Measuring Quartz Crystals

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Topic

Interfacial angles of crystals

Time

30 minutes

Safety

Please click on the safety icon to view the safety precautions.

Materials

two quartz crystals (For best results, use crystals that are at least 1½ ins. long and significantly different in size.)
masking tape
ruler
contact goniometer (If the science department in your school does not own one, your science teacher may be able to help you make one with a protractor and 6-in. clear ruler. See figure 3.)

Procedure

1. Choose one of the quartz crystals for measurement. Count the number of sides, and record the number on the data table. Stick a small piece of masking tape on each face (side) of the crystal, and number each face (1, 2, 3, . . .). Measure the width of each face to the nearest millimeter (see figure 1). Are the faces the same width? Record this information on the data table.

Figure 1

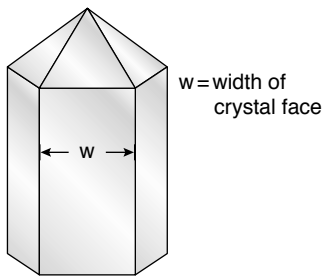
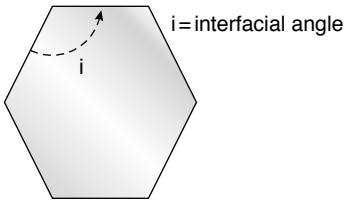


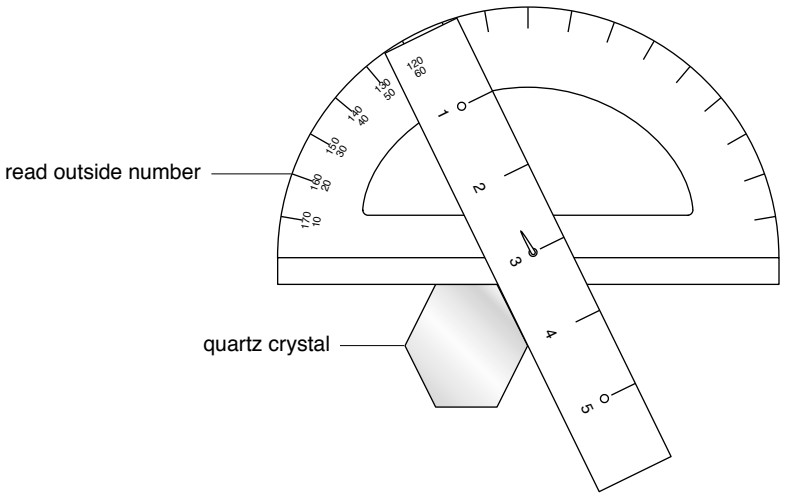
Figure 2



2. Use the contact goniometer to measure each interfacial angle of the crystal (the angle between adjacent crystal faces; see figure 2). To do this, place the contact goniometer so that the straight edge of the ruler is against one face and the straight edge of the protractor portion is against the adjacent face (see figure 3).

Next, read and copy the center of the ruler portion of the contact goniometer. There will be two numbers, one above the other. The outside number is the interfacial angle. Measure each interfacial angle and record each on the data table.

Figure 3



DATA TABLE

Crystal 1 Number of sides _____			Crystal 2 Number of sides _____		
Side number	Width of side	Interfacial angle	Side number	Width of side	Interfacial angle
1		Faces (1 and 2)	1		Faces (1 and 2)
2		Faces (2 and 3)	2		Faces (2 and 3)
3		Faces (3 and 4)	3		Faces (3 and 4)
4		Faces (4 and 5)	4		Faces (4 and 5)
5		Faces (5 and 6)	5		Faces (5 and 6)
6		Faces (6 and 1)	6		Faces (6 and 1)

3. Repeat the procedure with the other quartz crystal.
4. How many faces did crystal 1 have? Crystal 2?
5. How did the widths of the faces of crystal 1 compare with each other? How did the widths of the faces of crystal 2 compare with each other? How did the widths of crystal 1's faces compare with the width of crystal 2's faces?

6. How did the interfacial angles of crystal 1 compare with each other? How did the interfacial angles of crystal 1 compare with the interfacial angles of crystal 2?
7. Based on your results, what conclusion can you draw about the relationship between the widths of crystal faces and interfacial angles? Based on your data, what tentative conclusion might you draw about interfacial angles?

What's Going On

Although the widths of the two crystals' faces vary, the interfacial angles of crystals of the same mineral are essentially equal. This constancy is a basic mineralogical law and can be measured in other quartz crystals, as well as in the crystal forms of other minerals. Though their size may vary, all crystals of a specific mineral have the same characteristic shape. The atoms of molecules in crystals are arranged in a regular, repeating pattern, that is, outwardly manifested by the mineral crystal's plane faces and the angles between them. Interfacial angles in a crystal remain constant regardless of the size of the crystal's plane faces.

Connections

Amethyst and opal are much-valued quartz gems. Amethyst has colors ranging from orchid pink to regal purple. It was once thought that if you carried an amethyst gem with you, it would protect you from drunkenness. Opals display flashes of colored light. A specific type of opal named fire opal has flamelike colors that flash as the gem is rotated.

Safety Precautions

READ AND COPY BEFORE STARTING ANY EXPERIMENT

Experimental science can be dangerous. Events can happen very quickly while you are performing an experiment. Things can spill, break, even catch fire. Basic safety procedures help prevent serious accidents. Be sure to follow additional safety precautions and adult supervision requirements for each experiment. If you are working in a lab or in the field, do not work alone.

This book assumes that you will read the safety precautions that follow, as well as those at the start of each experiment you perform, and that you will *remember* them. These precautions will not always be repeated in the instructions for the procedures. It is up to you to use good judgment and pay attention when performing potentially dangerous procedures. Just because the book does not always say "be careful with hot liquids" or "don't cut yourself with the knife" does not mean that you should be careless when simmering water or stripping an electrical wire. 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, stop to find out for sure that it is safe before continuing the experiment. To avoid accidents, always pay close attention to your work, take your time, and practice the general safety procedures listed below.

PREPARE

- Clear all surfaces before beginning work.
- Read through the whole experiment before you start.
- Identify hazardous procedures and anticipate dangers.

PROTECT YOURSELF

- Follow all directions step by step; do only one procedure at a time.
- Locate exits, fire blanket and extinguisher, master gas and electricity shut-offs, eyewash, and first-aid kit.
- Make sure that there is adequate ventilation.
- Do not horseplay.
- Wear an apron and goggles.
- Do not wear contact lenses, open shoes, and loose clothing; do not wear your hair loose.
- Keep floor and work space neat, clean, and dry.
- Clean up spills immediately.
- Never eat, drink, or smoke in the laboratory or near the work space.
- Do not taste any substances tested unless expressly permitted to do so by a science teacher in charge.

USE EQUIPMENT WITH CARE

- Set up apparatus far from the edge of the desk.
- Use knives and other sharp or pointed instruments with caution; always cut away from yourself and others.
- Pull plugs, not cords, when inserting and removing electrical plugs.
- Don't use your mouth to pipette; use a suction bulb.
- Clean glassware before and after use.
- Check glassware for scratches, cracks, and sharp edges.
- Clean up broken glassware immediately.

- Do not use reflected sunlight to illuminate your microscope.
- Do not touch metal conductors.
- Use only low-voltage and low-current materials.
- Be careful when using stepstools, chairs, and ladders.

USING CHEMICALS

- Never taste or inhale chemicals.
- Label all bottles and apparatus containing chemicals.
- Read all labels carefully.
- Avoid chemical contact with skin and eyes (wear goggles, apron, and gloves).
- Do not touch chemical solutions.
- Wash hands before and after using solutions.
- Wipe up spills thoroughly.

HEATING INSTRUCTIONS

- Use goggles, apron, and gloves when boiling liquids.
- Keep your face away from test tubes and beakers.
- Never leave heating apparatus unattended.
- Use safety tongs and heat-resistant mittens.
- Turn off hot plates, bunsen burners, and gas when you are done.
- Keep flammable substances away from heat.
- Have a fire extinguisher on hand.

WORKING WITH MICROORGANISMS

- Assume that all microorganisms are infectious; handle them with care.
- Sterilize all equipment being used to handle microorganisms.

GOING ON FIELD TRIPS

- Do not go on a field trip by yourself.
- Tell a responsible adult where you are going, and maintain that route.
- Know the area and its potential hazards, such as poisonous plants, deep water, and rapids.
- Dress for terrain and weather conditions (prepare for exposure to sun as well as to cold).
- Bring along a first-aid kit.
- Do not drink water or eat plants found in the wild.
- Use the buddy system; do not experiment outdoors alone.

FINISHING UP

- Thoroughly clean your work area and glassware.
- 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 thoroughly.
- Clean up all residue, and containerize it for proper disposal.
- Dispose of all chemicals according to local, state, and federal laws.

BE SAFETY-CONSCIOUS AT ALL TIMES