



## EduTrend Contents

W4C · ASTRONOMY & SPACE SCIENCE · MIDDLE SCHOOL

# Solar System to Scale

How big and how far apart are the planets really?

Ages 12–14

Level: Intermediate

60 minutes

Groups of 4 · up to 30

Activity 04

Inside: activity at a glance · step-by-step session plan · facilitator notes · 3 student worksheets · assessment checklist

## ACTIVITY 04 · AT A GLANCE

# Solar System to Scale

Students build a scale model of the Solar System. First they calculate planet distances on a scale that fits the corridor or playground, then they calculate planet sizes on the same scale and find that most planets become tiny specks. The activity builds skills in ratio and scale and challenges common pictures of the Solar System.

## Learning outcomes

By the end of the session students can:

- use a scale factor to convert real distances and sizes;
- build a distance model of the Solar System;
- compare planet sizes accurately;
- explain why textbook diagrams are not to scale.

**KEY WORDS**

scale · astronomical unit · orbit · diameter · planet · ratio

**CURRICULUM LINKS**

Science: the Solar System. Maths: ratio, scale, standard form. Art: model making.

**1****QUESTION**

What do we want to know?

**2****OBSERVE**

Watch the sky

**3****MODEL**

Build a model

**4****MEASURE**

Take readings

**5****COMPARE**

Model vs reality

**6****EXPLAIN**

Use evidence

## Materials (per group)

- Long strip of till roll or toilet paper (at least 20 m)
- Planet data table
- Calculator, metre rule, pens
- Sand grains, peppercorns, a small ball for size model
- Worksheets 1, 2 and 3

## Before the session

- Measure the corridor or playground length.
- Prepare data tables of planet distances and diameters.
- Choose a scale: for example 1 AU = 1 metre.
- Collect small objects for size models.

**SAFETY**

Keep corridors clear for others. Take care stretching paper outdoors in wind.

## ACTIVITY 04 · SESSION PLAN

# Step by step

Timings are for 60 minutes. Outdoors is ideal for the distance model.

| Time                  | What happens                                                        | Say or ask                                           |
|-----------------------|---------------------------------------------------------------------|------------------------------------------------------|
| 0–5 min<br>Hook       | Show a typical Solar System poster. Is it accurate?                 | <i>"How far is Neptune compared with Earth?"</i>     |
| 5–20 min<br>Calculate | Groups use 1 AU = 1 m to calculate distances for each planet.       | <i>"How long does our strip need to be?"</i>         |
| 20–35 min<br>Build    | Groups mark planets along the strip.                                | <i>"What do you notice about the inner planets?"</i> |
| 35–50 min<br>Sizes    | Groups calculate planet sizes on the same scale and choose objects. | <i>"How big is the Sun at this scale?"</i>           |
| 50–55 min<br>Reflect  | Discuss why posters are not to scale.                               | <i>"What would a true-scale poster look like?"</i>   |
| 55–60 min<br>Exit     | Worksheet 3.                                                        |                                                      |

## CHALLENGE CARD (print or copy onto the board)

On your scale, work out where the nearest star (about 270,000 AU away) would be. Would it fit in your town?

## ACTIVITY 04 · FACILITATOR NOTES

# The astronomy in brief

Distances in the Solar System are so large that astronomers use the astronomical unit (AU), the average Earth–Sun distance of about 150 million km. On a scale of 1 AU = 1 m, Mercury is 0.39 m from the Sun, Earth 1 m, Jupiter 5.2 m and Neptune 30 m.

On the same scale, the Sun is less than 1 cm wide and Earth is smaller than a grain of fine sand, so a combined model of size and distance is almost all empty space. Diagrams exaggerate planet sizes and squeeze distances so that everything fits on one page.

## Common ideas to listen for

- “The planets are close together.” The gaps are enormous compared with planet sizes.
- “Planets line up.” They orbit at different speeds and are rarely aligned.
- “Pluto is still a planet.” Since 2006 it has been classified as a dwarf planet.

## Adapting the activity

### Support

Provide precalculated distances and focus on marking the model.

### Stretch

Choose a scale where Earth is 1 cm across and calculate the Earth–Sun distance on that scale.

**WORKSHEET 1**

# Scale distances

Name: \_\_\_\_\_

Class: \_\_\_\_\_ Date: \_\_\_\_\_

Scale: 1 AU = 1 m.

## Calculations

| Planet  | Distance (AU) | Scale distance (m) |
|---------|---------------|--------------------|
| Mercury |               |                    |
| Venus   |               |                    |
| Earth   |               |                    |
| Mars    |               |                    |
| Jupiter |               |                    |
| Saturn  |               |                    |
| Uranus  |               |                    |
| Neptune |               |                    |

WORKSHEET 2

# Scale sizes

Use the same scale for diameters.

## Sizes

| Body    | Real diameter (km) | Scale diameter (mm) | Object |
|---------|--------------------|---------------------|--------|
| Sun     |                    |                     |        |
| Earth   |                    |                     |        |
| Jupiter |                    |                     |        |
| Moon    |                    |                     |        |

## What surprised you most?

WORKSHEET 3

# Reflection

Explain your thinking.

**Why are Solar System posters not to scale?**

Self-check

| I can...                   | Not yet | Partly | Confidently |
|----------------------------|---------|--------|-------------|
| use a scale factor         |         |        |             |
| build a distance model     |         |        |             |
| compare sizes              |         |        |             |
| explain limits of diagrams |         |        |             |

FOR THE TEACHER

# Assessment checklist

Use during the session. One sheet covers up to eight students; copy as needed.

| Student | Calculates accurately | Builds to scale | Explains scale limits |
|---------|-----------------------|-----------------|-----------------------|
|         |                       |                 |                       |
|         |                       |                 |                       |
|         |                       |                 |                       |
|         |                       |                 |                       |
|         |                       |                 |                       |
|         |                       |                 |                       |
|         |                       |                 |                       |

Suggested codes: W = working towards · E = expected · G = greater depth

**ABOUT THIS ACTIVITY**

Solar System to Scale is a sample activity from the EduTrend Contents W4C Astronomy & Space Science programme (middle school, level: intermediate). Every activity in the programme follows the same format: a practical challenge, a clear session plan, facilitator notes and ready-to-print worksheets, so that teachers, club leaders and parents can run it without extra preparation.

Full 15-, 20- and 32-week programmes are available from EduStore at [edutrend.org](https://edutrend.org).

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