a storm cloud. In this Guide, students will explore how insect-induced static electricity might affect the atmosphere, review the concepts of electric charge and electrostatic force, and apply those concepts to their own experiences and the biological phenomenon of insect swarms. In a quick activity, students will create a poem or song about serendipity in science.

This Guide includes:

Article-based Comprehension Q&A — Students will read and answer questions about the online *Science News* article "Insect swarms might generate as much electric charge as storm clouds," which explores how insect-induced static electricity might affect the atmosphere. A version of the article, "Insect swarms might electrify the sky" appears in the December 3, 2022 issue of *Science News*. Related standards include NGSS-DCI: HS-PS2; MS-PS2.

> **Student Comprehension Worksheet** — These questions are formatted so it's easy to print them out as a worksheet.

Cross-curricular Discussion Q&A — Students will use their experiences of static electricity to learn about electric charge and electrostatic force, then apply the concepts to a biological phenomenon. Learning Outcomes: Reinforcement of Coulomb's Law with interdisciplinary examples. Related standards include NGSS-DCI: HS-PS2; MS-PS2.

> **Student Discussion Worksheet** — These questions are formatted so it's easy to print them out as a worksheet.

Science Bite Activity — In this quick activity, students will create a poem or song about a serendipitous finding in science.

> **Student Activity Worksheet** — These questions are formatted so it's easy to print them out as a worksheet.

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Article-based Comprehension, Q&A

Directions for teachers: Ask students to read the online *Science News* article "Insect swarms might generate as much electric charge as storm clouds," which explores how insect-induced static electricity might affect the atmosphere, and answer the following questions. A version of the article, "Insect swarms might electrify the sky" appears in the December 3, 2022 issue of *Science News*.

1. How does the author hook you into reading the article? What literary device does the author use and why do you think they chose this literary device?

The first sentence of the article uses an analogy that compares the electricity produced between animals to romantic feelings between two people. An analogy is a comparison between things that have similar features. This literary device is often used to help explain a principle or an idea. In the article, the analogy helps the reader understand that this article will cover the topic of animal electricity.

2. What types of things does the atmosphere's electric field influence?

The atmosphere's electric field affects how dust moves as well as the formation of water droplets and lightning strikes.

3. How are flying insects like particles in the atmosphere, according to physicist Joseph Dwyer?

Particles moving around in the atmosphere charge up easily and contribute to the atmosphere's electric field. Flying insects basically do the same thing.

4. What unexpected observation led scientists to investigate the question: How does biology influence atmospheric electricity?

When honeybees passed over a sensor that measures atmospheric electricity, the electric charge strength increased by an average of 100 volts per meter. And denser swarms produced greater increases in charge.

5. A claim is an assertion of something as a fact. What is one scientific claim made by scientists in the article that attempted to answer their new scientific question?

The electricity produced by swarms of insects such as honeybees and locusts could add to the atmosphere's electric charge.

6. Evidence is the scientific data that are given to support a claim. What information do the scientists give as evidence?

The scientists measured the charges of individual desert locusts, found locust density data from other studies and used a computer simulation based on the honeybee swarm to estimate the per-meter electric charge of a locust swarm.

7. Reasoning is the explanation of why the evidence supports the claim. What reasoning is given by the scientists?

Because the electric charge of the simulated locust swarm was on par with that in storm clouds, scientists think that the electricity generated by locusts and other flying insects may be large enough to impact the environment.

8. Why were scientists interested in studying locusts?

Scientists were interested in studying locusts because the insects can form gigantic swarms.

9. Could locust swarms generate enough electricity to produce lightning? How might the electricity produced by insect swarms affect people?

No, it is unlikely that locust swarms would ever reach the densities required to produce lightning. But the swarms could interfere with sensors that people use to monitor lightning strikes.

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Student Comprehension Worksheet

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Cross-curricular Discussion, Q&A

Directions for teachers:
Ask students to read the *Science News* article "Insect swarms might generate as much electric charge as storm clouds" and answer the following questions. Your students can answer all of the questions on their own or in pairs, or you can walk students through the first set and then have them do the second set on their own. A version of the article, "Insect swarms might electrify the sky," appears in the December 3, 2022 issue of *Science News*. Review concepts of static electricity and electric fields if needed.

Want to make it a virtual lesson? Post the online *Science News* article to your virtual classroom. Discuss the article and questions with your class on your virtual platform.

Static electricity explained
Before diving into the fascinating world of electrically charged insects, let's review some basic science concepts and discuss how we experience the concepts in our daily lives.

Static electricity occurs when a stationary electric charge builds up on the surface of a substance. When two objects have opposite charges (positive and negative), the objects attract. When two objects have the same charge (positive and positive; negative and negative), the objects repel. The force of attraction or repulsion between two charged objects is called Coulomb force, or the electrostatic force.

1. Think of a time when you've experienced static electricity. How did you know you experienced it? What action caused it to happen?

Student answers will vary but might mention walking on carpet in socks and seeing a spark when touching a doorknob. Or students might mention having their recently dried clothes stick to them, or having their hair stick out and float away from their head uncontrollably on a cool, dry day.

2. Based on your knowledge of the particles that make up atoms and molecules, explain how charges can build up on surfaces.

Atoms and molecules are made up of protons, neutrons and electrons, and generally exist in nature in a neutrally charged state, meaning they have the same number of electrons as protons. When this balance is disrupted by bumping or rubbing on other atoms, electrons may travel from one surface to another. When this happens, there's an imbalance of charge on both surfaces. The surface that lost electrons is positive and the surface that gained them is more negative.

3. Explain the science behind your experience of static electricity. Why did your hair stand up or your freshly clean clothes stick to your body? Why did you see a spark when you touched a doorknob, for example?

A stationary electric charge built up between two surfaces, likely from the friction of the surfaces rubbing together. One surface lost electrons and the other surface gained electrons. Surfaces that stick together, such as the clothes on your body and the clothes fresh out of a dryer, had opposite charges. Surfaces that repelled each other, such as hair repelling other hair, had the same charge. Static shocks or sparks resulted from the transfer of electrons from an electron-rich surface to an electron-deficient one.

Electric charge in the atmosphere

1. Describe how flying insects generate static electricity. How does this electricity contribute to the electric field of the atmosphere?

Flying insects are constantly bumping into atoms and molecules in the air. This disturbance can move electrons to and from atoms and molecules in the atmosphere, creating a buildup of charge, or a charge potential, and generating static electricity.

2. What is the relationship between the density of an insect swarm and the change in the atmosphere's electric charge? Based on what you've learned so far from this discussion, explain the science behind this relationship.

The denser the swarm, the greater the change in the atmosphere's electric charge. If there are many insects bumping into air atoms and molecules within the same small area, then the insects will collide with many more air atoms and molecules, disrupting the charge distribution and producing a greater electric charge than just one or a few insects could.

Optional extension: Explain how this relationship relates to Coulomb's law.

Coulomb's law states that electrostatic force is greater when charged particles are closer together. Researchers observed that denser swarms generate greater electrostatic force.

3. How does the atmosphere's electric field impact weather?

The article mentions the atmosphere's electric field influences how water droplets form, dust particles move and lightning develops.

4. Using the example from the *Science News* article and your answers above, explain how static electricity helps produce lightning. Tip: If you need more information, use this article from *Science News Explores*.

As water vapor in the atmosphere condenses to form a cloud, the cloud heats up and rises. The higher the cloud rises, the colder the air gets. Small ice crystals form in the cloud. Winds cause the crystals to collide with water droplets and other particles in the cloud, transferring electric charge. Over time, negative electric

charges collect at the bottom of the cloud while positive electric charges collect at the top. Eventually, the difference in electric charge between the ground, which is positively charged, and the cloud's bottom becomes large enough that the cloud discharges an electric current that we call lightning.

5. Why do you think physicist Joseph Dwyer says that electrically charged flying animals are unlikely to ever reach the density required to produce lightning like storm clouds do?

The electric charge generated by dense swarms probably wouldn't be large enough to produce lightning.

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Student Discussion Worksheet

Directions: Read the *Science News* article "Insect swarms might generate as much electric charge as storm clouds" and answer the following questions as instructed by your teacher. A version of the article, "Insect swarms might electrify the sky," appears in the December 3, 2022 issue of *Science News*.

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Electric charge in the atmosphere

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Science Bite Activity: Science Sonnets

Directions for teachers: Use this short activity as a warm-up or exit ticket in class. The activity highlights an example of a serendipitous science discovery in the recent *Science News* article "Insect swarms might generate as much electric charge as storm clouds." After students explore this article to define one example of a serendipitous finding in science, they can use any *Science News* article that highlights an unexpected discovery in science and create their poem or song about it.

Science's happy accidents

Serendipity is the development of moments that occur by chance, often in a happy or beneficial way. Many times, serendipitous moments are shown through art, such as in movies, paintings and poems. Many scientific findings or discoveries also happen by accident, sometimes when an experiment fails or produces completely unexpected or unintended results.

1. Why is the study described in the *Science News* article considered serendipitous? Explain.

The scientists started out trying to determine something different and had unexpected results. They were measuring the atmosphere's electric charge when a swarm of honeybees happened to fly by the sensor and changed the electric charge. They discovered that insect swarms can cause an electric charge in the atmosphere and decided to further investigate it.

2. Brainstorm some lessons you can take from how the scientific discovery happened. Why did the scientists think their study was uniquely successful?

Student answers will vary but may include remaining open to new discoveries, looking for connections across disciplines, not making assumptions, etc. The scientists were working together across the fields of biology and physics and were open to exploring an unexpected result from an initial experiment.

3. Use the *Science News* or *Science News Explores* archives to find another serendipitous scientific discovery and create a poem or song about it. Check out a few types of poems by Penguin Random House for ideas.

Student answers will vary.

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Student Activity Worksheet: Science sonnets

Directions: Use the *Science News* article "Insect swarms might generate as much electric charge as storm clouds" to answer the following questions about a recent serendipitous scientific discovery. Then, find another *Science News* article that highlights an unexpected discovery and create a poem or song about it. Check out a few types of poems by Penguin Random House for ideas.

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