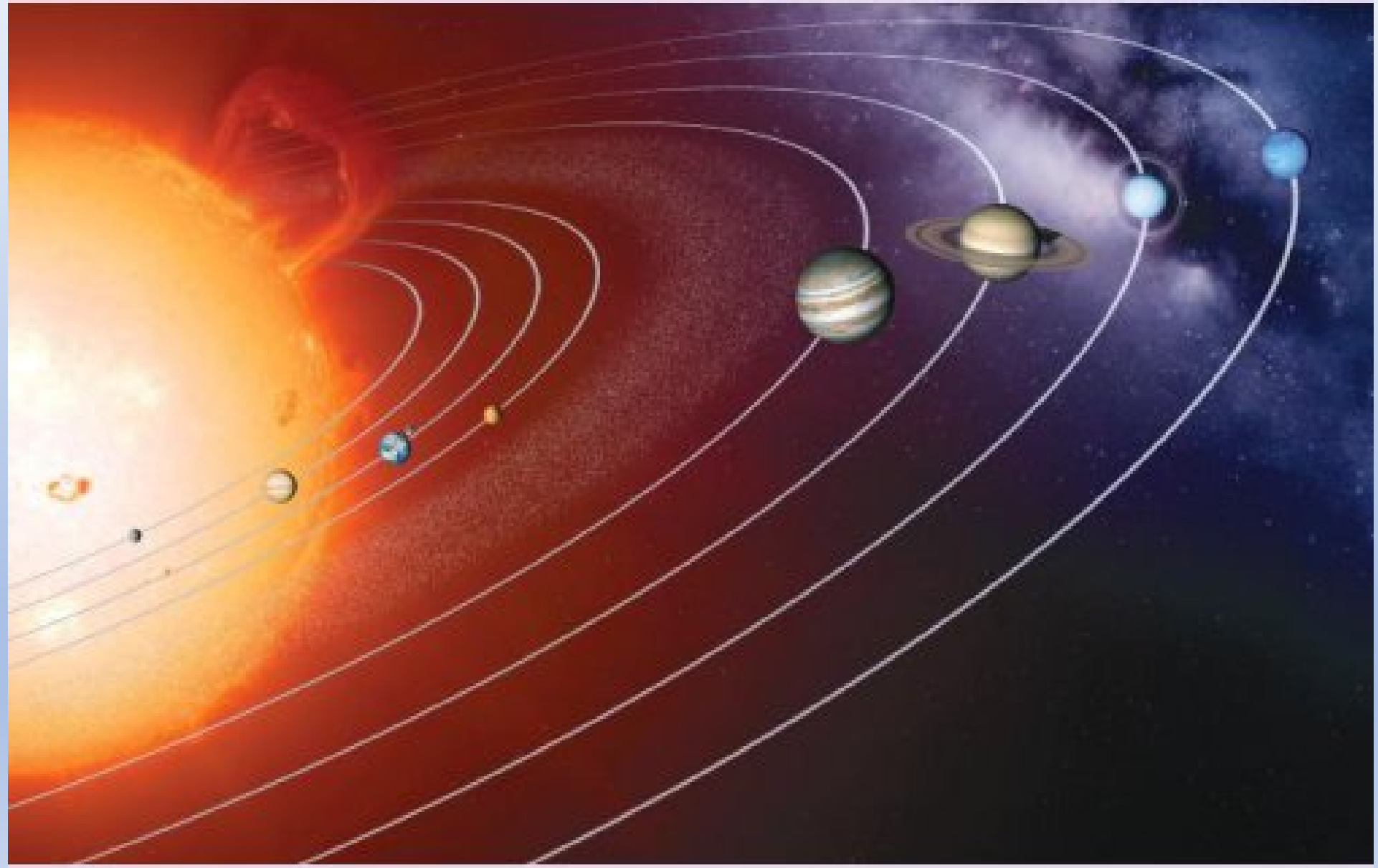
The speed of light



The speed of light

Learning Objectives

By the end of the lesson, students will be able to:

1. **Recall** the speed of light in a vacuum
   (ACP: Knowledge & Understanding)
2. **Use** the equation **speed = distance ÷ time** to calculate the speed of light.
   (ACP: Applying)
3. **Analyse** real-life examples where the speed of light calculation is important.
   (ACP: Analyzing)

Key words:

- Speed of light
- Vacuum
- Distance
- Time
- Speed equation
- Light-year
- Signal
- Satellite

Starter

The speed of light

1.State the formula linking speed, distance, and time

2.What are the sources of light

Think–Pair–Share

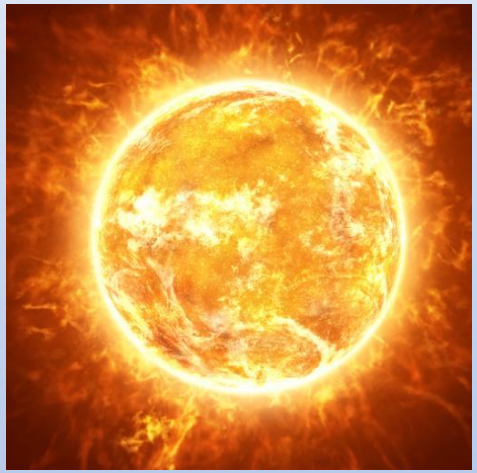
3. Question:

Light from the Sun takes about 8 minutes to reach Earth. What does this tell us about light?

HPL:

- ACP: Linking
- VAA: Confidence

What are sources of light?



What about the moon?

The speed of light

How fast does light travel?

The **speed of light** is the fastest speed that there is. Nothing travels faster than light.

There are lots of ways of writing down the speed of light.

300 million m/s 300 000 000 m/s 300 000 km/s 300 thousand km/s

The speed of light

Using speed to measure distance

Rajiv reads that light takes 1.3 seconds to travel from the Moon to the Earth. He wonders if he can work out how far away the Moon is.

$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$

so distance = speed × time

= 300 000 000 m/s × 1.3 seconds

= 390 000 000 m or 390 000 km

What is light?

Light carries energy and travels as a transverse wave.

Light travels much faster than sound at a speed of 300,000,000 m/s, which is the same as 300,000 km/s.

Light waves travel in straight lines.

- https://www.youtube.com/watch?v=DFYNxsEsvBY

Question sheet:
How far does light travel in one year?

$$Distance = speed \; x \; time$$

$$Distance = 300{,}000{,}000 \; x \; (60 \; x \; 60 \; x \; 24 \; x \; 365)$$

$$Distance = 9.46 \; x \; 10^{15} \; m$$

This is called a LIGHT YEAR.

HPL:

- ACP: Applying
- VAA: Hard-working

Task A – Foundation Question:

State the speed of light in a vacuum.

HPL:

- ACP: Applying
- VAA: Hard-working

HPL:

- ACP: Knowledge
- VAA: Confidence

Task B – Core (Calculation)

Question:

Light travels **900,000,000 m** in **3 s**.
Calculate its speed.

Task C – Challenge (Reasoning)

Question:

Why do astronauts communicate with a delay when far from Earth?

HPL:

- ACP: Analysing & Reasoning
- VAA: Resilience, Responsibility

How long does it take for light to travel 100km?

$$Time = \frac{Distance}{Speed}$$

$$Time = \frac{100{,}000}{300{,}000{,}000}$$

$$Time = 0.0003\ seconds$$

HPL:

- ACP: Applying
- VAA: Hard-working

How long (in seconds) does it take light to travel the 150,000,000,000 metres from the Sun to the Earth?

$$Time = \frac{Distance}{Speed}$$

$$Time = \frac{150{,}000{,}000{,}000}{300{,}000{,}000}$$

$$Time = 500\ seconds = 8\ minutes,\ 20\ seconds$$

HPL:

- ACP: Applying
- VAA: Hard-working

UAE IDENTITY

UAE Links

Real-World Applications

- **UAE Mars Mission (Hope Probe)**
- **Satellite communication & GPS**
- **High-speed fibre-optic internet**

Why must scientists calculate the speed of light accurately in UAE space projects?

HPL:

- ACP: Linking
- VAA: Responsibility

UAE IDENTITY

Why must scientists calculate the speed of light accurately in UAE space projects?

Accurate positioning of satellites

•UAE satellites orbit Earth and use light-speed signals to send data.

•Scientists calculate distances using:

distance = speed × time

Why this is important:

•Keeps satellites in the **correct orbit**.

•Prevents collisions with other satellites or space debris.

HPL:

. ACP: Linking

. VAA: Responsibility

Plenary

Why engineers have to calculate the speed of light in Fiber Optic Internet and Communication such as Internet cables and phone networks?

Exit Ticket

1. Write the formula for speed
2. One place speed of light is important

HPL:

- ACP: Meta-thinking
- VAA: Confidence

HOMEWORK

The speed of light

Q1) The Sun is 150,000,000,000 meters from the Earth. How long does it take for the light to reach us from the sun? Show your workings and give your time in minutes.

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Q2) It takes light 5 hours 28 minutes and 30 seconds to reach Pluto from the Sun. How far away is Pluto? Don't forget to convert the time into seconds.

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