

PROFILES IBSE Teaching/Learning Materials for Students

compiled by the PROFILES Working Group of the Freie Universität Berlin – Germany

Junior Climatologists Required! “How can we avoid global climate change?” Reflexions on Air Pollution, Tornados & Global Climate Change



A Module for Science Instruction – especially Chemistry – for Grades 8 to 10

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Outline

In this PROFILES module “Junior climatologists required!”, you will have the opportunity to obtain information which will help to explain rather complex processes using simple experiments. It is important that you experience the fact that scientific work does not only include conducting experiments but also includes looking for information and working with sources. A further substantial part of scientific work is being amazed by and marvelling at things. That is why you should raise questions and formulate assumptions as well as plan possible experimental setups. The following worksheets will help you in doing exactly that.

Acknowledgement:

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www.parsel.eu.

Junior Climatologists Required! “How can we avoid global climate change? – Reflections on Air Pollution, Tornados and Global Climate Change”

These worksheets belong to:

Introduction

The word “tornado” comes from Spanish, meaning “turning”. In the USA tornados are often simply called “twisters”. Meteorologists do not distinguish between “large” tornados in the US or “small” tornados, like they might occur in Europe. There are no differences in their physical nature or power. A tornado remains a quickly rotating column of air which reaches from the clouds to the ground and tears up anything it comes across in its path.



Fig.1. Tornado

Small tornados might whirl up leaves or dust, large ones destroy whole cities. The diameter of the tube varies greatly – 20 metres are possible, but so is 1 kilometre! If the column of air travels across water, it sucks the water up and turns into a “water spout”. Meteorologists have great respect for tornados, and they should do. Tornados can develop within minutes during thunderstorms, can be forecast only with difficulty and they twist and turn unpredictably across land and violently destroy everything that dares to stand in the way of their greedy funnels of air. That includes meteorologists and their measuring equipment!

Tornados form during thunderstorms. Most of them occur in the US where every year around 100,000 thunderstorms wreak havoc across the country. Out of these thunderstorms about 1,200 cyclones of air form every year: tornados! Their peak season is during March, April and May. (www.planet-wissen.de)



Fig.2. Tornados occur worldwide (marked blue)

My questions:

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Answering Questions on Tornado Formation

1. Crushing a can

Into an empty drink can add one tablespoon of water and heat the can on a hotplate. When the water starts boiling and steam comes out of the opening, hold the can with the crucible tongs and dip it upside down into the bowl of ice-cold water.

Observation:

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2. Dancing coin

Chill an empty glass bottle in ice. Wet the top of the bottle and place a coin onto the opening. Now clutch the bottle in your hands. Watch the coin!

Observation:

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3. Egg in a bottle

Place the peeled egg onto the bottle opening. Put the bottle into the bucket with ice. Before the egg has slid all the way into the bottle, you can heat it up again.

Observation:

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4. Air pressure I

Using the pump, evacuate the air out of a 1 l round flask. Close the flask's stopcock, pull the hose out of the pump and attach the long glass tube to stopcock.

Climb on a chair and let the lower end of the glass tube slowly dip into a beaker with water. Now open the stopcock carefully! [4]

Observation:

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5. Air pressure II

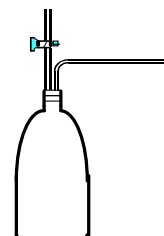
Build an air pressure gauge as shown on the right. Carefully place the paraffin drop into the right-hand glass tube. Determine the air pressure at different heights! Note down the locations at which you measured and the gauge's readings. Estimate the differences in altitude! [15]

Observation:

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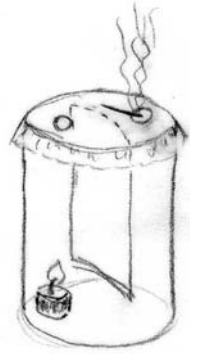
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6. How wind forms – a model experiment

Cut a rectangle out of the cardboard so that it can be wedged into the beaker –creating two chambers (see figure). Position the tea candle in one of the chambers and light it. Cover the opening of the beaker with the aluminium foil and cut a hole in it over each chamber. Ignite a piece of the incense stick and lay it onto the hole over the empty chamber.



Observation:

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Interpretation:

Try to write down some general statements about warm and cold air and about air pressure. We will use these results to explain how tornados are formed.

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How Does a Tornado Form?

Correctly fill in the blanks in the following diagram.

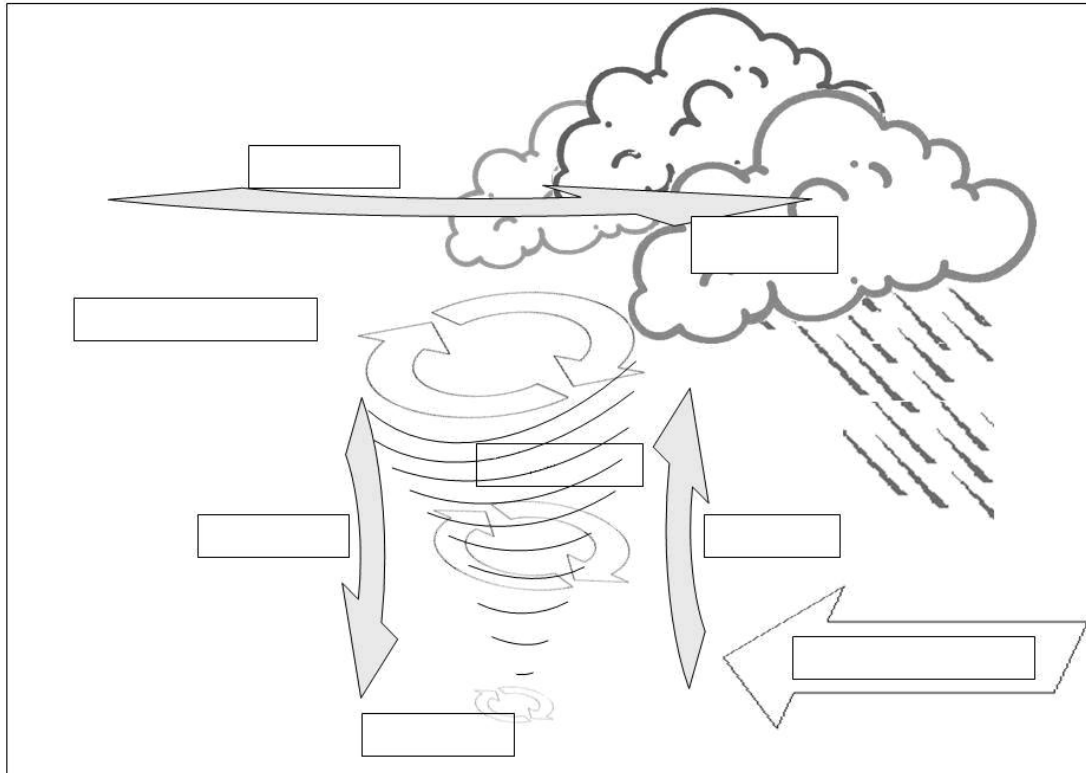


Diagram of tornado formation

The Composition of Air

1. Add ice into a beaker and very carefully observe the outside of the glass.

Observation:

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2. Fill two glasses up to about 1 cm with lime water.

- a) Carefully add air into one of the glasses, pumping it from the bicycle pump through a straw.
- b) Through another straw, carefully blow air into the second glass yourself.

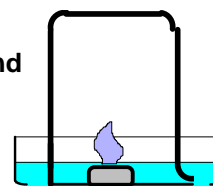
Compare the glasses with one another.

Observation:

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3. Fill a saucer with water, place a tea candle in the middle, light the candle and cover it with an upside down beaker.



Observation:

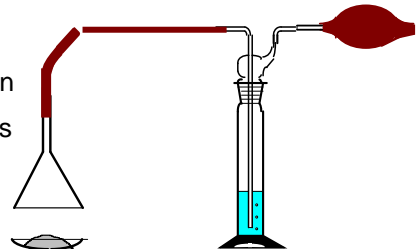
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Change in the Composition of Air

Test for carbon dioxide in combustion gases

Fill a gas wash bottle up to about 3 cm with lime water. One after the other, burn different substances in the porcelain dish and let the gas travel through the gas wash bottle (see figure). Caution: After burning each substance, replace the lime water in the bottle! Try out beforehand how you can suck in the air!



Observation:

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