

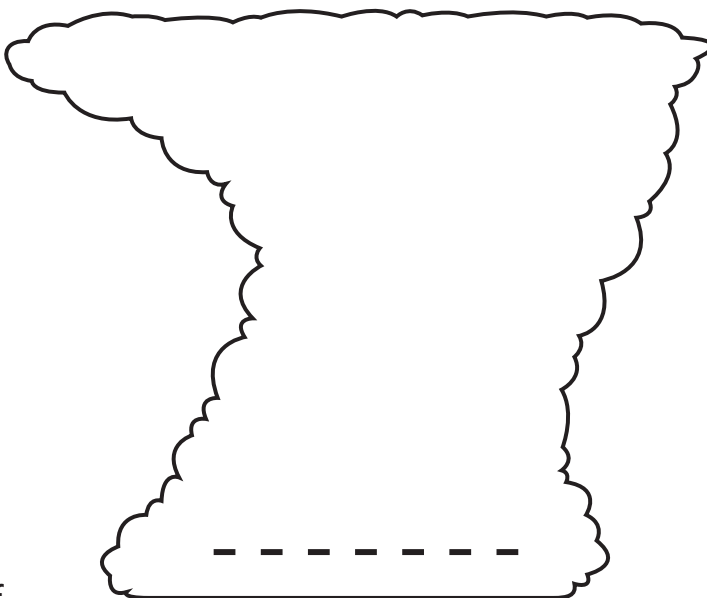
Thunder and lightning

Thunder and lightning occur in tall tower clouds. Lightning may be created in daytime storms, but it is most spectacular at night.

Q1. What is lightning an example of?

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Q2. Static electricity jumps between places that have opposite charges. Only some of the charges have been drawn on to the diagram on the right. Mark the places where you think there are other charges. Make sure you draw in the sign, '+' or '-', of the charge, too.



Q3. Now draw on the diagram where the lightning sparks might jump



Q4. What is sheet lightning?



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Q5. What causes the sound we know as thunder?



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Q6. The picture on the right shows an 18th-century design for a lightning proof umbrella. What would the risks have been of using this in a thunderstorm?



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Background

This is a good opportunity to combine geography and science in the study of static electricity.

This is the same kind of static electricity as the sparks produced by rubbing a comb against a jumper. The only difference is in the size of the voltage and the size of the spark.

Lightning (and the sound of the expanding hot air caused by the lightning flash, ie thunder) is produced by strong thermals that cause water droplets to brush against each other. This brushing effect gradually builds up an electric charge. Lightning cannot develop in thinner clouds, because the updraughts are not great enough to cause water droplets to brush against each other.

Static electricity in a cloud is produced by multitudes of tiny raindrops being whisked past larger drops. The result is to set up one kind of charge in the upper cloud (where the fine drops are) and an opposite charge on the larger drops near the bottom of the cloud.

The charge in the cloud causes an opposite charge to occur on the ground below it. (Notice that this is a positive charge, whereas we normally think of the ground as being negatively charged, as indeed it is everywhere except under the cloud.)

Pulling a comb through hair is enough to produce static electricity and to cause hair to be attracted to the comb. It works best on a dry day because the insulation effect of the air will then be at its best.

Answers

- Q1. Static electricity**
- Q2. See diagram below.**
- Q3. See diagram below.**
- Q4. Ordinary fork lightning that happens between layers of cloud so that we see only the reflected flash of light. In fact, sheet lightning is the same as fork lightning.**
- Q5. Thunder is the shock wave produced when the air expands as it is heated by the spark (lightning) jumping through the air. (We hear it because the frequency of the shock wave is within our audible range. It rumbles because the shock wave is bounced off layers of cloud and the ground and so it reaches us from many directions. The main 'crack of thunder' is the direct single shock wave.)**
- Q6. It would not be a good idea to try to attract electricity to yourself! The current flowing through a lightning flash is large. The lightning could easily jump from the spike of the umbrella through the person rather than simply running down the thin cable to the ground. Best to stay indoors!**

