Where's East?

How to determine an east-west line by the Sun

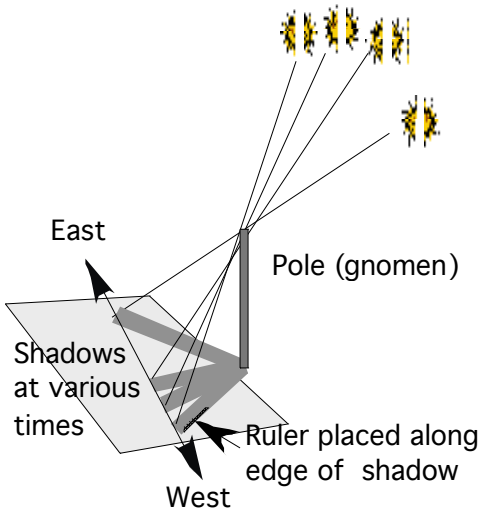
Materials:

- 5' tall pole for casting shadow (gnomon)
- Marking pen
- Ruler, 12" (30 cm) or yardstick (meter stick)
- Stiff board, at least 1'x2' (30x60cm), e.g. cardboard, posterboard, tagboard, foamboard
- A way to secure the board to the ground: e.g. big nails if it's soil, or tape (masking tape or duct tape) if it's pavement
- Sheet(s) of paper to cover the board
- Tape

What To Do:

1. Secure the gnomon pole either by driving it into the ground (as a stake) or securing it to a flat board so it stands straight up. A stanchion with a pointy piece of cardboard taped to the top works well also.
2. Secure the stiff board north of the gnomon so that the shadow of the gnomon falls on it and tape paper onto the board for marking shadow positions.
3. Starting about a half hour before local noon* mark the tip of the gnomon's shadow, using a marking pen. Place the ruler along the western edge of the shadow of the gnomon to make it easy to observe the movement of the shadow. ***"Over time, is there a pattern to the marks?"***
4. After a symmetrical pattern of marks shows on the marking sheet, measure the lengths of the shadows (distance from the gnomon base to the tip of the shadow). A line between any two marks that are at equal distances from the base of the gnomon should be a true east-west line.

* To determine local noon, find the shortest length of gnomon shadow. The shadow is shortest at local noon and also points to true north at that time.



If you need to know the time of local noon in advance, visit http://aa.usno.navy.mil/data/docs/RS_OneDay.html, enter your location and then look for "Sun transit time" which is the same as local noon.

Solar Snippets:

The Sun's name: Egyptians called it *Ra*; the Greeks called it *Helios*; the Romans called it *Sol*. There are many other names—each culture is different.

Sun's Age: 4.5 billion years (happy birthday!)

Sun's size: Diameter is about 1.4 million km (870 million mi), or 109 times Earth Diameter. In terms of volume, the Sun could contain 1.3 million Earths

Sun's Rotation Rate: at the equator the surface rotates once every 25.4 days; near the poles it's as much as 36 days. This odd behavior is due to the fact that the Sun is not a solid body like the Earth. Similar effects are seen in the gas planets.

Surface Temperature of the Sun: about 5,800°K (5,430°C, or 9,800°F)

Core Temperature of the Sun: 15,600,000°K (28,000,000°F)

Temperature of the Sun's atmosphere (called the corona): Over 1,000,000K° (The fact that this is so much higher than the Sun's surface temperature was a puzzlement for a long time. We are only beginning to understand the reason for this—it has to do with activity on the surface of the Sun.

The Sun is made of about 75% hydrogen and 25% helium. This changes slowly over time as the Sun converts hydrogen to helium in its core.

Sunspots are "cool" regions, only 3800 K (they look dark only by comparison with the surrounding regions). Sunspots can be very large, as much as 50,000 km in diameter—larger than Earth! Sunspots are caused by complicated, not very well understood changes in the Sun's magnetic field.

Pressure at the Sun's core: 250 billion times Earth atmospheric pressure.

Density at the Sun's core: > 150 times that of water.

Energy output of the Sun: 386 billion billion megawatts. Each second about 700,000,000 tons of hydrogen are converted to about 695,000,000 tons of helium and 5,000,000 tons of energy in the form of gamma rays. As it travels out toward the surface, the energy is continuously absorbed and re-emitted at lower and lower temperatures so that by the time it reaches the surface, it is primarily visible light. Since its birth it has used up about half of the hydrogen in its core. It will continue to radiate "peacefully" for another 5 billion years or so (although its luminosity will approximately double in that time). But eventually it will run out of hydrogen fuel. It will then be forced into radical changes which, though commonplace by stellar standards, will result in the total destruction of the Earth (and probably the creation of a planetary nebula).