

At-Home STEM Activities: Make Your Own Sundial

Tell time with nothing more than the sun and a few household objects!

This sunny-day activity is geared toward elementary and middle-school learners: it requires an ability to read time and to find magnetic north with a compass (with or without assistance).



A **sundial** tells time using sunlight. Just like the hour-hand moves around a clock face and points to the current hour, a sundial shows the current hour with a **shadow**. The shadow is created by the sun shining onto a pointer called a **gnomon**.

If the sundial stays in place, the gnomon's shadow changes position as the sun moves through the sky over the course of the day. If the sundial is aligned correctly, the shadow will point to the current hour!

Materials

- Paper plate
- Crayons, markers, or coloured pencils
- Ruler/straight edge
- Geographic compass
- A sharp pencil
- Plastic drinking straw
- Rock or paperweight
- Open outdoor area that receives direct sunlight throughout the day



Process:

1. Write the number **12** along one edge of your plate; this will anchor the rest of your clock



2. Use the sharp pencil to poke a hole in the centre of the plate, and put the straw into this hole so that it is sticking straight upward



3. Use a ruler to draw a straight line from the hole to the number 12

4. **JUST BEFORE NOON**, take your plate outside with the compass. Use the compass to find **magnetic north**—this is the direction the arrow is pointing. Place your compass on the ground with the arrow pointing north.



5. Place your plate on the ground next to the compass.

6. **RIGHT AT NOON**, position your plate so that the gnomon's shadow is right over the line pointing to 12:00, without moving the gnomon. You'll need to hold the gnomon in place with one hand and rotate the plate from side-to-side with your other hand, until the shadow aligns with the line.

You have now **calibrated** your sundial. The sun moves from east to west in the sky. At noon, the sun is in the middle of the horizon, to the south—so it casts a shadow to the north.

7. Use a rock or a paperweight to hold your sundial in place on the ground. You may take the compass inside.



Come out every hour throughout the afternoon, and use the gnomon's shadow to mark each hour on the plate.

9. You'll have to return in the morning to mark the remaining hours (for example, you'll find your marks on the left side of your dial from 8, 9, 10, and 11 A.M.) Your sundial is then ready to tell the time whenever the sun is out! Just keep in mind that the angle at which the sun hits its surface changes throughout the year...What do you think would happen if you tried to use the same sundial in the same location six months from now?

Note: If you'd rather complete this activity in one day, you can start early in the morning, at any even hour. Don't write any numbers on your face before going outside. Position your plate on the ground, and make a mark where the gnomon's shadow currently casts. Label this mark with the current hour. Then, at noon, you can double-check your work by finding magnetic north with the compass and making sure that the gnomon's shadow points in that direction.

When you've recorded every hour, take a look at your sundial: how is this different from a clock face?

Clocks tell time by dividing a circle (360 degrees) into 12 equal segments, each evenly spaced 30 degrees apart. ($360 \text{ degrees} / 12 \text{ hours} = 30 \text{ degrees per hour}$.) A whole circle represents 12 hours, and the hands go all the way around in the course of a 24-hour day. Can you think of why your "clock" face only looks like half a circle?



Participating at Home? Share a picture of your work by emailing:

Debbie.jones@hereward.ac.uk