Scattered Clues

Topic

Effects of wind

Introduction

Clues at a crime scene can be very small; seeds, hairs, threads, and even pollen can direct the investigator to the nature of the crime and to the perpetrator of the crime. Such clues can be scattered by air movements. At an outdoor crime scene, therefore, it is important that investigators are aware of the speed and direction of the wind when searching for clues, as these could have been scattered far and wide. In the first part of this experiment, you will study wind direction. This is given as the compass bearing from which the wind is blowing. In the second part of this experiment, you will make an anemometer – an instrument that will give an indication of the speed at which the wind is blowing.

Time required

Part A: 40 minutes
Part B: 1 hour

Materials

For Part A:
sheet of cardboard
3 mm diameter knitting needle
2 beads with a hole large enough to fit over the knitting needle (can be any shape)
large diameter drinking straw
re-usable adhesive putty
translucent tape
scissors
compass
pencil
30 cm ruler

For Part B:
disposable plastic dinner plate
360° protractor
colored marker pen
4 paper or plastic (disposable) cups (approx. 8 oz)
3 mm diameter knitting needle
2 beads with a hole large enough to fit over the knitting needle (can be any shape)
3 cm length cut from large diameter drinking straw
thumbtack
re-usable adhesive putty (ball about 1 mm in diameter)
scissors
4 lengths translucent tape (each about 8 – 10 cm long)
all purpose white glue
stopwatch
fan that can operate at more than one speed

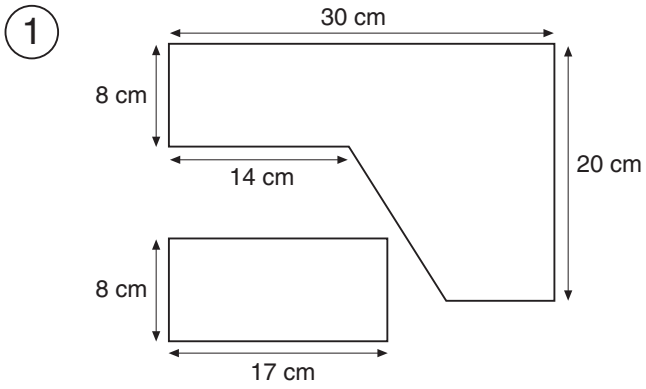
Safety note

Please read the general safety precautions.

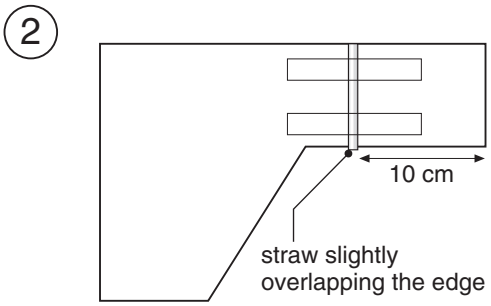
Procedure

Because you will be studying wind speed and direction, it is important that there is at least a gentle breeze forecast when you perform this experiment.

Part A: Wind direction

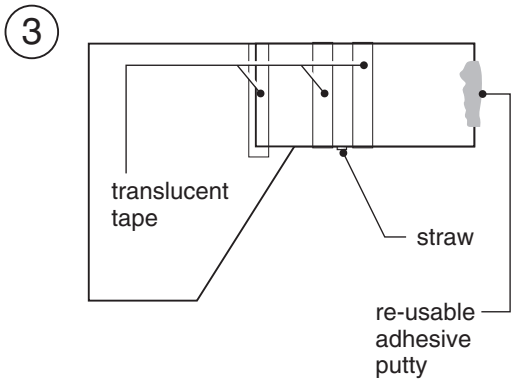


Dimensions of the shapes to be cut from cardboard

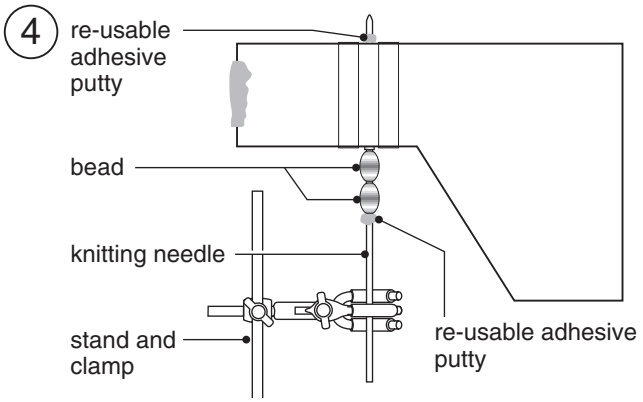


Straw taped to the larger shape

1. Using the ruler and pencil, draw the shapes shown in diagram 1 above on the cardboard and cut them out using the scissors.
2. Cut a length of drinking straw approximately 9 cm long and tape it to the larger shape at the position shown in diagram 2 above. Ensure that the straw is perpendicular to the edge of the shape and overlapping its lower edge.
3. Place the smaller shape on top of the larger one, covering the drinking straw. Secure with translucent tape at both ends and on either side of the drinking straw as shown in diagram 3 below. Squeeze a large piece of re-usable adhesive putty firmly over the taped-together pieces of cardboard.



Two shapes taped together



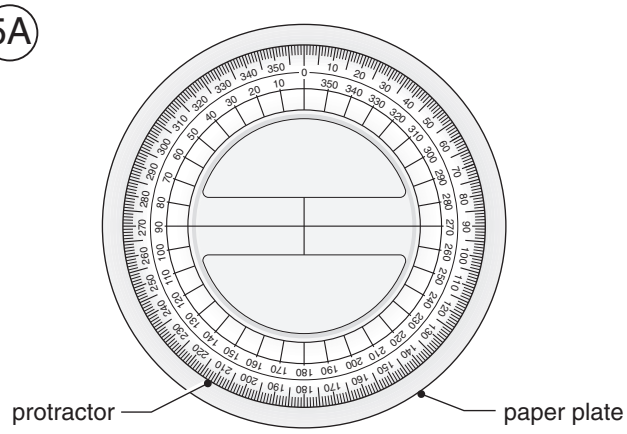
Completed wind direction indicator

4. Place a 1 cm ball of re-usable adhesive putty about halfway along the knitting needle and thread the two beads onto the needle above this ball.
5. Insert the pointed end of the knitting needle into the drinking straw secured within the cardboard shapes (see diagram 4 on the previous page). Place a small piece of re-usable adhesive putty on the top of the needle – but not touching the cardboard – to prevent the cardboard shapes being blown off the needle.
6. Take your wind direction indicator and the compass outside. Position the compass on level ground, and turn it so that the North-seeking point of the compass needle points North.
7. Hold the needle of the wind direction indicator firmly at arm's length. Observe which way the narrow end of the indicator is pointing. Record this in data table A below.

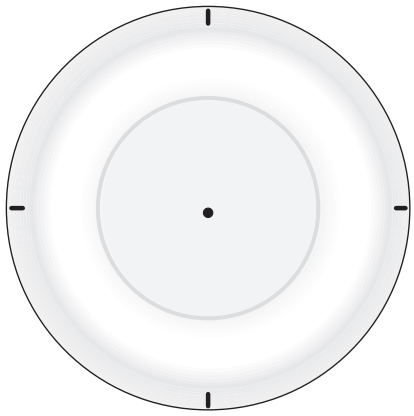
DATA TABLE A	
Direction in which the narrow end of the indicator is pointing (compass reading)	

Part B: Wind speed

5A

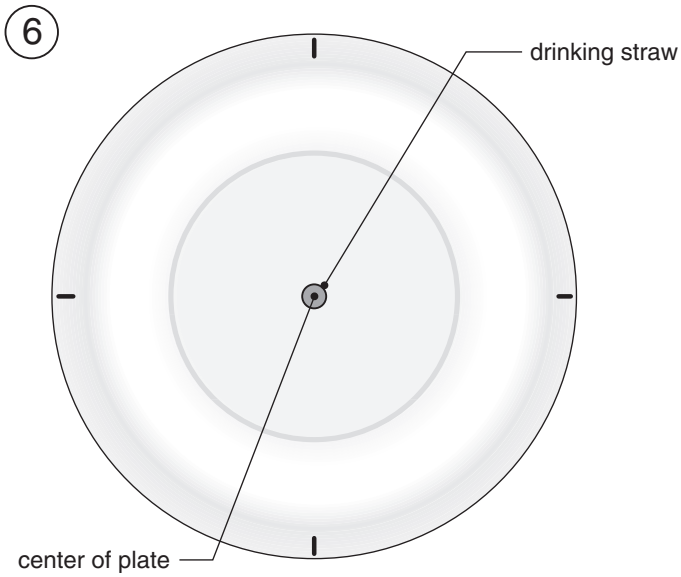


5B

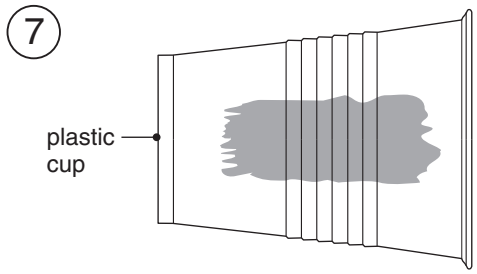


Marking the paper plate

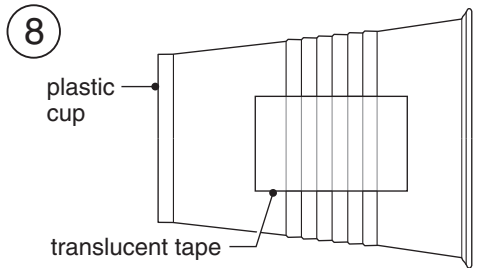
1. Using the protractor and the colored marker pen, find and mark the center of the paper plate. Mark four points, 90° apart, around the outer edge of the paper plate with the plate face down (see diagram 5 above).
2. Use the thumbtack to make a hole in the marked center of the paper plate. Enlarge this hole using the knitting needle until the hole is just large enough for the straw to fit through (see diagram 6 on the next page). Glue the straw in place.



Straw inserted through the hole in the center of the paper plate

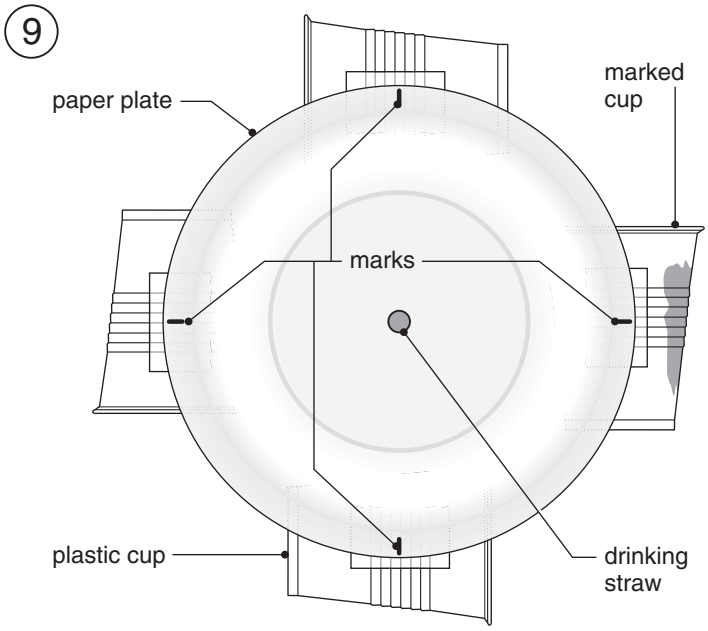


Cup identified by colored ink



Cup with loop of translucent tape

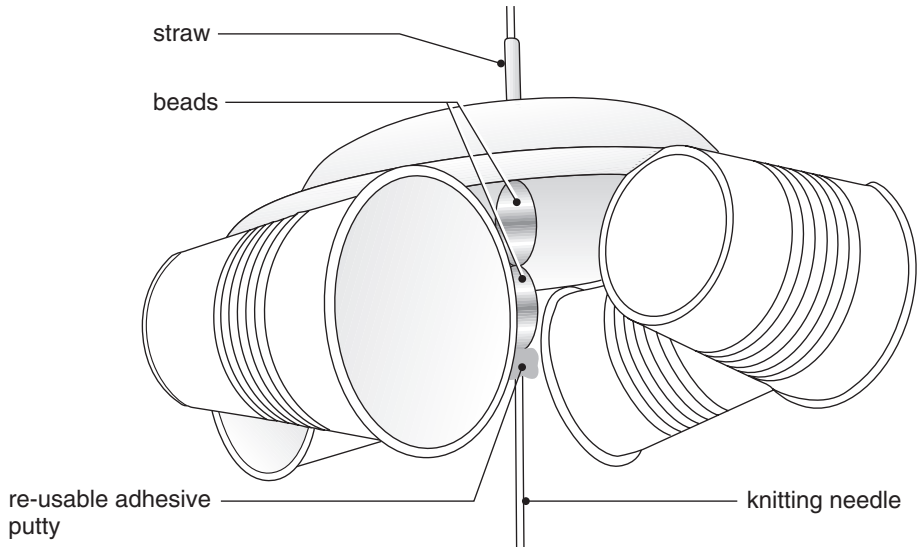
3. Use the marker pen to make an identifying mark on one of the cups (see diagram 7 above).
4. Fold one of the strips of translucent tape back on itself to make a closed loop with the sticky side outermost. Stick it on one of the cups (along the ridged section if the cup has ridges, otherwise halfway up the cup) as in diagram 8 above. Repeat with the other three cups (including the marked one).
5. Use the loops of translucent tape to stick the cups to the plate at the marks on its outer edge. Make sure that each mark is attached to the same point of a cup (this ensures the device is balanced) and the mark on the marked cup is facing outwards (see diagram 9 opposite).
6. Secure a ball of re-usable adhesive putty about halfway along the knitting needle. Thread the two beads onto the knitting needle above this ball.
7. Place the paper plate onto the knitting needle above the beads (see diagram 10 on the next page). This is your anemometer.



Cups attached to paper plate

8. Hold the anemometer in front of the fan. Switch the fan to a low speed and count the number of times the marked cup returns to its starting point in a minute. Enter this number in data table B below.
9. Repeat step 8 with the fan switched to a fast speed.

10



Anemometer

DATA TABLE B	
	Number of times the marked cup returns to its starting point in a minute
Slow speed	
Fast speed	

Analysis

Part A: Wind direction

1. Did the narrow or the wide end of the wind direction indicator point in the direction the wind was blowing?
2. What was the wind direction?

Part B: Wind speed

1. Why do you think the device moves around?
2. Was there a difference between the number of times you counted the marked cup returning to its starting point when the fan was switched to a slow and a fast speed?

Want to know more?

Part A: Wind direction

1. The wide end of the wind direction indicator pointed toward the direction the wind was blowing.
2. The wind direction is the compass reading in data table A, the direction from which the wind was blowing.

Once you have determined the direction in which the wind is blowing at a crime scene, you will know in which direction to look for any small, light clues.

Part B: Wind speed

1. The device moves around because air blows into a cup and pushes against the inside of its base. The plate to which the cup is fixed rotates and the air blows into the next cup, etc.
2. The marked cup returned to the starting point more times in a minute when the air was moving at a fast speed than it did when the air traveled at a slow speed. Once you have determined approximately how fast the wind is blowing at a crime scene, you will be able to estimate how far small, light clues may have been blown.

Wind speed is measured on the Beaufort scale, which was devised by Rear-Admiral Sir Francis Beaufort in the early 1800s. The scale goes from 0 (wind speed less than 1 knot) or Calm, to 12 (wind speed over 64 knots) or Hurricane. For more information about the Beaufort scale, visit the following websites:
http://www.crh.noaa.gov/lot/webpage/beaufort/
http://www.zetnet.co.uk/sigs/weather/Met_Codes/beaufort.htm

Special Safety Note To Experimenters

Each experiment includes any special safety precautions that are relevant to that particular project. These do not include all of the basic safety precautions that are necessary whenever you are working on a scientific experiment. For this reason, it is absolutely essential that you read, copy, and remain mindful of the General Safety Precautions that follow this note. Experimental science can be dangerous, and good laboratory procedure always includes carefully following basic safety rules. Things can happen very quickly while you are performing an experiment. Things can spill, break, even catch fire. There will be no time after the fact to protect yourself. Be prepared for unexpected dangers by following basic safety guidelines the entire time you are performing the experiment, whether or not something seems dangerous to you at a given moment.

We have been quite sparing in prescribing safety precautions for the individual experiments. We made this choice for one reason: We want you to take very seriously every safety precaution that is printed in this book. If you see it written here, you can be sure that it is here because it is absolutely critical to your safety.

One further note: The book assumes that you will read the safety precautions that follow, as well as those in the box within each experiment you are preparing to perform, and that you will remember them. Except in rare instances, the general precautions listed below will not be repeated in the procedure itself. It is up to you to use your good judgment and pay attention when performing potentially dangerous parts of the procedure. Just because the book does not say **BE CAREFUL WITH HOT LIQUIDS or DON'T CUT YOURSELF WITH THE KNIFE** does not mean that you should be careless when boiling water or cutting a section of a stem for microscope work. It does mean that when you see a special note to be careful, it is extremely important that you pay attention to it. If you ever have a question about whether a procedure or material is dangerous, wait to perform it until you find out from a qualified adult that it is safe.

GENERAL SAFETY PRECAUTIONS

Accidents caused by carelessness, haste, insufficient knowledge, or taking unnecessary risks can be avoided by practicing safety procedures and being alert while conducting experiments. Be sure to check the individual experiments in this book for additional safety regulations and adult supervision requirements. If you will be working in a lab, do not work alone.

PREPARING:

—Clear all surfaces before beginning experiments
—Read the instructions before you start
—Know the hazards of the experiments and anticipate dangers

PROTECTING YOURSELF:

—Follow the directions step-by-step; only do one experiment at a time
—Locate exits, fire blanket and extinguisher, gas and electricity shut-offs, eyewash, and first-aid kit
—Make sure there is adequate ventilation
—Act sensibly at all times
—Wear an apron and safety glasses
—Do not wear open shoes, loose clothing, or loose hair
—Keep floor and workspace neat, clean, and dry
—Clean up spills immediately, being careful to follow the recommended procedure for dealing with the spilt substance
—Never eat, drink, or smoke in the laboratory or workspace
—Do not eat or drink any substances tested unless expressly permitted to do so by a knowledgeable adult

USING EQUIPMENT WITH CARE:

—Set up apparatus far from the edge of the desk
—Use knives and other sharp or pointed instruments with caution
—Pull plugs, not cords, when removing electrical plugs

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—Don't use your mouth to pipette liquids; use a suction bulb
—Check glassware is clean and dry before use
—Check glassware for scratches, cracks, and sharp edges
—Report broken glassware immediately so that it can be cleaned up by a responsible person
—Do not use reflected sunlight to illuminate your microscope
—Use only low voltage and current materials such as lantern batteries
—Be careful when using stepstools, chairs, and ladders

USING CHEMICALS AND BIOLOGICAL MATERIALS:
—Never taste or inhale chemicals
—Label all bottles and apparatus containing chemicals
—Read labels carefully
—Avoid chemical contact with skin and eyes (wear safety glasses, lab apron, and gloves)
—Do not touch chemical solutions
—Wash hands before and after using solutions
—Wipe up spills thoroughly
—Use sterile procedures when handling even common and harmless microorganisms
—Avoid contact with human blood
—Treat all living organisms with appropriate respect

HEATING SUBSTANCES:
—Wear safety glasses, apron, and gloves when boiling water
—Keep your face away from test tubes and beakers
—Use test tubes, beakers, and other glassware made of Pyrex™ or borosilicate glass
—Use alcohol-filled thermometers (do not used mercury-filled thermometers)
—Never leave apparatus unattended
—Use safety tongs and heat-resistant mittens
—If your laboratory does not have heat-proof workbenches, put your Bunsen burner on a heat-proof mat before lighting it
—Take care when lighting your Bunsen burner; use a Bunsen burner lighter in preference to wooden matches
—Turn off hot plates, Bunsen burners, and gas when you are done
—Keep flammable substances away from heat
—Keep sheets of paper and other flammable objects away from your Bunsen burner
—Have a fire extinguisher on hand

FIELDWORK:
—Be aware of environmental dangers (e.g., do not carry out fieldwork near dangerous roads, cliffs, or water)
—Remember that strong sunlight can be dangerous – pack sunscreen and a good supply of drinking water if you will be outside all day
—Never carry out fieldwork in areas where you cannot find your way to safety easily and quickly and never wander off on your own in search of new areas to study

FINISHING UP:
—Clean your work area and glassware (follow any instructions given by a supervising adult)
—Be careful not to return chemicals or contaminated reagents to the wrong containers
—Don't dispose of materials in the sink unless instructed to do so
—Wash your hands
—Clean up all residues and put in proper containers for disposal
—Dispose of all chemicals according to all local, state, and federal laws
—Dispose of all microbiological cultures by treatment with an appropriate disinfectant

BE SAFETY CONSCIOUS AT ALL TIMES