LEARNING RESOURCE
MEASURING THE SUN

SCIENCE Years 7–10
EARTH AND SPACE Stage 5

WHAT IS THE AIM:

To calculate the diameter of the Sun in km.

EXPERIMENT:

We will record the time the Sun takes to cross a line as seen through a telescope. This is called the transit time, ***T***.

If we know the distance to the Sun ***d*** and the rate of the Earth's rotation, basic trigonometry can be used to calculate the diameter of the Sun, ***D*** in km.

THEORY:

As the Earth rotates, the Sun appears to circle the Earth (360°) once each day (24 hours).

Half of the apparent angular size, θ°, of the Sun, α° * is equal to a fraction of that 360° circle.
* Why will we use half of the angular diameter of the Sun and half of the transit time?

We know half of the transit time, ***t*** is a fraction of a day and half of the apparent Solar diameter, α is a fraction of a full circle (note the units).

That is: $\frac{\alpha°}{360°} = \frac{t_{sec}}{24_{h}}$ Eqn (i)

Therefore $\alpha = \frac{\square \times \square}{\square}$

However, our time will be in seconds, so convert 24 hours to seconds:

$\alpha = \frac{\square \times t}{\square \times \square \times \square} = \frac{\square \times t}{\square} = \frac{t}{\square}$

$\alpha =$ _____

If we now use the Sine ratio and look at the diagram on the far right we see the following:

$\sin(\alpha) = \frac{\square}{\square} = \frac{\square}{\square}$ Eqn (ii)

Rearranging equation (ii), we now calculate the solar radius

$r = \sin\left(\frac{\square}{\square}\right) \times \square$

$r =$ _____ km, and finally

$D = 2 \times r$ Eqn (iii)

$D =$ _____ km

ADDED COMPLICATIONS:

The value of ***d*** (shown below) is an average, from centre to centre. If you make your own transit device to record the time you will also need to find the Earth-Sun semi-major axis distance for that day.

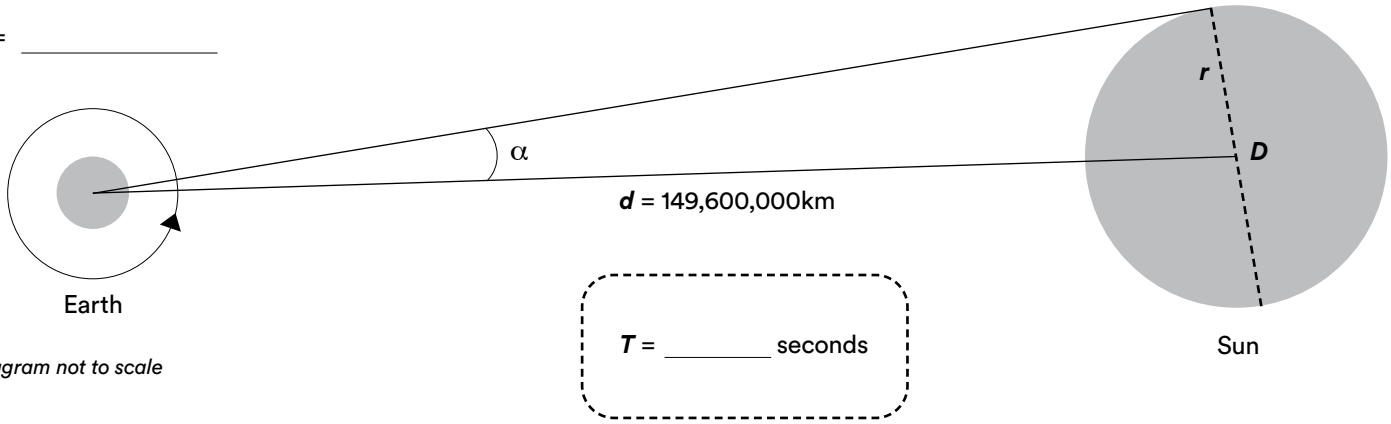

Diagram not to scale

T = _____ seconds