Playground Patterns of Cracks

Are some angles more common than others?

Materials
- playground or other paved surface
- paper
- clipboard or book to create a sturdy drawing surface
- pencil
- Pocket Protractor or other protractor

Group Size
individuals or small groups

Related Activity
Pocket Protractor

Background
Paved surfaces sometimes form cracks due to stress from objects embedded in the surface, or due to stress created by expansion or contraction. In this activity, you'll observe and sketch cracking patterns.

Try This
1. Carefully observe the surface of the playground, walking slowly as you look for cracking patterns. Be sure to look for cracks where there are objects in the pavement such as poles, utility covers, and buildings, as well as in open areas. Try to find several examples of different patterns of cracks.

2. Draw the cracks you observe, and include any structures that touch the cracks. For example, if you see a crack coming from a pole cemented into the playground, include the pole in your sketch. Such objects should be drawn from a bird's eye view—so a cylindrical pole would be represented by circle.

3. Use your protractor to measure the angles on your sketches, or measure them directly on the pavement, and label the angles.

4. What do you notice? Are some angles more common than others? If you're part of a group, discuss your observations with each other.

What's Going On?

Force applied to an area is called *stress*. Stresses in paved surfaces cause cracking. When cracks appear in an open area of the paved surface (when the crack isn't touching an object), you may notice three main cracks with 120° angles between each crack. This pattern forms when the stress is equal in all directions. Uniform stress can be caused by expansion or contraction due to changes in temperature.

Cracks that form around objects develop because the embedded objects cause unequal stress. The cracks generally are perpendicular to the stress, creating two 90° angles.

cement step
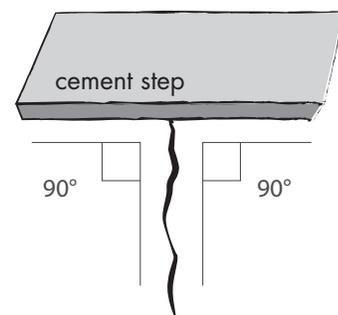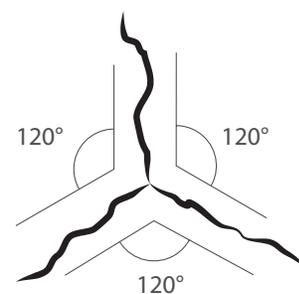
Cracks that develop at a corner, such as the corner of the building, form two 135° angles.

corner of building

135°

135°
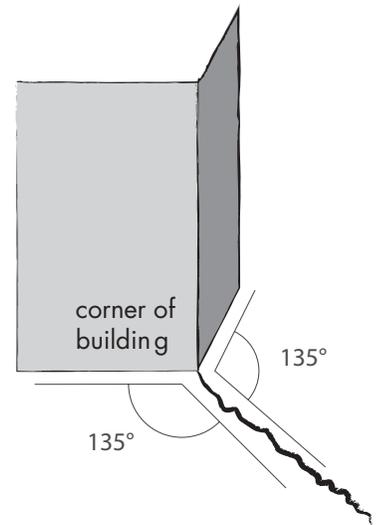
So What?

The 120° angle pattern that you may have found in an open area of the playground can also be found in the natural world. When an area of lava dries, for example, this same pattern forms. That's because the lava shrinks as it dries (just as the pavement contracts when it's cold), creating stress throughout the lava, and it cracks to relieve that stress. Cracks that meet at 120° angles are the shortest possible cracks that can get the job done—and nature always finds ways to take the shortest path and to expend the least amount of energy.

Extension

Looking for patterns isn't just something you can do on a playground. In the days and weeks ahead, look for patterns of cracks on sidewalks, driveways, and other surfaces.