Plenary Talk Placemat

Today I have learnt that ....

The skills I used in today's lesson were…
I could also use these skills in….

Be a reflective learner.

Discuss with a partner before you share it with the class.

I would like to find out more information about….

One thing I need to remember from today's lesson is…

Before this lesson I could already…

Three key words I have learned today are…

I was successful today when I…

Plenary - complete one of the sentences below

I was successful when I …………..

A question I have about today's lesson is ……….

Today I learnt …………..

The part of the lesson I enjoyed the most was……

The skills I used in today's lesson were……….

One thing I need to remember from today's lesson is…………..

Success Criteria

Praise – What is good about this piece of work?

Next steps – What needs to be improved?

How can this be improved?

Forces & Space – E&Os

	Level 2	Level 3	Level 4
Space	By observing and researching features of our solar system, I can use simple models to communicate my understanding of size, scale, time and relative motion within it. SCN 2-06a	By using my knowledge of our solar system and the basic needs of living things, I can produce a reasoned argument on the likelihood of life existing elsewhere in the universe. SCN 3-06a	By researching developments used to observe or explore space, I can illustrate how our knowledge of the universe has evolved over time. SCN 4-06a
Forces	By investigating how friction, including air resistance, affects motion, I can suggest ways to improve efficiency in moving objects. SCN 2-07a	By contributing to investigations of energy loss due to friction, I can suggest ways of improving the efficiency of moving systems. SCN 3-07a	I can use appropriate methods to measure, calculate and display graphically the speed of an object, and show how these methods can be used in a selected application. SCN 4-07a By making accurate measurements of speed and acceleration, I can relate the motion of an object to the forces acting on it and apply this knowledge to transport safety SCN 4-07b
	I have collaborated in investigations to compare magnetic, electrostatic and gravitational forces and have explored their practical applications. SCN 2-08a	I have collaborated in investigations into the effects of gravity on objects and I can predict what might happen to their weight in different situations on Earth and in space. SCN 3-08a	I can help to design and carry out investigations into the strength of magnets and electromagnets. From investigations, I can compare the properties, uses and commercial applications of electromagnets and supermagnets. SCN 4-08a
	By investigating floating and sinking of objects in water, I can apply my understanding of buoyancy to solve a practical challenge. SCN 2-08b		Through experimentation, I can explain floating and sinking in terms of the relative densities of different materials. SCN 4-08b

Forces & Space – scheme of work

1. Intro to Forces
2. Balanced & Unbalanced Forces
3. Forces in Space (intro to universe)
4. The Solar System 1
5. The Solar System 2
6. Craters and the Moon
7. Craters and the Moon 2
8. Space Terms & Scale of universe
9. Weight & Mass 1 – O1
10. Weight & Mass 2 – O1
11. Weight & Mass Calculations
12. Friction

12. Air resistance – Drag/Parachute
13. Space exploration 1
14. Space exploration 2
15. Revision
16. Assessment
17. Assessment Feedback & Intro to AVU
18. AVU- Exoplanets
19. AVU- Exoplanets
20. AVU- Exoplanets

Forces and Space

20/08/2025

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Starter:

Open

Last lesson: What did we learn last lesson?

Empty your brain: write down everything you remember about …

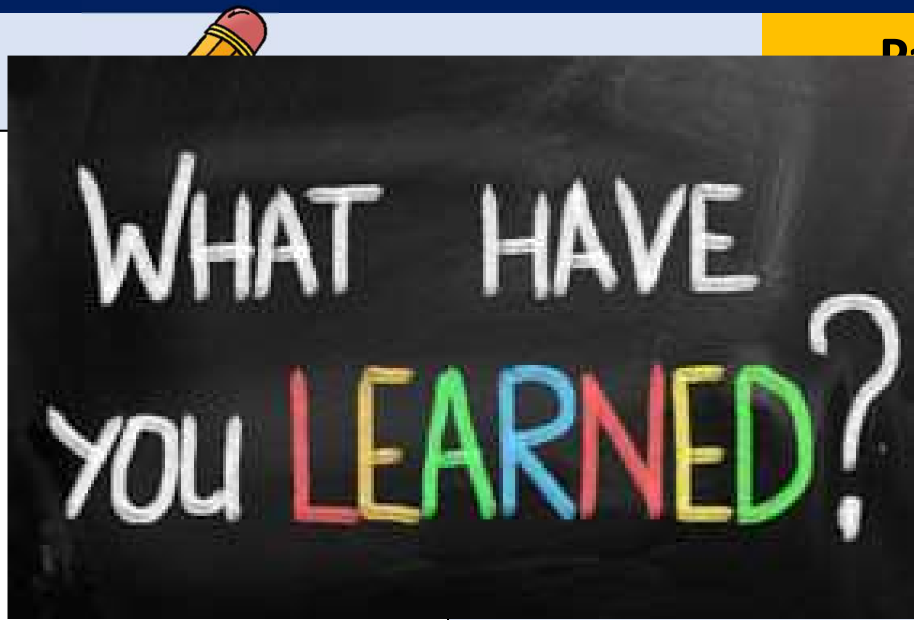
Structured

Teacher – quizzing: short answer response, fill in the blanks, true or false, odd one out, dilate mistakes, multiple choice

Show-me Boards

Self- quizzing

Peer-quizung



Plenary:

Short response questions

Empty your brain

True or false

Multiple choice questions

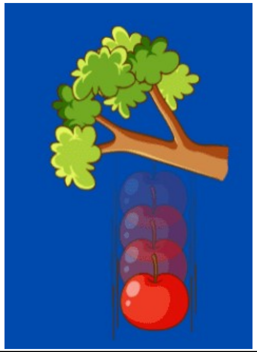
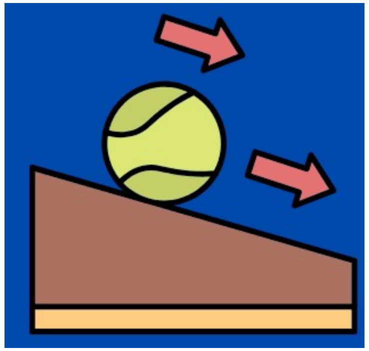
Exit Tickets or show me boards – everyone taking part.

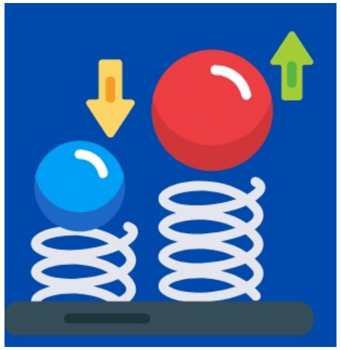
What is a Force?

20/08/2025

Starter: Empty your brain

Write down everything you know about **forces**.



Be ready to share your answer.

What is a Force?

20/08/2025

Learning Intentions:

- To understand what a force is.
- To name different types of forces.

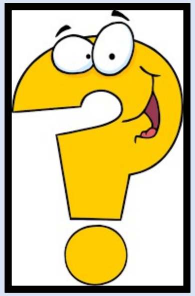
Success Criteria

- I can describe what a force is.
- I can measure forces with a Newton meter.
- I can describe real life applications of forces.

What is a Force?

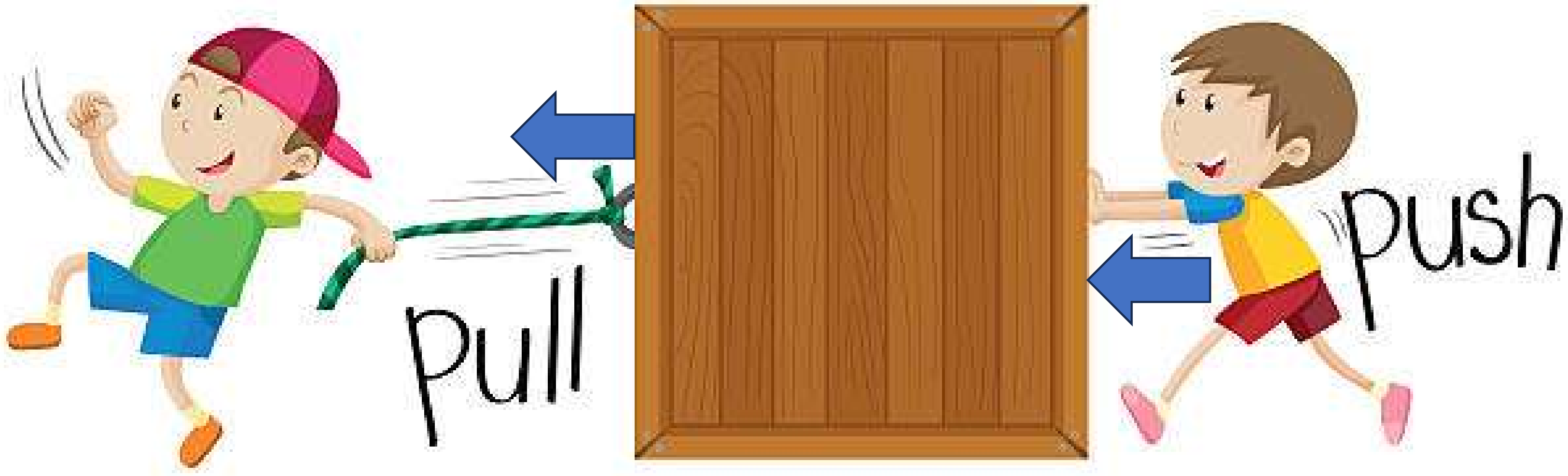
20/08/2025

https://www.youtube.com/watch?v=3HjKFOVhm_o



What is a Force?

A force is a push or a pull.



What is a Force?

A force can change the shape, speed or direction of an object.

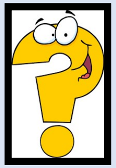
What is a Force?

Think about a ball…

1. If you push the ball it starts to roll. The ball's speed changes.
2. If you push against the motion of a ball, you can stop it. The ball's speed changes.
3. If you push at an angle to the ball's motion, you can change the direction of the motion.
4. If you squeeze the ball you can change the shape of the ball.

Forces

Name as many **types of forces** as you can.



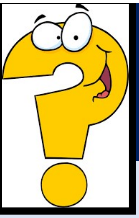
Thinking prompts:

1. What force pulls everything toward the Earth?
2. What force pushes back when something moves through air?
3. What force slows things down when they rub together?

Challenge Question:

Where can you see these forces in action?

https://www.youtube.com/watch?v=7_Uo7RufH4c&t=183s



Forces

Name as many types of forces as you can.

- Push
- Pull
- Twist
- Drag
- Lift
- Thrust
- Weight
- Friction
- Gravitational
- Air Resistance
- Tension
- Upthrust
- Buoyancy
- Magnetic
- Electrostatic

Contact Forces

Some forces **need to touch** an object to affect it.

Examples of these forces are push, pull and friction.

Non-contact Forces

Some forces **do not need to have contact** to affect an object.

Examples of these forces are gravitational, magnetic and electrostatic forces.

Forces

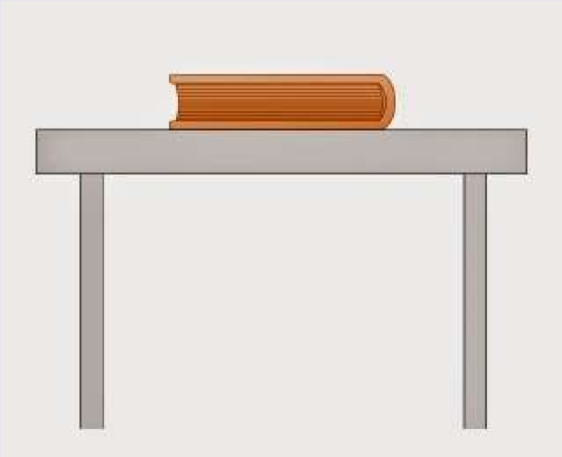
- Forces are all around us but we cannot see them. When forces cause movement it is possible to see their effects.

- However when something is not moving, there can still be forces at work…

Forces: think about it…..

A book sitting on a table does not move.

- Are there any forces acting on it?
- What might these forces be?



https://www.bbc.co.uk/bitesize/guides/z78nb9q/revision/3 - ANSWER

If you pushed the book…

- what forces are acting?

(think about making it move, or trying to stop it…)

Discuss in your group before sharing your thoughts with the class.

Be ready to share your answer.

Article 13 *Every child must be free to express their thoughts and opinions and to access all kinds of information, as long as it is within the law.*

Measuring Force

A Newton balance (also called a force meter) is used to measure force.

The unit of measurement for force is Newtons. The letter N represents Newtons.

Sir Isaac Newton (1643-1727)

Using a Newton Balance

🧪 How to Use a Newton balance

1. Check the scale
    - make sure it is **zeroed** (the pointer should be at 0 when nothing is hanging).
2. Hang the object
3. Hold it steady
4. Read the scale

⚠️ **Safety & Tips:**

- Don’t overload the balance – check the **maximum force limit and use** a suitable balance. We have 10 N or 30 N balances.
- Avoid jerky movements or bouncing the object.

Measuring Forces

Aim:

To estimate, and measure, the force required to move different objects.

Method: *Describe how you will carry out your investigation. Include a labelled diagram.*

Measuring Forces

Aim: To estimate, and measure, the force required to move different objects.

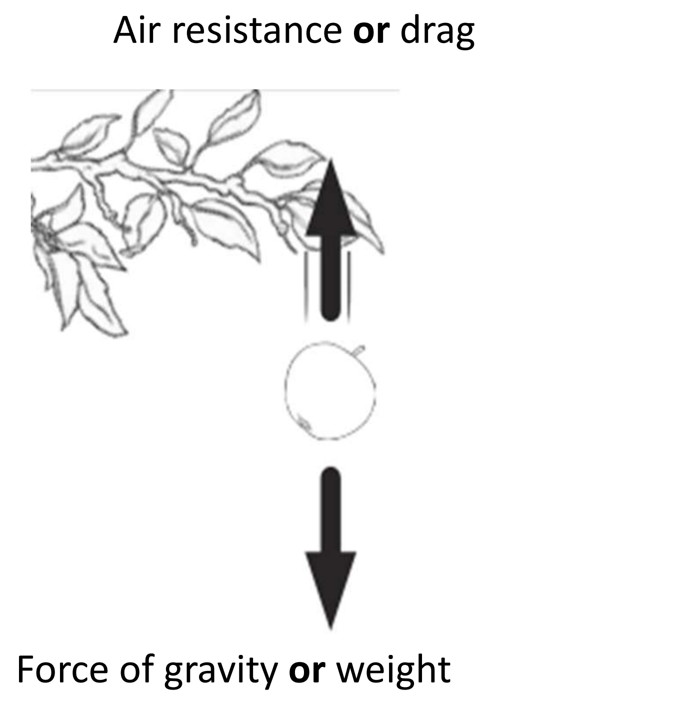
Results:

Object	Estimate of force needed (N)	Actual force needed (N)
Lift a bag		
Open the door		
Pull a stool across floor		

Conclusion: How accurate were your estimates? What did you find out?

Challenge yourself: Naming Forces

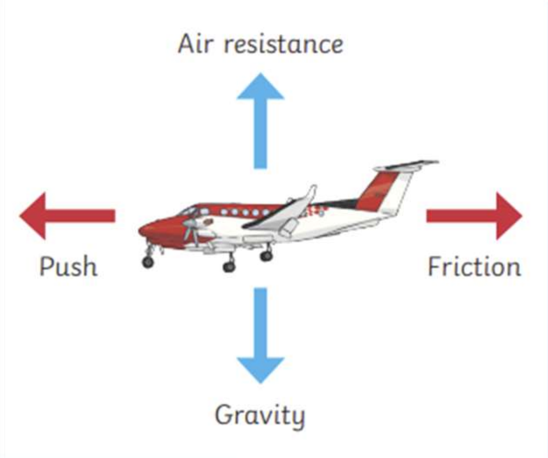
Draw arrows on the pictures below to show the forces acting in them.

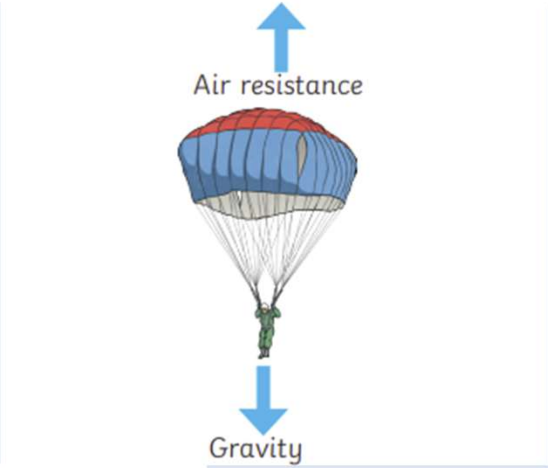


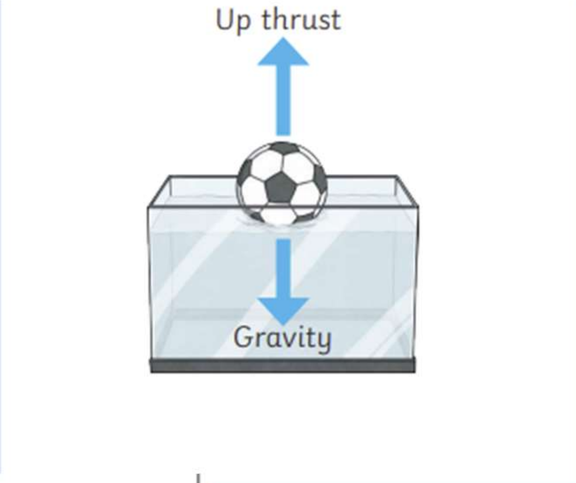
List of forces: Air resistance I Force of gravity I Push I Weight
Pull I Friction I Drag I Buoyancy I Engine force I Upthrust

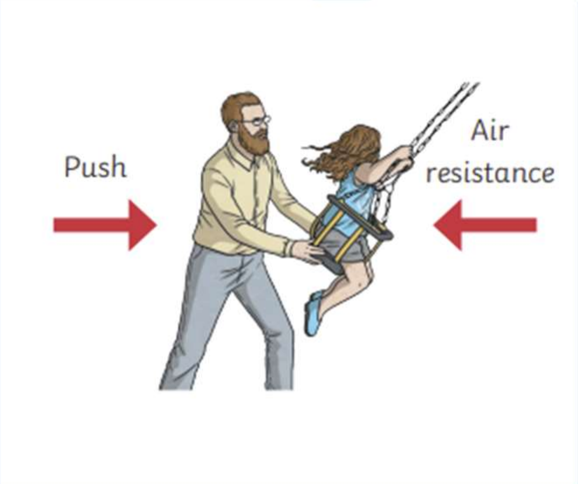
Challenge yourself: Answers

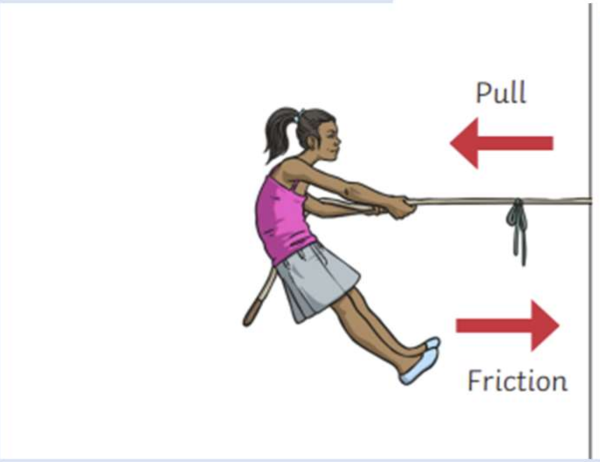
Draw arrows on the pictures below to show the forces acting in them.











Sometimes forces can be described in a few different ways.

What is a Force? 20/08/2025

Learning Intentions:

- To understand what a force is.
- To name different types of forces.

Success Criteria

- I can describe what a force is.
- I can measure forces with a Newton meter.
- I can describe real life applications of forces.

What is a Force?

20/08/2025

Plenary: Empty your brain

Write down everything you know about forces.

- How does you your answer compare to the start of the lesson?
- What did you learn today?

Balanced and Unbalanced forces

20/08/2025

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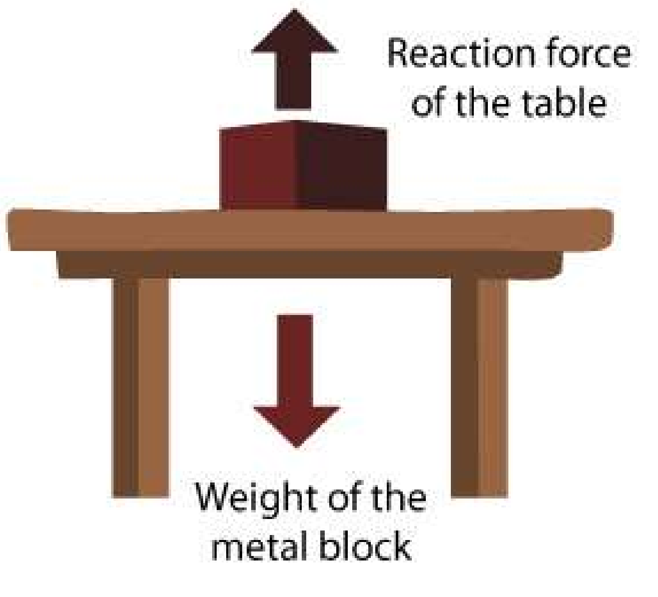
Starter: Prior Knowledge

1. What is a force?
2. Name two types of forces.
3. What happens to an object if a force acts on it?



Be ready to share your answer.

Balanced and Unbalanced forces

20/08/2025

Learning Intentions:

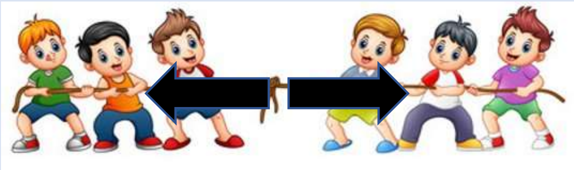
- To identify balanced and unbalanced forces.
- To describe the effect a pair of forces have on an object.

Success Criteria

- I can identify balanced and unbalanced forces from a force diagram.
- I can predict the movement of an object using force diagrams.
- I can draw or interpret a force diagram using a simulation.

Balanced and Unbalanced forces

Balanced forces mean the effects of the forces cancel each other out.

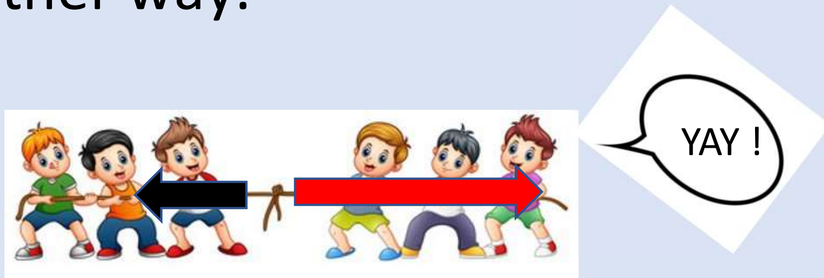


In this tug-o-war there is a dead heat. Both sides pull with the same size of force. There is no change of speed, direction or shape. There is **no change in motion**.

Watch this video

CLICK HERE

Unbalanced force happens when there is only one force on an object **or** the forces one way are bigger than the other way.



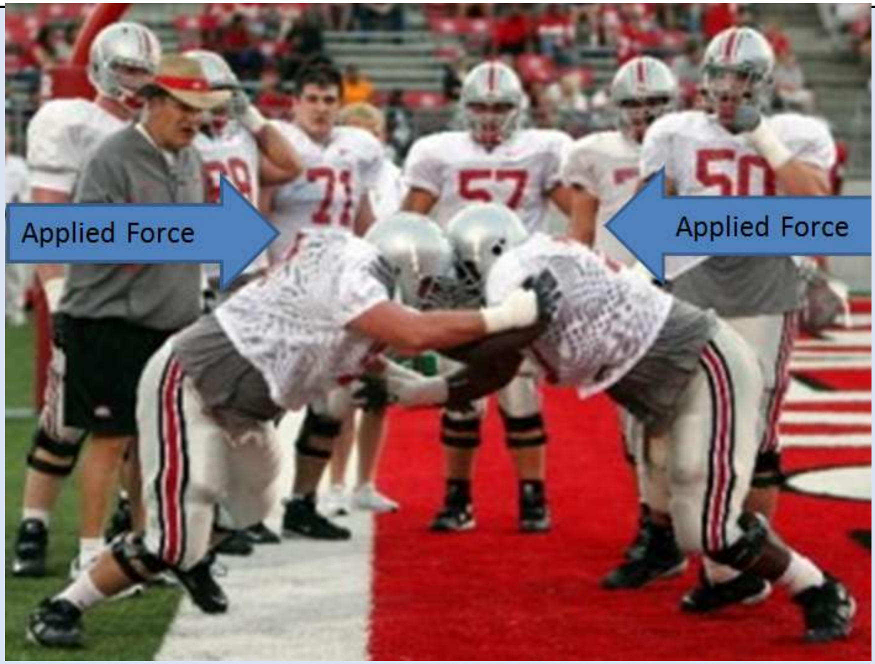
In this tug-o-war the team on the right pull with a bigger force. The forces <u>don't</u> balance and everybody **moves** to the right. There **is** a change of speed, direction or shape. There is a **change in motion**.

Balanced and Unbalanced forces

Page 8

A **balanced force** is two **equal** forces but in **opposite** directions.

Balanced forces cause an object to **stay still** (stationary) or travel at a **constant speed**.



Balanced and Unbalanced forces

An **unbalanced force** is when there is one or more forces, but the overall force in one direction is **greater**.

Unbalanced forces cause a change in **shape, direction or speed.**

A change in **speed** is called acceleration**.**

Balanced and Unbalanced forces

In the following situations, say whether the forces are **BALANCED** or **UNBALANCED**.

1. A book sitting still on a table
2. A person sitting still on a chair
3. A car speeding up, moving off at traffic lights
4. A ball being caught by a dog
5. A car going at a steady 70 miles per hour down the motorway
6. A footballer heading the ball into the net
7. A rocket starting to take off
8. An astronaut moving through space at a steady speed
9. Crushing a can of irn bru
10. An apple falling from a tree.

REMEMBER

If the object KEEPS DOING what it did before, the forces are **BALANCED**.

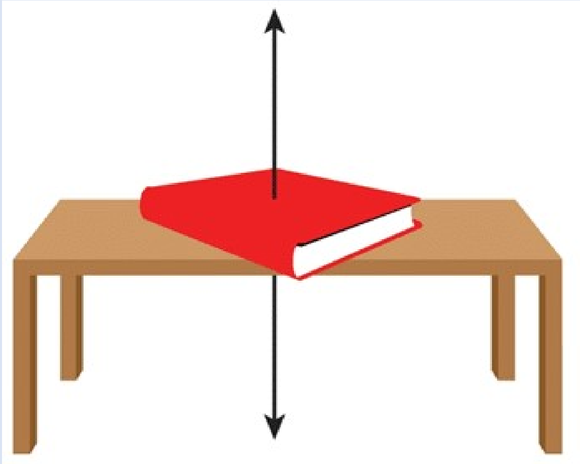
If the object's SPEED, DIRECTION or SHAPE changes, the forces are **UNBALANCED**

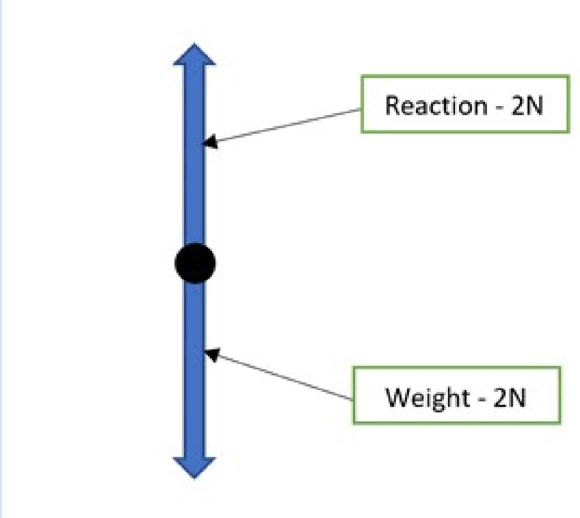
Force Diagram

A **force diagram** (sometimes called a **free-body diagram**) is a simple drawing used in science to **show all the forces** acting on an object.

Key Features:

- The object is usually shown as a dot or a simple box.
- Arrows are drawn to represent each force acting on the object.
- Arrows show:
  - Direction of the force (where it's pushing or pulling).
  - Size of the force (longer arrow = stronger force).
- Each arrow is labelled (e.g. gravity, friction, thrust).

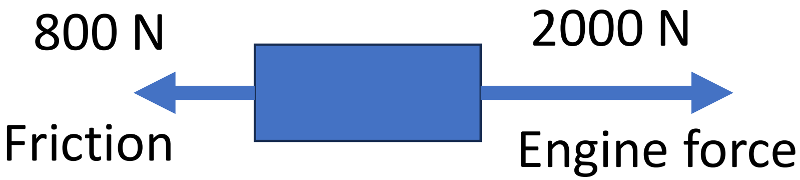




Balanced or Unbalanced?

1. Are the forces acting on the car **balanced** or **unbalanced**?

2. What direction is the car travelling in?



3. Calculate the resultant force on the car.

Balanced or Unbalanced?

1. Are the forces acting on the parachutist **balanced** or **unbalanced**?

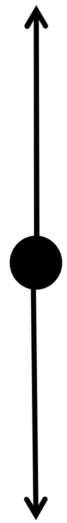
2. Describe the movement of the parachutist.

3. Calculate the resultant force on the car.

Air resistance = 920 N

Weight = 920 N

920 N

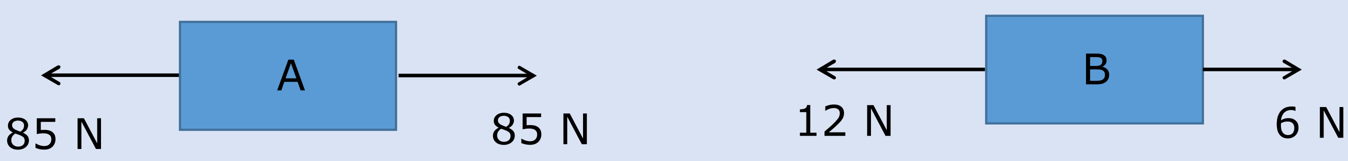


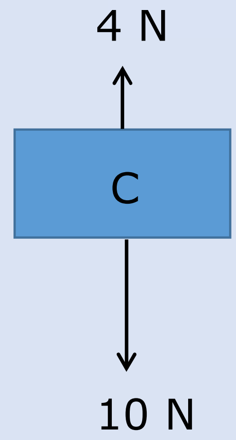
920 N

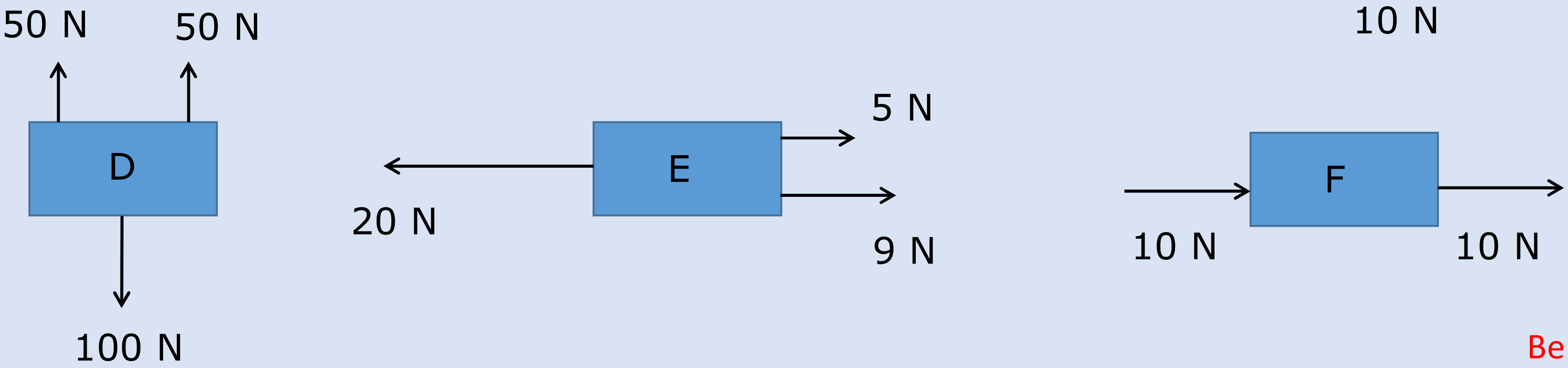
Class Quiz

In the following examples,

1. State if the forces on the objects are **balanced** or **unbalanced**.
2. Calculate the resultant force.







Be careful!

Pupil Activity: Exploring Forces Using PhET Simulation

https://phet.colorado.edu/sims/html/forces-and-motion-basics/latest/forces-and-motion-basics_en.html and click on **'Net Force'** when you get on the site

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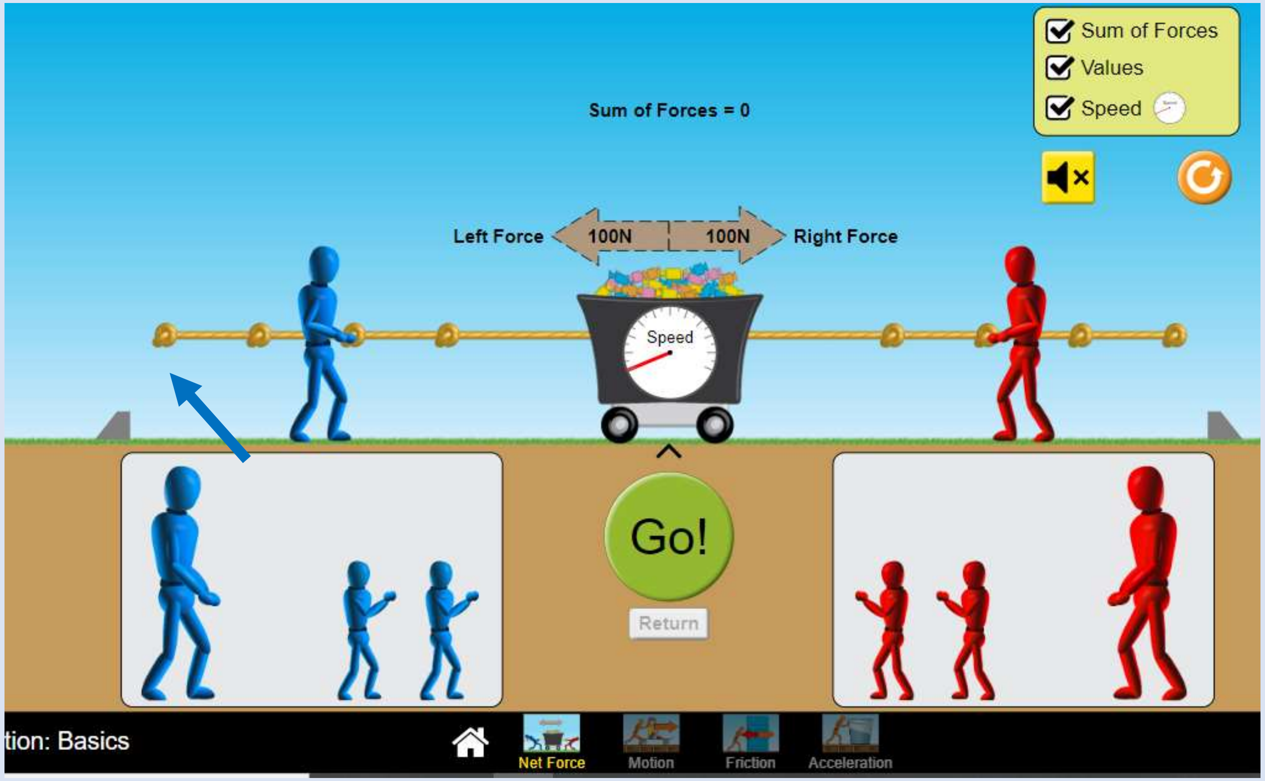
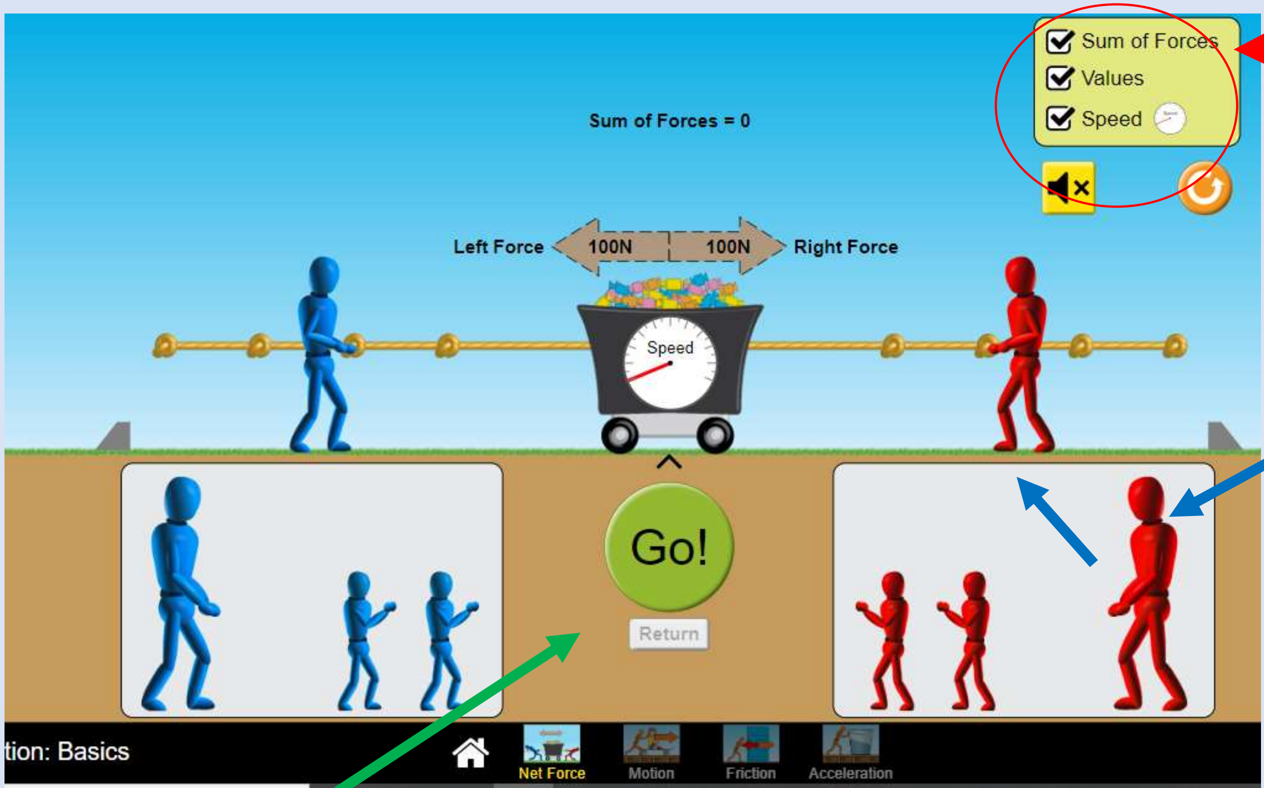
Instructions:

- **Open the Simulation** and select the **"Forces and Motion: Basics"** module.
- Choose the **"Force" tab** to start.
- Select an object (e.g. the box or the crate).



Pupil Activity: Exploring Forces Using PhET Simulation

CLICK HERE and click on **'Net Force'** when you get on the site

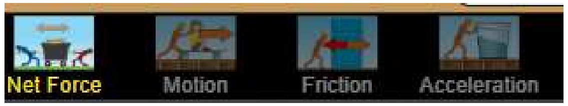


Make sure you click the **'Sum of Forces'** and **'Values'** on. This will allow you to see the values of the forces.

Drag the person onto the rope

Try it again with a different combination of people.

Extension: Try the other simulations in 'Forces and Motion: Basics'



Click 'Go' to see the effect of the pulling forces.

Pupil Activity: Exploring Forces Using PhET Simulation

https://phet.colorado.edu/sims/html/forces-and-motion-basics/latest/forces-and-motion-basics_en.html and click on **'Net Force'** when you get on the site

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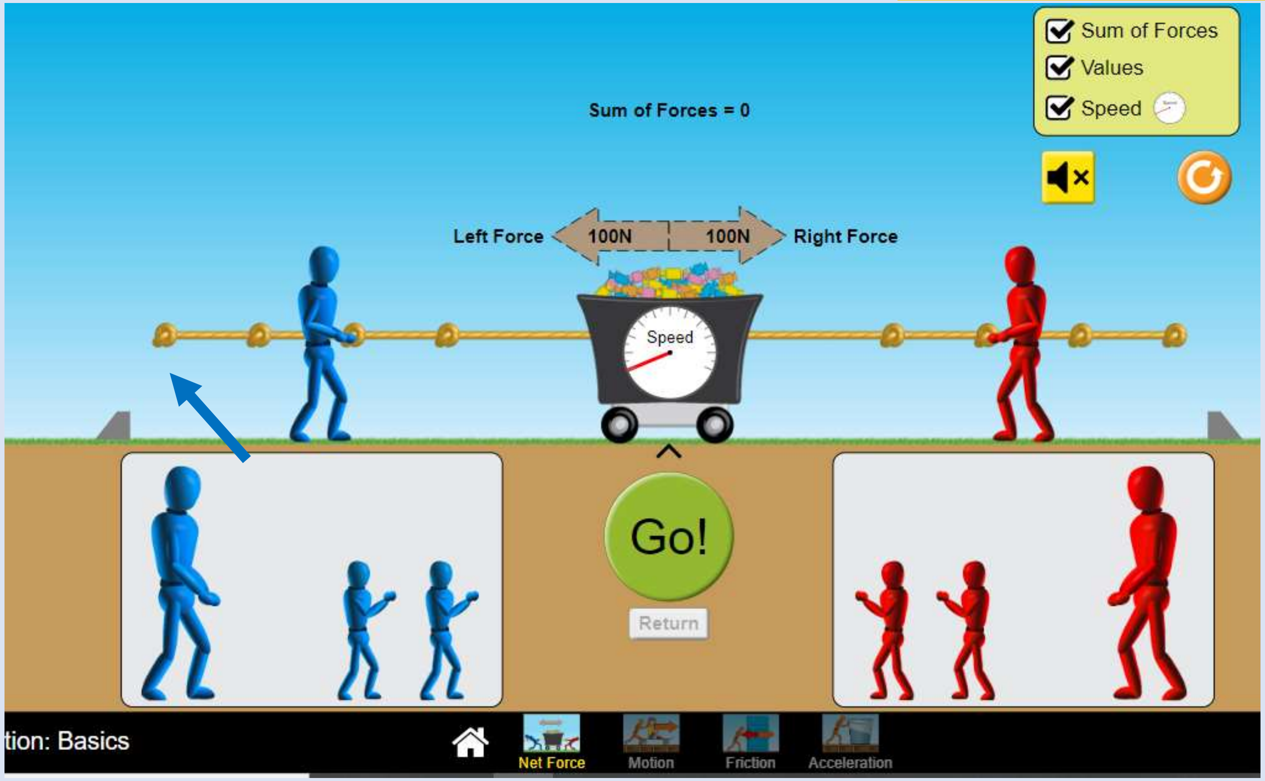
🔍 Task 1: Playing with Forces

- Try **pulling** the object using the red person.
- Observe what happens to the object when:
  - **Only one person pulls**
  - **Two people pull in opposite directions**
  - **No one pulls**

✏️ Questions:

1. What happens when both sides pull with **equal force**?
2. What happens when one side pulls **harder**?
3. What do you need to do to make the blue team win?



Pupil Activity: Exploring Forces Using PhET Simulation

https://phet.colorado.edu/sims/html/forces-and-motion-basics/latest/forces-and-motion-basics_en.html and click on **'Net Force'** when you get on the site

Page 11

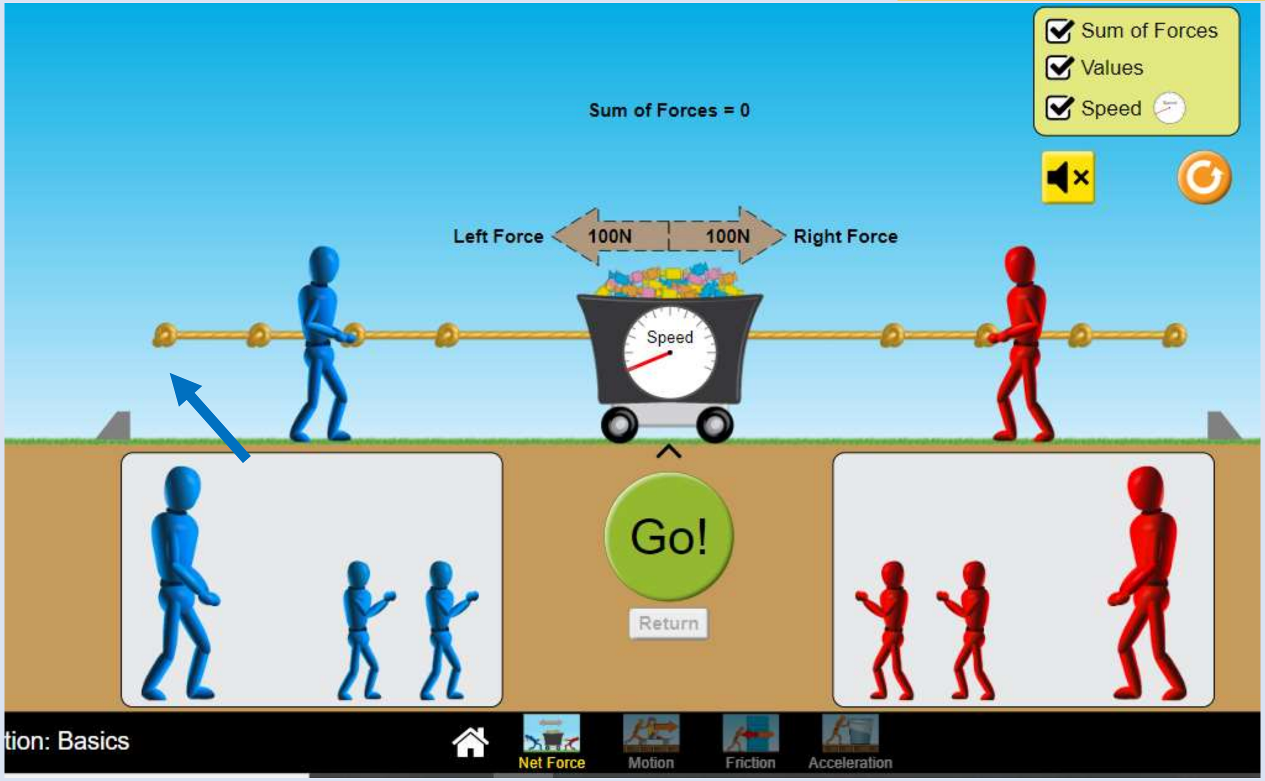
Task 2: Force Diagrams

- Tick the Sum of Forces" and "Values" option to view force arrows.

Draw a **force diagram** for:

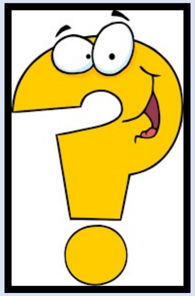
1. The object being pulled with **balanced forces**.
2. The object being pulled with **unbalanced forces**.

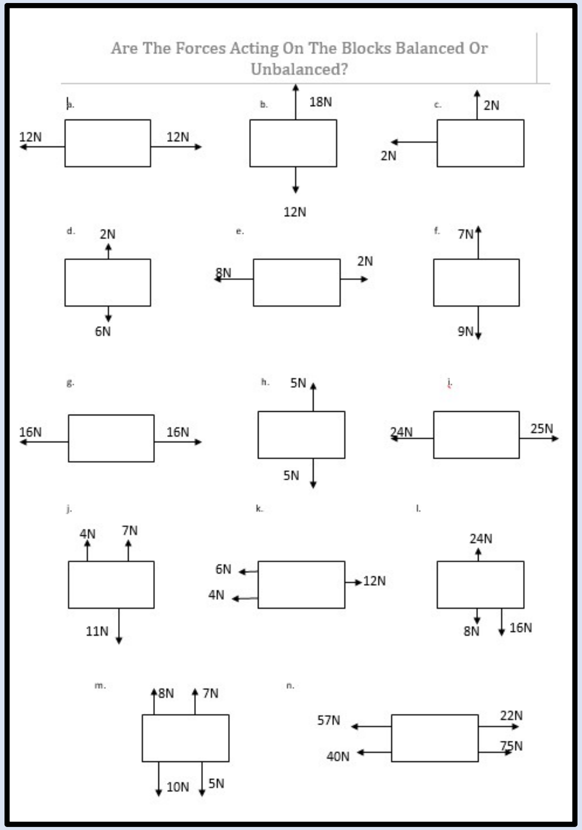
Label the arrows and show the **direction and relative size**.

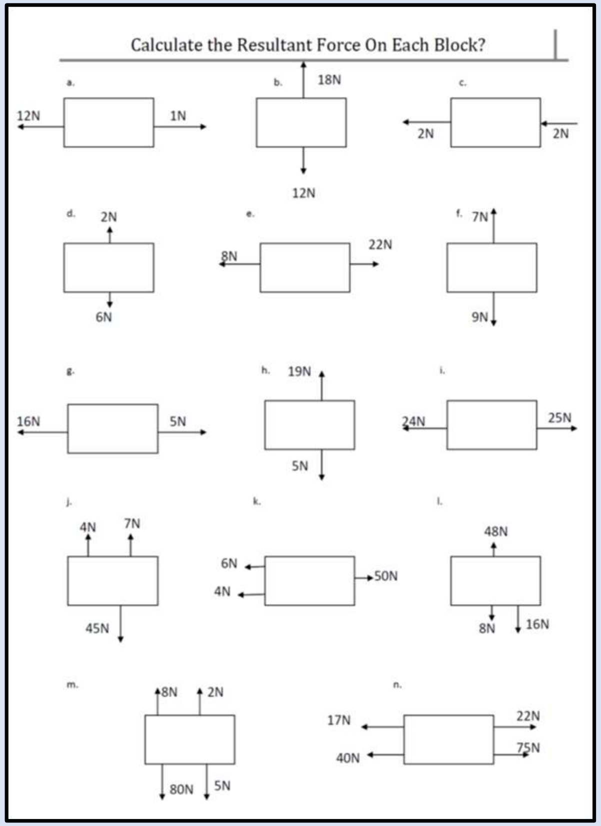


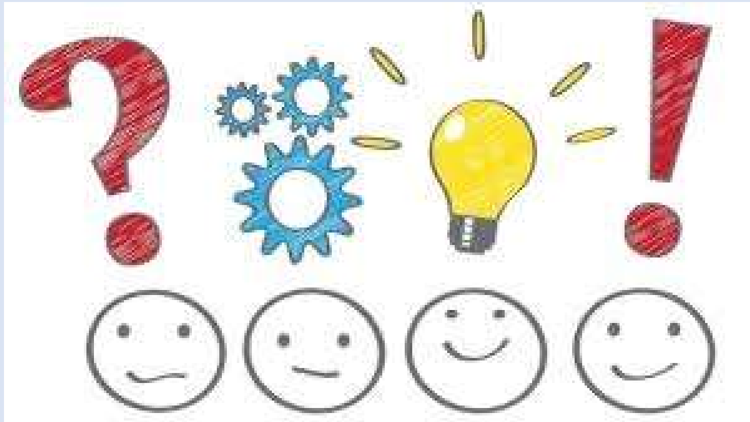
Balanced and Unbalanced forces

Pages 12 & 13









Write your own question

On a post it note or whiteboard.

Write a force question for someone else to answer.

Write the question on the front and the answer on the back.

Balanced and Unbalanced forces 20/08/2025

Learning Intentions:

- To identify balanced and unbalanced forces.
- To describe the effect a pair of forces have on an object.

Success Criteria

- I can identify balanced and unbalanced forces from a force diagram.
- I can predict the movement of an object using force diagrams.
- I can draw or interpret a force diagram using the simulation.

Balanced and Unbalanced forces

20/08/2025

Plenary: Exit ticket

1. When are the forces on an object balanced?
2. What must happen for an object to start moving?
3. What surprised you when using the simulation?

Forces in Space

20/08/2025

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Starter: Prior Knowledge

1. What's the difference between a balanced and unbalanced force?

2. What force pulls objects down to Earth?

3. What keeps the Moon in orbit around Earth?

Be ready to share your answer.

Forces in Space

20/08/2025

Learning Intentions:

- To understand how gravity acts as a force in space.
- To explore the movements of Earth and how they create day, night, months, and years.

Success Criteria

- I can list forces acting on moons, planets, stars and satellites.
- I can state that day and night are caused by the Earth rotating on its axis.
- I can state that the Earth orbits the Sun once in one year.

Forces in Space

Page 14

Questions for video:

1. What force keeps a planet in orbit around the Sun?
2. What would happen if there was no gravitational force between the Earth and the Moon?
3. The Moon orbits the Earth. What other objects orbit the Earth?

https://youtu.be/n40OmR6Rvpo

Be ready to share your answer.

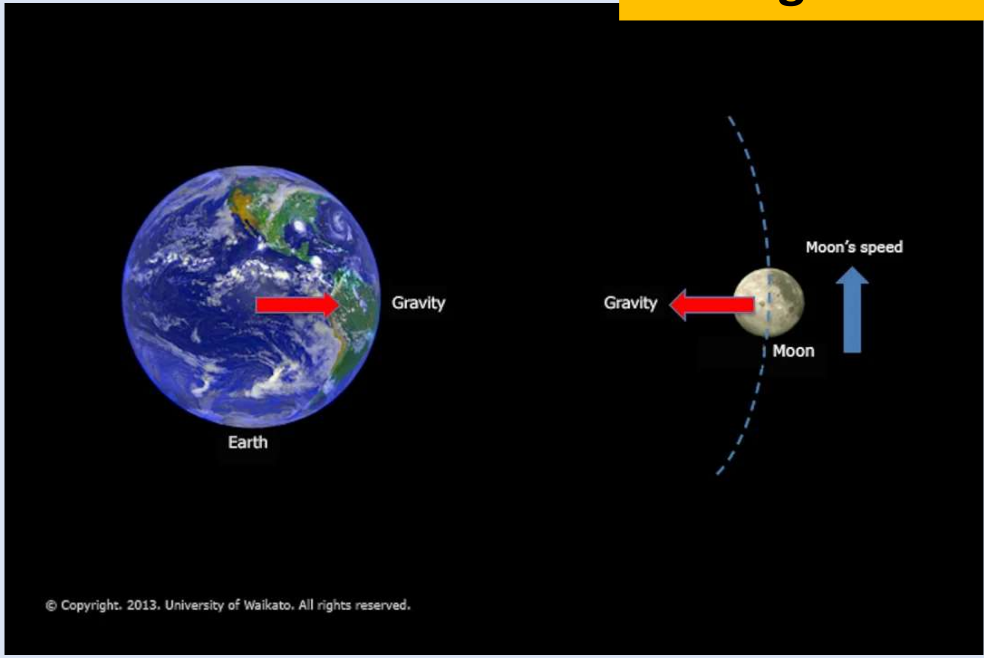
Forces in Space

Gravity is the force pulling objects together.

In space, gravity keeps:

- Moons orbiting planets
- Planets orbiting the Sun
- Satellites in orbit

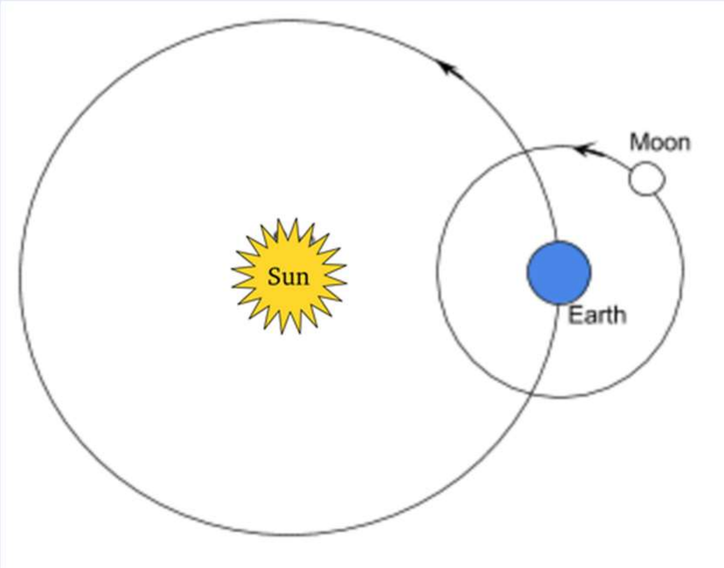
Without gravity, objects would move in straight lines.



https://www.sciencelearn.org.nz/resources/268-gravity-and-satellite-motion

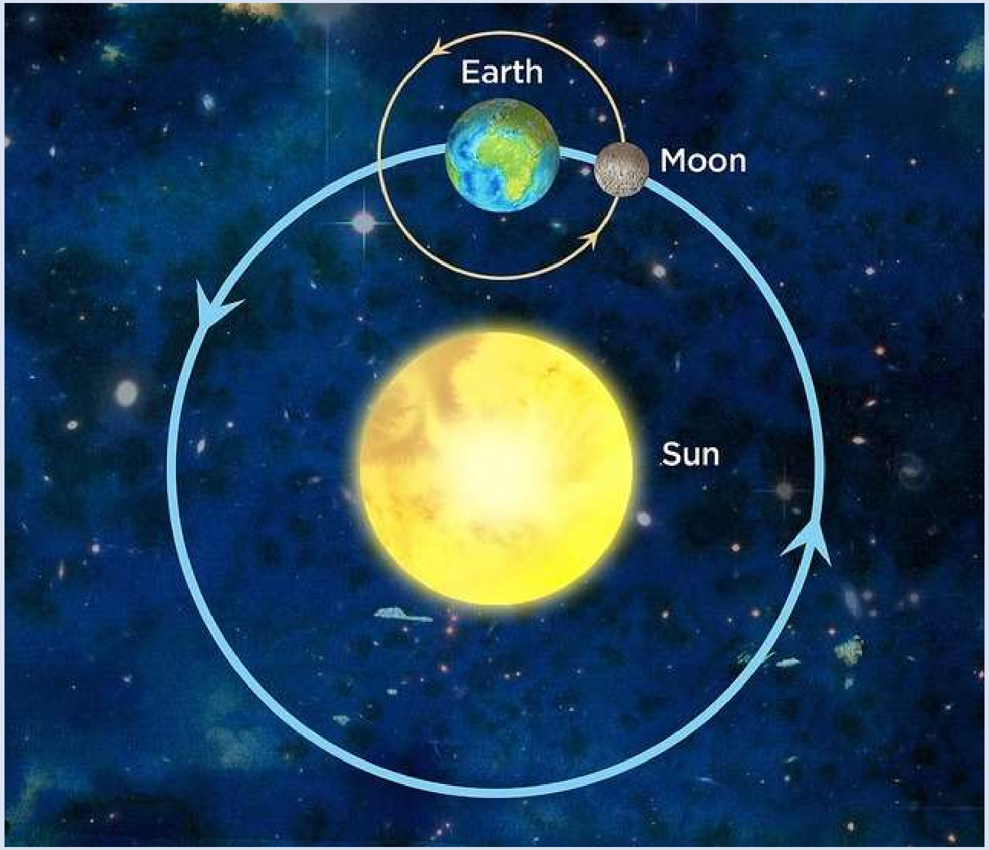
Forces in Space

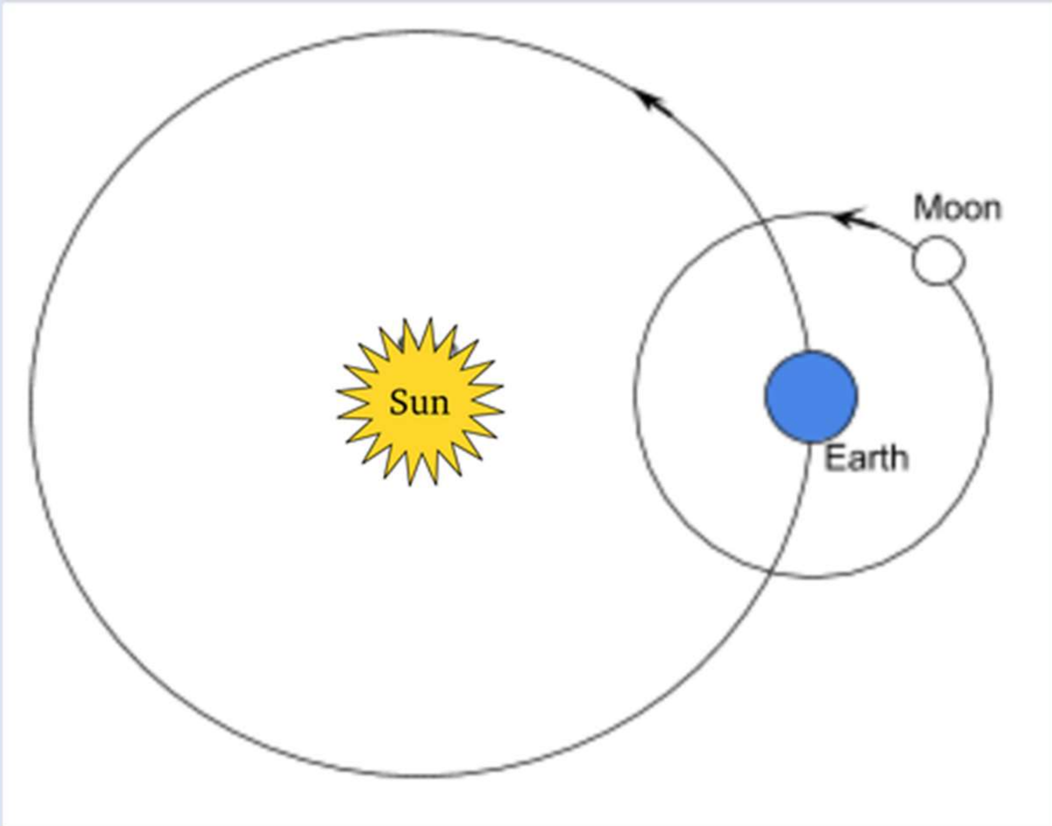
Watch the following video. On Your orbit diagram draw arrow to show the gravitational forces acting.



https://youtu.be/Rfk9KlWXZdU

Forces in Space





Earth, Space, and Time

We have all heard these words before, can you describe what they mean?

Discuss these words with your partner and describe scientifically what the mean.

Daytime

Night-time

Day

Month

Year

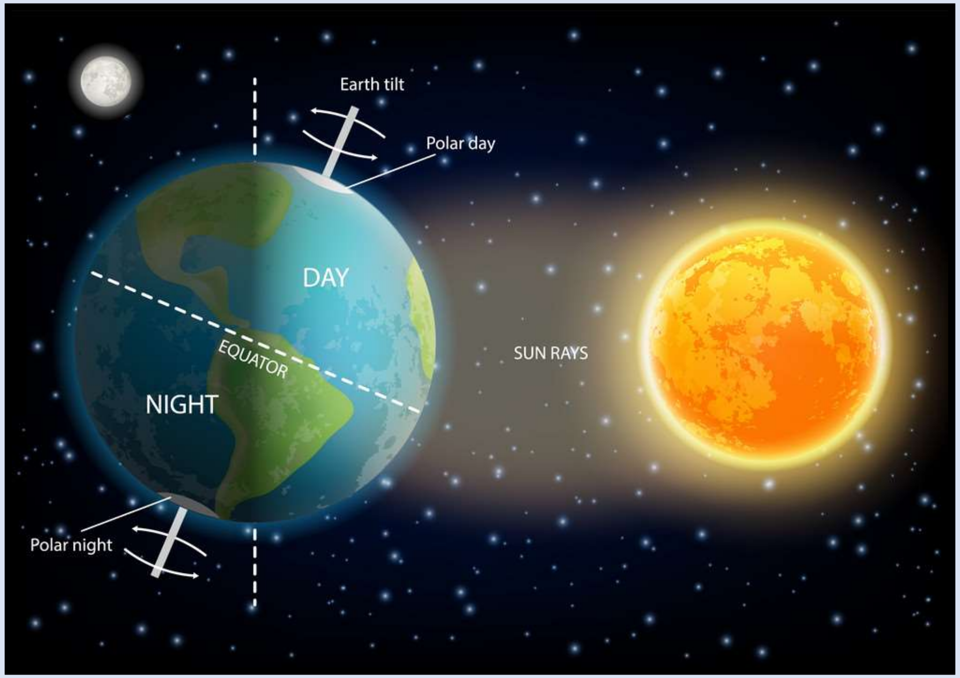
Seasons

Be ready to share your answer.

Daytime and Night-time

The side of the Earth facing the Sun is bathed in light and heat (daytime).

The side of the Earth facing away from the Sun is darker and colder (night-time).



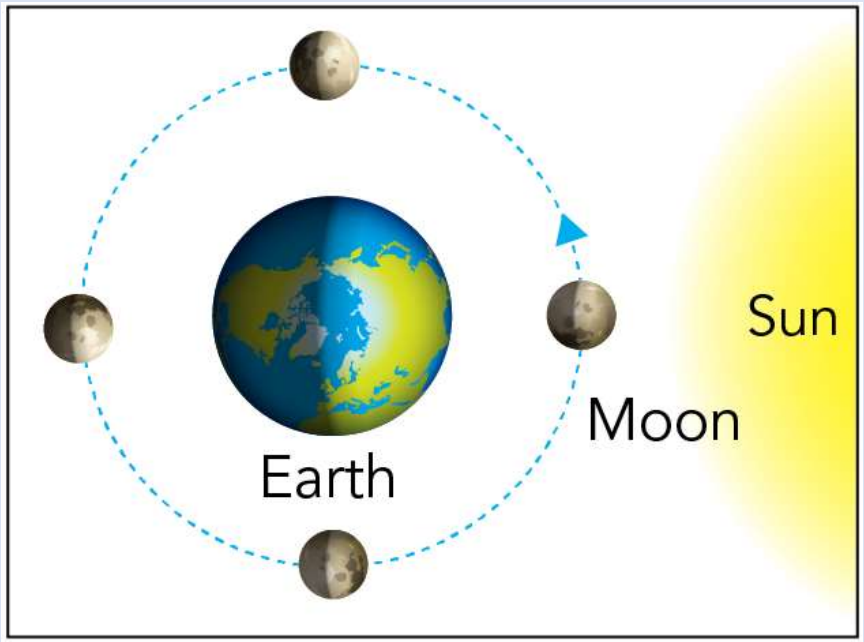
A Day

A day is the period of time during which the Earth completes one rotation around its axis.

The Earth has a day of 24 hours.

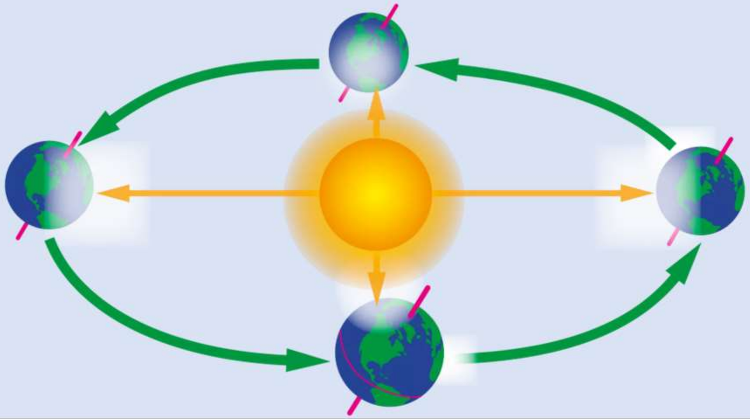
A Month

It takes 29.5 days for the Moon to orbit the Earth. This period is called a lunar **month**.

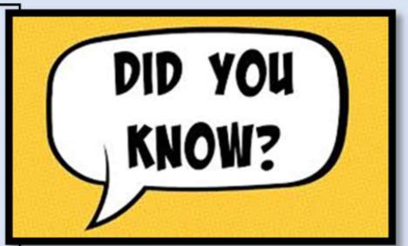


A Year

The Earth orbits the Sun once every 365.25 days. This is known as a year.

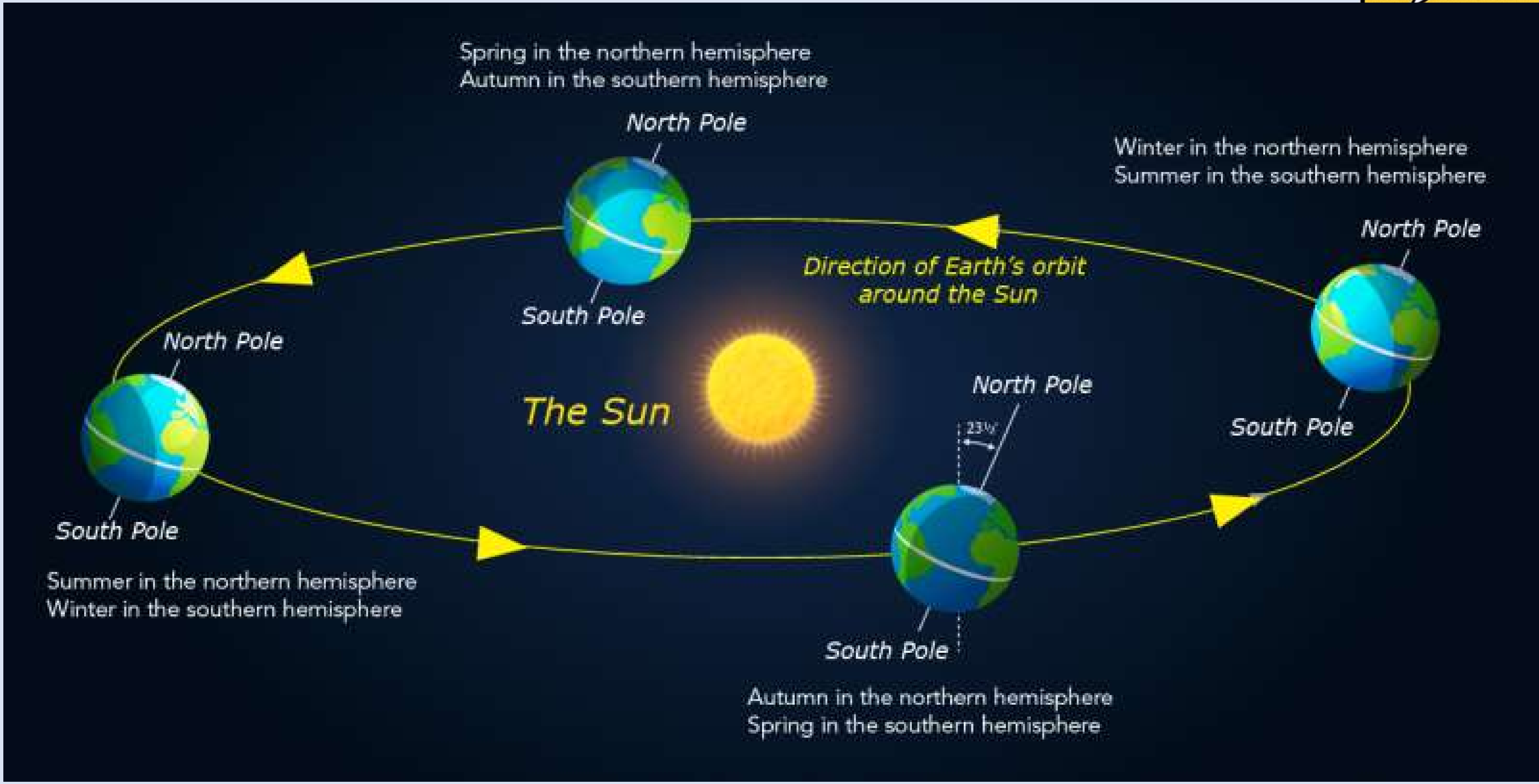


Our calendar year is 365 days. Every 4 years we have a leap year and add another day to the calendar. This makes up for the 4 missing quarters.



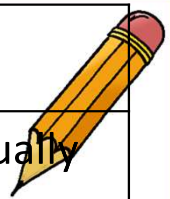
The Seasons

DID YOU KNOW?



Earth, Space, and Time

Daytime Month Nighttime Year Seasons Day



Terms	Definitions
	when your part of the Earth is facing the Sun, so you can see light and it is usually warm.
	when your part of the Earth is turned away from the Sun, so it becomes dark and usually cooler.
	the time it takes for the Earth to make one full spin (rotation) on its axis. This takes 24 hours.
	how long it takes the Moon to orbit the Earth once. This takes roughly 29.5 days, which is why months are about 30 days long.
	the time it takes the Earth to orbit once around the Sun. This takes about 365¼ days.
	Seasons happen because the Earth is tilted on its axis as it orbits the Sun.This tilt means different parts of Earth get more or less sunlight during the year, creating spring, summer, autumn, and winter.

Earth, Space, and Time

Terms	Definitions
Daytime	when your part of the Earth is facing the Sun, so you can see light and it is usually warm.
Night-time	when your part of the Earth is turned away from the Sun, so it becomes dark and usually cooler.
Day	the time it takes for the Earth to make one full spin (rotation) on its axis. This takes 24 hours.
Month	how long it takes the Moon to orbit the Earth once. This takes roughly 29.5 days, which is why months are about 30 days long.
Year	the time it takes the Earth to orbit once around the Sun. This takes about 365¼ days.
Seasons	**Seasons** happen because the **Earth is tilted** on its axis as it orbits the Sun. This tilt means different parts of Earth get more or less sunlight during the year, creating **spring, summer, autumn, and winter**.

Earth’s Rotation & Orbit – Role Play

Task: Role play the Earth’s rotation and orbit and be the Solar System.
You will be placed in groups of three and assigned roles.

1. Sun
2. Earth
3. Moon

Prepare a 3-minute presentation where you shows the Earth’s rotation and orbit.

Success Criteria:

Explain how the movements between the Sun, Earth and Moon cause:

- Day and night
- Months
- A year
- Bonus: What might cause seasons?

Use your creativity and teamwork — your goal is to make the invisible visible!

Earth's Rotation & Orbit – Role Play

Success Criteria:

Explain how the movements between the Sun, Earth and Moon cause:

- Day and night
- Months
- A year
- Bonus: What might cause seasons?

Use your creativity and teamwork — your goal is to make the invisible visible!

Praise – What is good about this piece of work?

Next steps – What needs to be improved?

How can this be improved?

Praise – What is good about this piece of work?

Next steps – What needs to be improved?

<u>How</u> can this be improved?

Earth’s Rotation & Orbit - Demo

Your teacher may show you the Earth’s rotation & orbit demonstration.

Forces in Space

20/08/2025

Learning Intentions:

- To understand how gravity acts as a force in space.
- To explore the movements of Earth and how they create day, night, months, and years.

Success Criteria

- I can list forces acting on moons, planets, stars and satellites.
- I can state that day and night are caused by the Earth rotating on its axis.
- I can state that the Earth orbits the Sun once in one year.

Forces in Space

20/08/2025

Plenary: Exit ticket

1. What movement causes day and night?
2. Why do we have years?
3. How long does it take the Moon to orbit Earth?
4. What happens if gravity stops?

The Solar System

20/08/2025

Page 16

Starter:

1. What does our solar system consist of?

2. Name the force which holds the solar system together.

The Solar System

20/08/2025

Learning Intentions:

- To identify the planets and their key features.

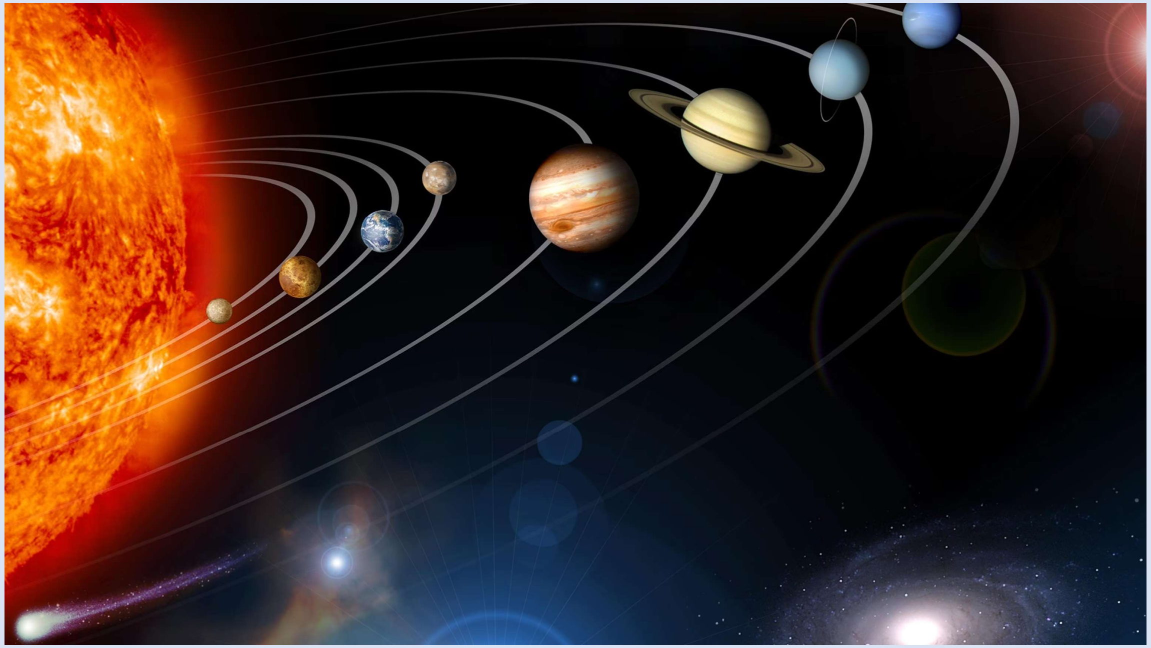
Success Criteria

- I can state that the Solar System consists of eight planets that orbit the Sun.
- I can list the planets in order of increasing distance from the Sun.
- I can describe the relative size and scale of the planets in the Solar System.

The Solar System

Our solar system consists of our Sun and everything in its gravitational pull around it.

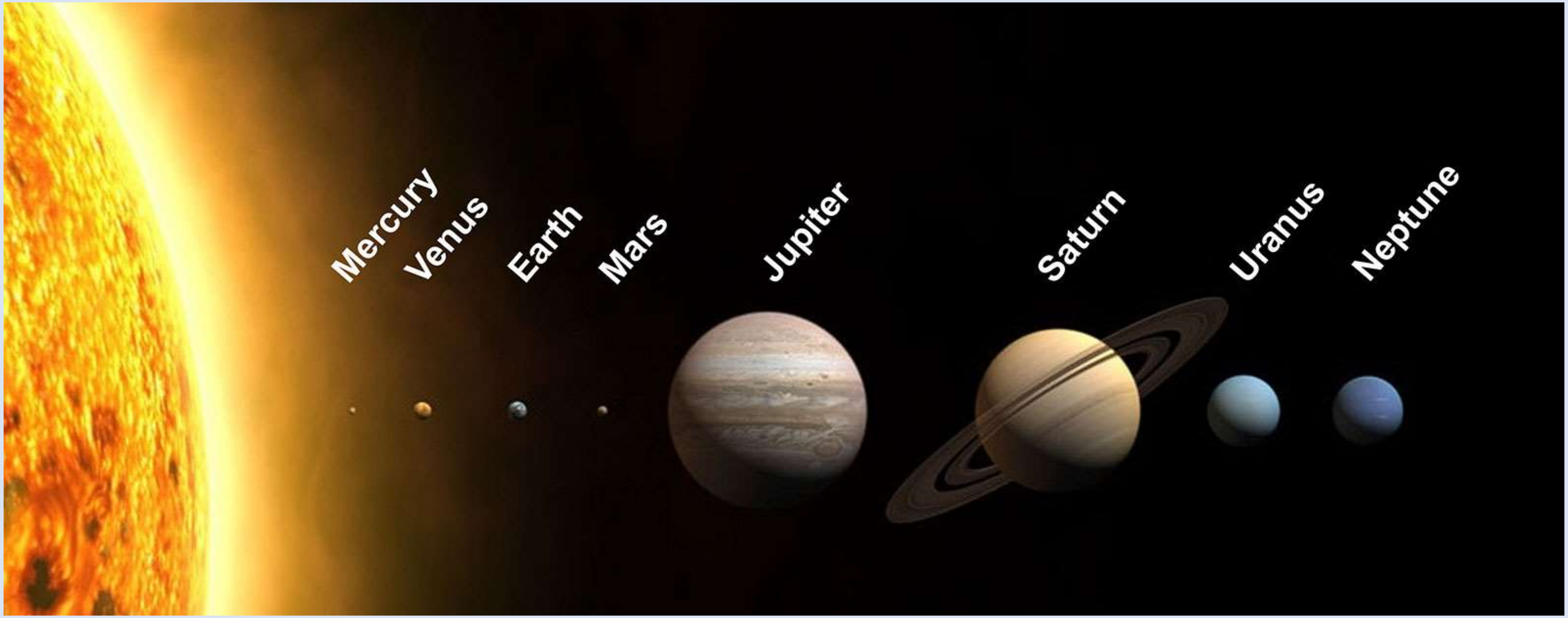
Planets, moons, asteroids, minor planets, comets, dust and gas all belong to the solar System.



The Solar System

Class question:

List the planets in order of increasing distance from the Sun.



The Solar System

8 Sun

The Earth is one of ________ planets which orbit the ________. Together with other objects like comets, asteroids and dwarf planets, they make up

Solar System

the _______ _____________.

The Solar System

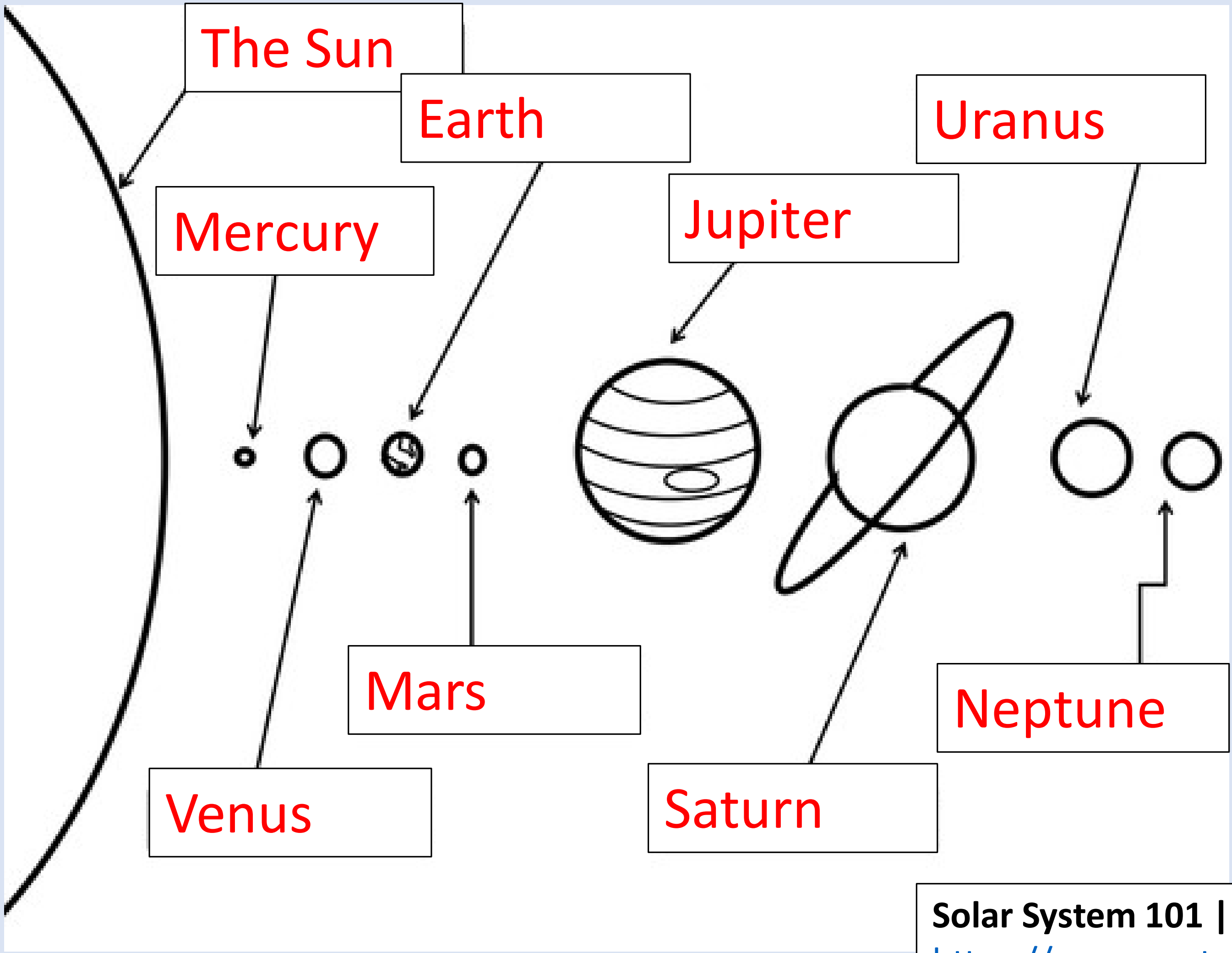
Page 16

The ___inner___ planets (Mercury, Venus, Earth and Mars) are small and rocky.

The ___outer___ planets (Jupiter, Saturn, Uranus and Neptune) are large gas/ice giants.

The Solar System

Page 17



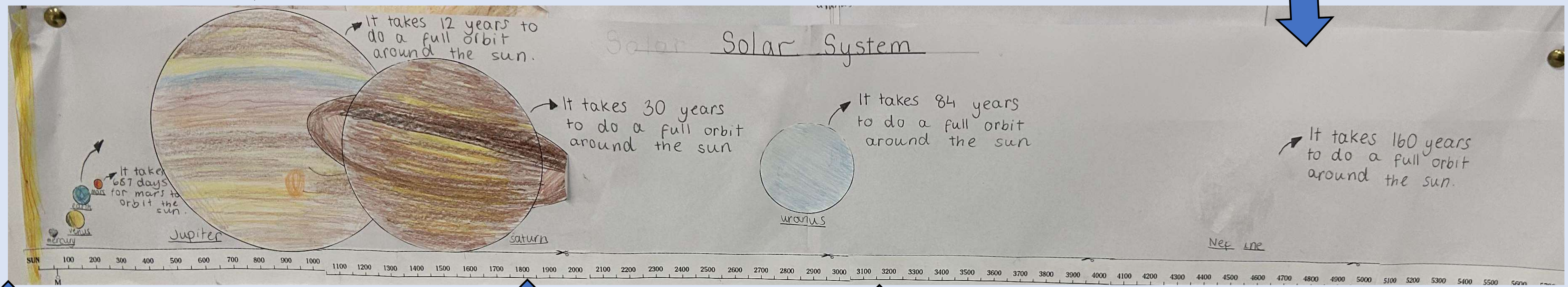
Solar System 101 | National Geographic 4:10
https://www.youtube.com/watch?v=libKVRa01L8

The Scale of the Solar System

Create a map of the solar system to show the scale of the solar system.

Planets coloured

Planet Facts



Include the Sun

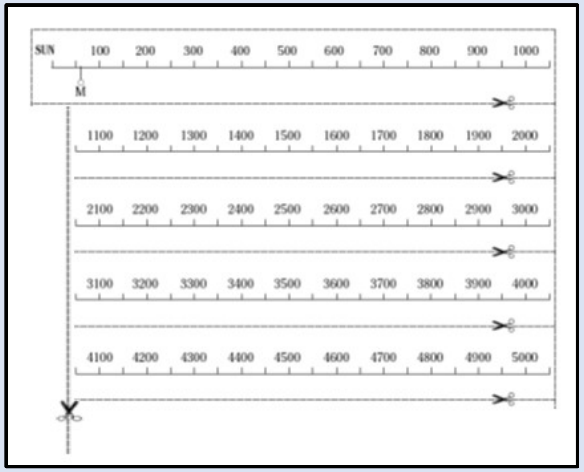
Solar System Scale

Planets placed at the correct distance

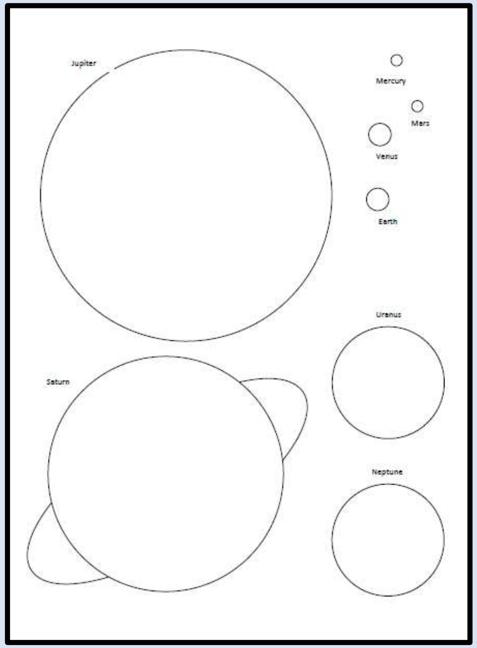
The Scale of the Solar System

Collect a ………

Solar System Scale



Planet diagram



A3 piece of paper

The Scale of the Solar System

1. Fold the A3 paper in half to create two long strips. Tape them together.
2. Cut out the ‘solar system scale’ and glue it along the bottom of your paper.
3. Mark each planet at the correct **distance to the Sun** using the data table in your booklet. Mercury has been completed.
4. Colour and cut out your planets the glue them on your scale at the correct **distance to the Sun** .
5. Add facts on your solar system map.

The Scale of the Solar System

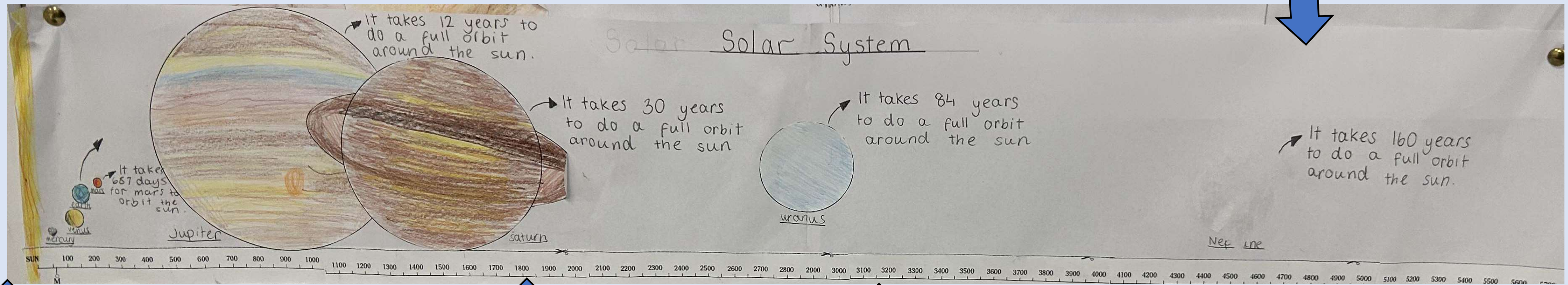
Planet	**Distance to the Sun (million km)**	**Time for 1 orbit around the Sun (Earth days)**	**Average surface temperature (° C)**	**Strength of gravity (Nkg^{-1})**	**Moons**
Mercury	60	88	167	3.7	0
Venus	110	225	464	8.9	0
Earth	150	365	15	9.8	1
Mars	230	687	-65	3.7	2
Asteroids	400	-	-	-	-
Jupiter	780	4330	-110	23	67
Saturn	1400	10800	-140	9.0	62
Uranus	2900	30600	-195	8.7	27
Neptune	4500	59800	-200	11	14

The Scale of the Solar System

Create a map of the solar system to show the scale of the solar system.

Planets coloured

Planet Facts



Include the Sun

Solar System Scale

Planets placed at the correct distance

The Solar System

20/08/2025

Learning Intentions:

- To identify the planets and their key features..

Success Criteria

- I can state that the Solar System consists of eight planets that orbit the Sun.
- I can list the planets in order of increasing distance from the Sun.
- I can describe the relative size and scale of the planets in the Solar System.

The Solar System

20/08/2025

Plenary:

There are a number of mnemonics to help you remember the order of the planets in the Solar system.

Can you think of any others?

Tick me at the end if ***you can*** …

The Solar System (cont.)

20/08/2025

Starter: Prior Knowledge

1. Name all 8 planets in order from the Sun.

2. Which planet is the largest?

3. How does the size of the four **inner** planets compare to the size of the four **outer** planets?

https://www.bobthealien.co.uk/solarsystem/innerouter.htm

The Solar System (cont.)

20/08/2025

Learning Intentions:

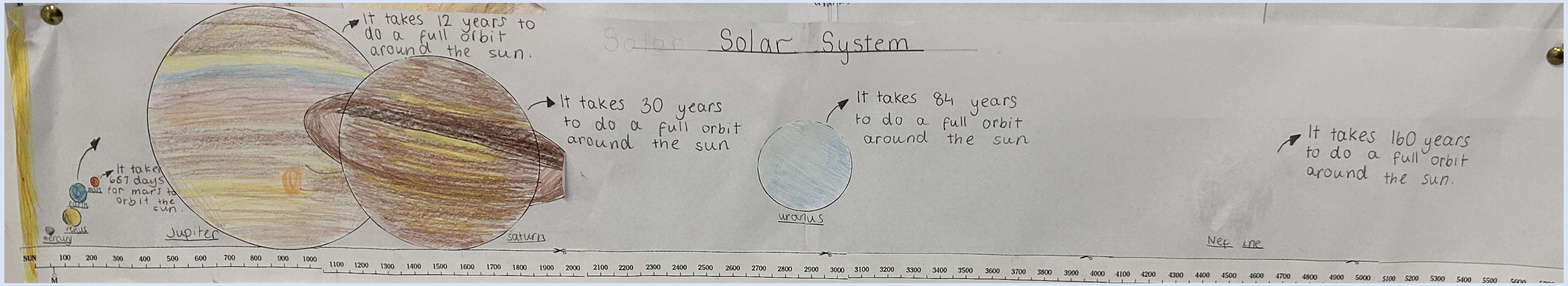
- To compare planetary characteristics.

Success Criteria

- I can describe the size of the planets relative to each other.
- I can describe the distances between each planet and the Sun.
- I can produce a poster to showcase my knowledge.

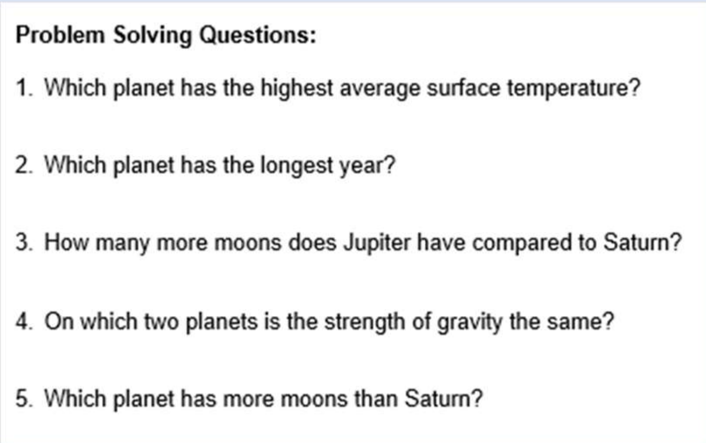
The Scale of the Solar System

Continue with your scale of the solar system poster.



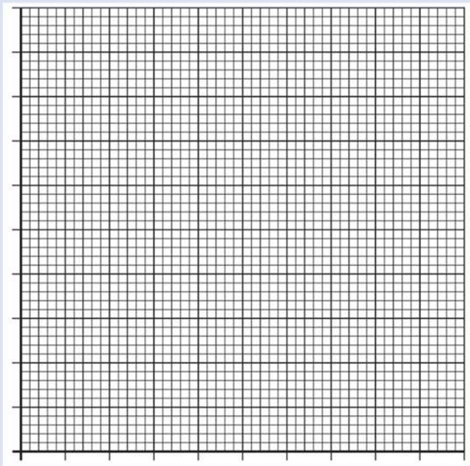
If finished, try the following challenge tasks:

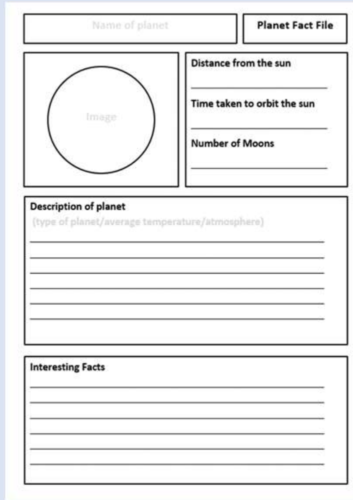
Problem Solving Questions   Bar Graph Practice   Planet Fact File



Problem Solving Questions:

1. Which planet has the highest average surface temperature?
2. Which planet has the longest year?
3. How many more moons does Jupiter have compared to Saturn?
4. On which two planets is the strength of gravity the same?
5. Which planet has more moons than Saturn?





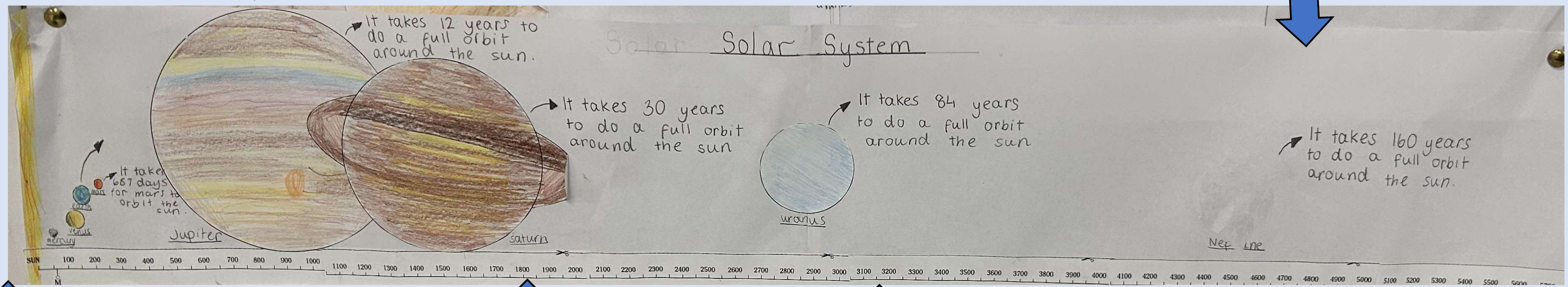
Name of planet
Planet Fact File
Image
Distance from the sun
Time taken to orbit the sun
Number of Moons
Description of planet
(type of planet/average temperature/atmosphere)
Interesting Facts

The Scale of the Solar System

Create a map of the solar system to show the scale of the solar system.

Planets coloured

Planet Facts



Include the Sun

Solar System Scale

Planets placed at the correct distance

The Scale of the Solar System

1. Fold the A3 paper in half to create two long strips. Tape them together.
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3. Mark each planet at the correct **distance to the Sun** using the data table in your booklet. Mercury has been completed.
4. Colour and cut out your planets the glue them on your scale at the correct **distance to the Sun** .
5. Add facts on your solar system map.

Bar Graph Practice

Pages 18 & 19

Extension: Plot this data on a bar graph

Planet	**Distance to the Sun (million km)**
Mercury	60
Venus	110
Earth	150
Mars	230
Asteroids	400
Jupiter	780
Saturn	1400
Uranus	2900
Neptune	4500

Name of planet

Planet Fact File

Image

Distance from the sun

____

Time taken to orbit the sun

____

Number of Moons

____

Description of planet

(type of planet/average temperature/atmosphere)

____

____

____

____

____

____

Interesting Facts

____

____

____

____

____

____

Planet Fact File

The Scale of the Solar System

Planet	Distance to the Sun (million km)	Time for 1 orbit around the Sun (Earth days)	Average surface temperature (° C)	Strength of gravity ($\mathrm{Nkg^{-1}}$)	Moons
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The Scale of the Solar System

Problem Solving Questions:

1. Which planet has the highest average surface temperature?

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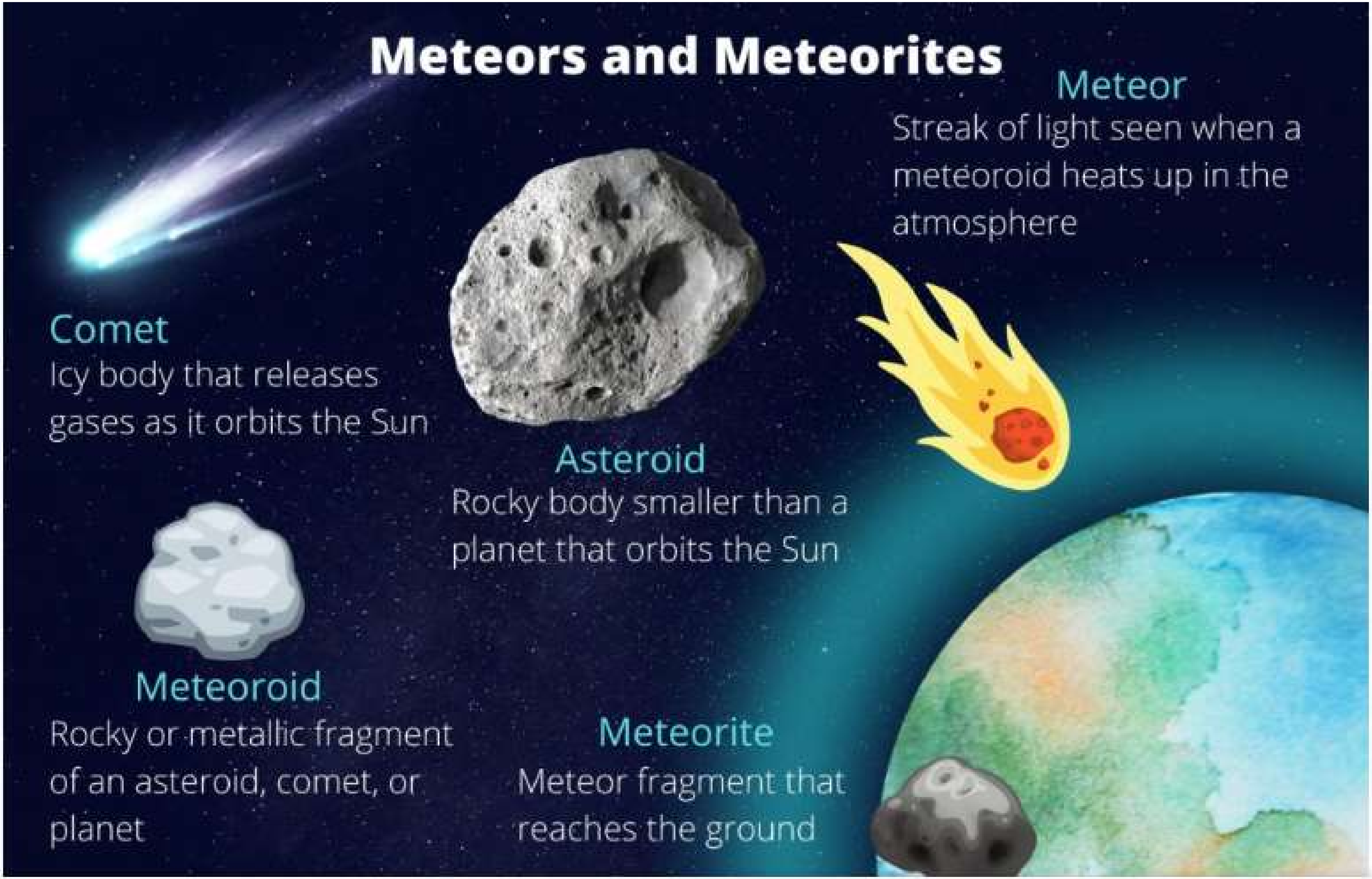

Meteors and Meteorites
Meteor
Streak of light seen when a meteoroid heats up in the atmosphere
Comet
Icy body that releases gases as it orbits the Sun
Asteroid
Rocky body smaller than a planet that orbits the Sun
Meteoroid
Rocky or metallic fragment of an asteroid, comet, or planet
Meteorite
Meteor fragment that reaches the ground

The Solar System (cont.)

20/08/2025

Learning Intentions:

- To compare planetary characteristics.

Success Criteria

- I can describe the size of the planets relative to each other.
- I can describe the distances between each planet and the Sun.
- I can produce a poster to showcase my knowledge.

The Scale of the Solar System Continued …. 20/08/2025

Plenary:

I was successful when I …………..

The part of the lesson I enjoyed the most was……

The skills I used in today's lesson were………

The Surface of the Moon

20/08/2025

Page 21

Starter: Prior Knowledge

1. What's different about the Moon's surface compared to Earth's?
2. What causes craters on planets or moons?
3. Why would a rover need friction to move on Mars?

The Surface of the Moon

20/08/2025

Learning Intentions:

- To explore how craters are formed on the surface of the Moon.

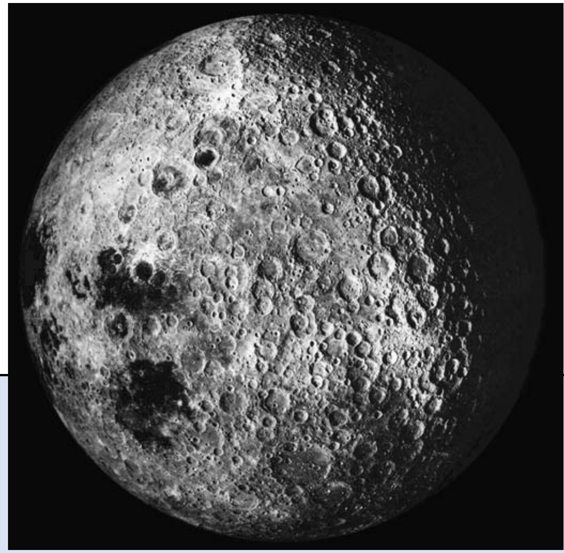
Success Criteria

- I can carry out an experiment to show how craters are formed on the surface of the Moon.
- I can write an experiment report with Aim, Method, Results, Graph Conclusion, Evaluation.

Investigating Craters

The surface of the Moon has many ___craters___.

The craters on the Moon are caused by ___asteroids___ and ___meteorites___ colliding with the lunar surface.



Investigating Craters

Unlike Earth’s surface, the lunar surface is covered with craters.

This is because the Moon has almost no erosion because it has no atmosphere.

That means nothing can remove marks on its surface once they are made.

Investigating Craters – The Variables

Planning your investigation. What factors could you investigate?

Independent variable **What you change or control**	**Dependent variable** **What you measure**	**Variable(s) to be kept constant** **What you keep the same**
• diameter of the asteroid • mass of the asteroid • height the asteroid is dropped from	• depth of crater. • width of crater.	• diameter of the asteroid • mass of the asteroid • height the asteroid is dropped from

Investigating Craters – The Variables

Over the next 2 lessons we will be writing a full science investigation.

- Aim
- Hypothesis
- Method
- Results
- Graph
- Conclusion
- Evaluation

You will be supported throughout this investigation.

Investigating Craters

Aim: *What are you trying to find out in your investigation?*

Aim: To investigate how the ______________________ affects the

_________________________________.

Investigate how changing the…

- diameter of the asteroid
- mass of the asteroid
- height the asteroid is dropped from

affects the…

- width of crater.
- depth of crater.

Investigating Craters

Example

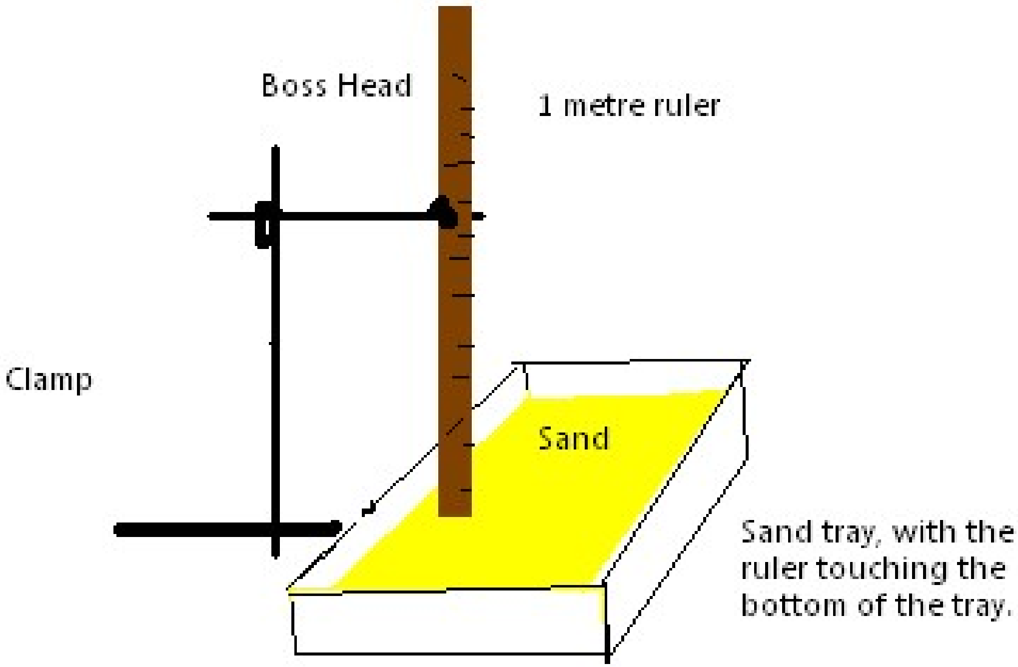
Aim: To investigate how the **diameter of an asteroid** affects the **width of the crater**.

Investigating Craters

Hypothesis: What do you think will happen?

Investigating Craters

Method: Describe how you will carry out your experiment. Include a labelled diagram



Investigating Craters

Method: Variables

- I will change the ________________________________ by

  ____

- I will measure the ________________________________ using

  ____

- I will keep the ____

  constant.

Teacher Information - Can repeat measurements or not…

the following slides cover both options

Investigating Craters

Results:

- What will your results table look like?
- How many columns and row to you need?
- What will you heading be?
- Do you need to include units?

Investigating Craters

Results:

Investigating Craters

Results:

Diameter of asteroid (marble) (cm)	Width of crater (cm)
1.5	
2	
2.5	
3	

Repeating your results

Today we will be repeating our measurement three times and calculating an average. – Why do we want to do this?

To get more accurate and reliable results by reducing errors. Our results will be closer to the true value.

Think about how you will draw your results table with repeat measurements in it.

How do we calculate an average (mean) time?

The **mean** is the **average** of the numbers.

To calculate: **add up** all the numbers, then **divide** by how many numbers there are.

Example: Find the average of

6 2 7 2 3

Step 1: **add up** all the numbers

6 + 2 + 7 + 2 + 3 = 20

Step 2: **divide** by how many numbers there are

20 ÷ 5 = 4

The average is 4.

Investigating Craters

Results:

	1	2	3	Average

Investigating Craters

Results: record your observations/ measurements in a table. Remember heading and units.

Diameter of asteroid (marble) (cm)	Width of crater (cm)			
	1	2	3	Average
1.5				
2				
2.5				
3				

The Surface of the Moon

20/08/2025

Learning Intentions:

- To explore how craters are formed on the surface of the Moon

Success Criteria

- I can carry out an experiment to show how craters are formed on the surface of the Moon.
- I can write an experiment report with Aim, Method, Results, Graph Conclusion, Evaluation.

Investigating Craters (lesson 2)

20/08/2025

Plenary: Exit Pass

1. What did you do well?

2. What did you find challenging?

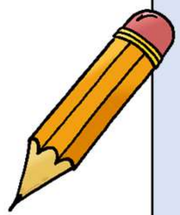
3. What question do you need to ask your teacher next lesson?

Investigating Craters (lesson 2)

20/08/2025

NOT in booklet

Starter:



1. Put these scientific investigation headings in the correct order.

Results Conclusion Title Hypothesis

Method Aim Evaluation

2. Select **two** of them and describe what they mean.

The Surface of the Moon

20/08/2025

Learning Intentions:

- To explore how craters are formed on the surface of the Moon

Success Criteria

- I can carry out an experiment to show how craters are formed on the surface of the Moon.
- I can write an experiment report with Aim, Method, Results, Graph Conclusion, Evaluation.

Spot the mistake

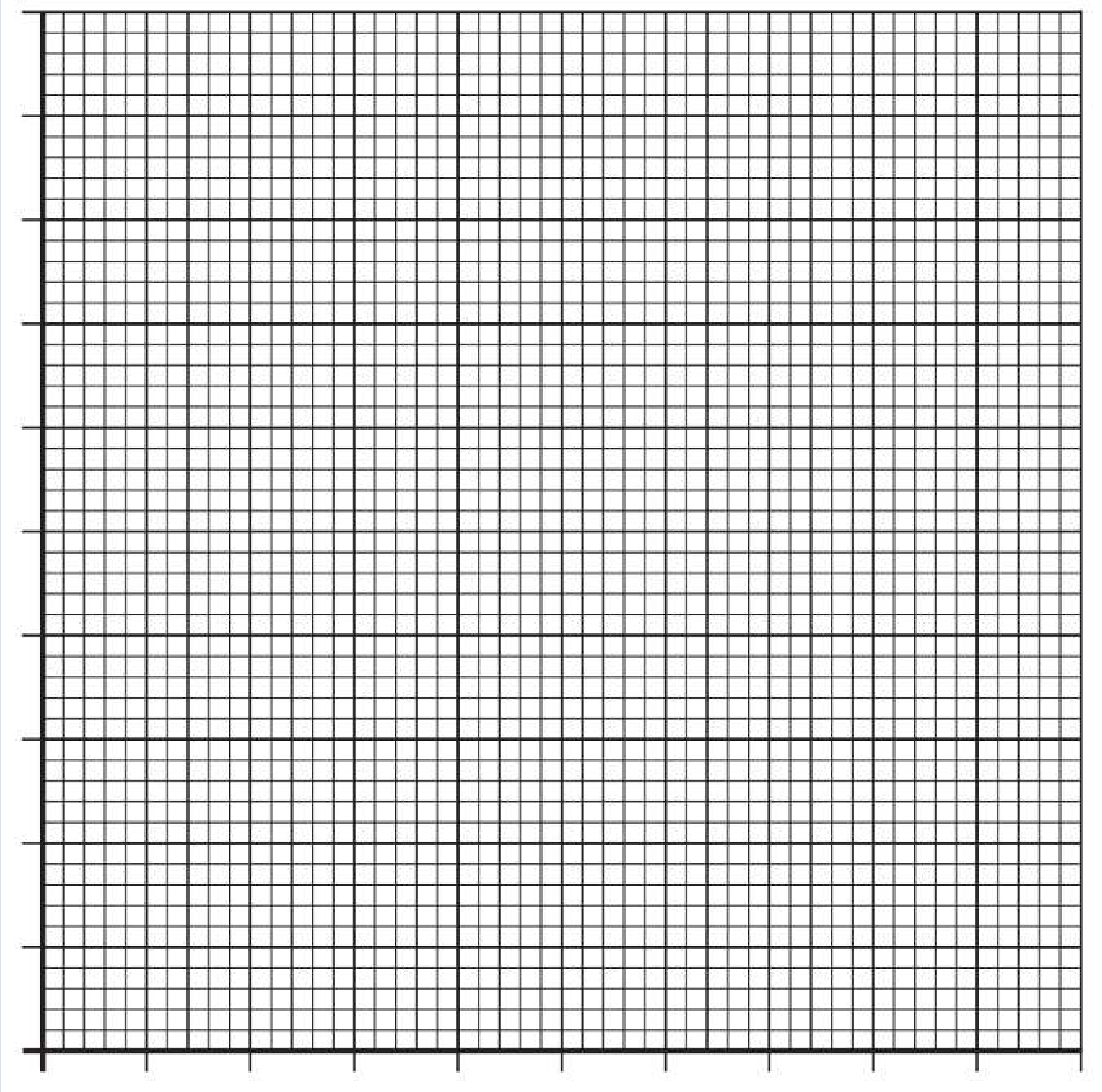
How to draw a line graph

Investigating Craters (Extension)

Page 25

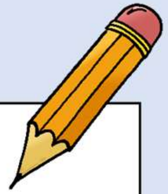
Graph:

Plot a scatter graph with a best fit line.



Investigating Craters

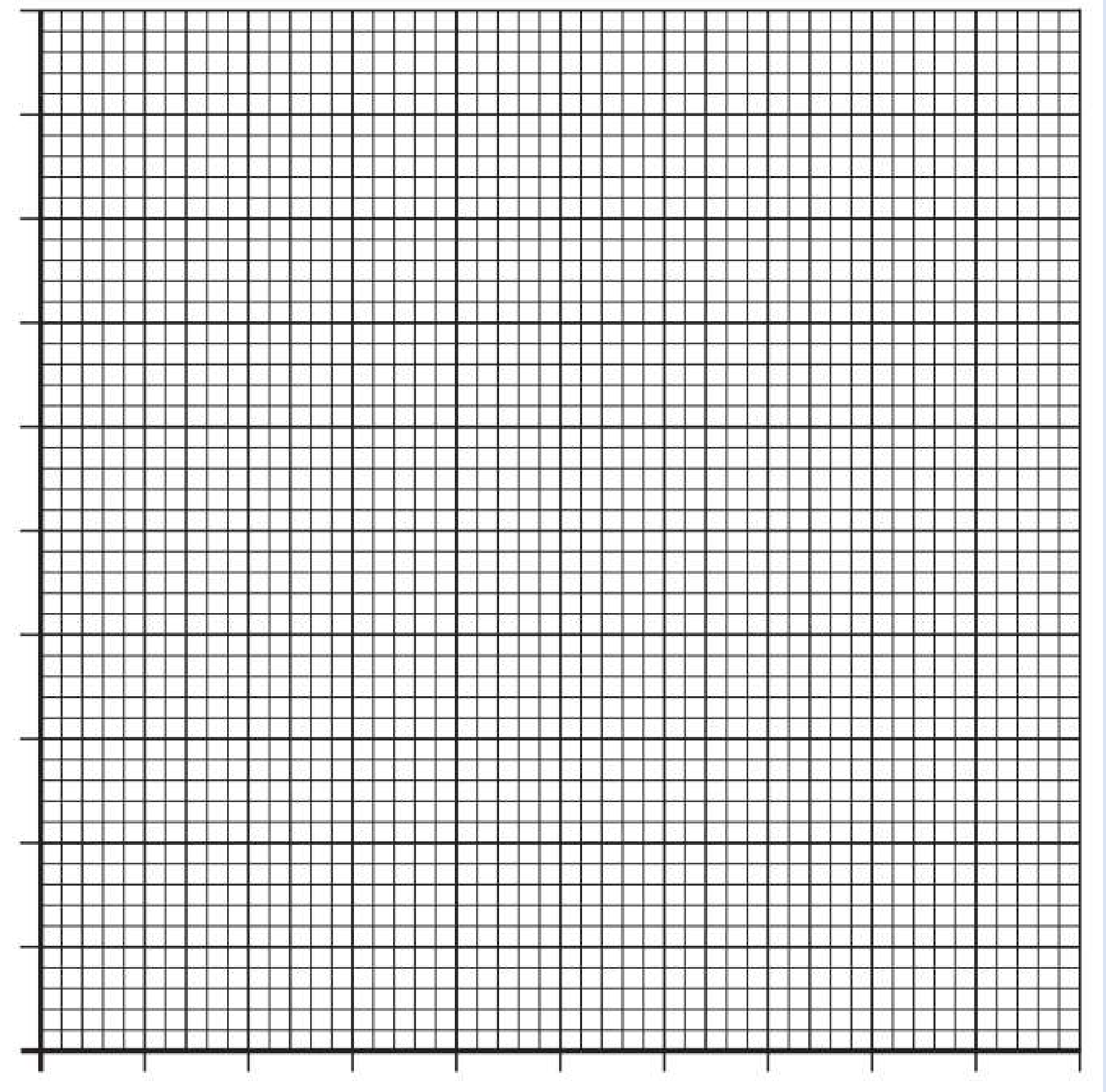
Page 25



Graph:

Plot a scatter graph with a best fit line.

Width of crater (cm)



Diameter of marble (cm)

Investigating Craters

Aim: To investigate how the **diameter** of an asteroid from affects the **width of the crater**.

Conclusion: *What did you find out? This should your aim.*

Measuring Forces

Evaluation: *You must identify a factor in your experiment that had a significant effect on the reliability, accuracy or precision of your experiment. You must then explain:*

- *What you did to minimise the effect of this factor or*
- *What you could have done to minimise the effect of this factor or*
- *How you know this factor had a significant effect.*

Peer Feedback

Give WOW NOW HOW feedback to someone from another group.

Instructions:

- Carefully read their science report.
- Fill in the NOW WOW HOW feedback sheet
- Return the feedback to your classmate
- Collect and read your peer feedback

Praise – What is good about this piece of work?

Next steps – What needs to be improved?

How can this be improved?

Praise – What is good about this piece of work?

Next steps – What needs to be improved?

<u>How</u> can this be improved?

Peer Feedback

Success Criteria

Praise – What is good about this piece of work?

Next steps – What needs to be improved?

How can this be improved?

The Surface of the Moon

20/08/2025

Learning Intentions:

- To explore how craters are formed on the surface of the Moon

Success Criteria

- I can carry out an experiment to show how craters are formed on the surface of the Moon.
- I can write an experiment report with Aim, Method, Results, Graph Conclusion, Evaluation.

Investigating Craters

20/08/2025

Plenary:

Read over your feedback carefully.

1. WOW, what is good about this piece of work?
2. NOW what needs to be improved?
3. HOW can this be improved?

Beyond the Solar System

20/08/2025

Page 27

Starter: Prior knowledge

1. What do we mean by "solar system"?

2. What is beyond our solar system?

Scale of the Universe

20/08/2025

Learning Intentions:

- To state what is meant by the terms: planet, moon, star, solar system, exoplanet, galaxy and universe.
- To understand the scale of the universe.

Success Criteria

- I can explain what is meant by the terms: planet, moon, star, solar system, exoplanet, galaxy and universe.
- I can order space objects by size and distance to show my understanding of the scale of the universe.

“What do you think is beyond Neptune? What part of space is bigger—the Solar System or a galaxy?”

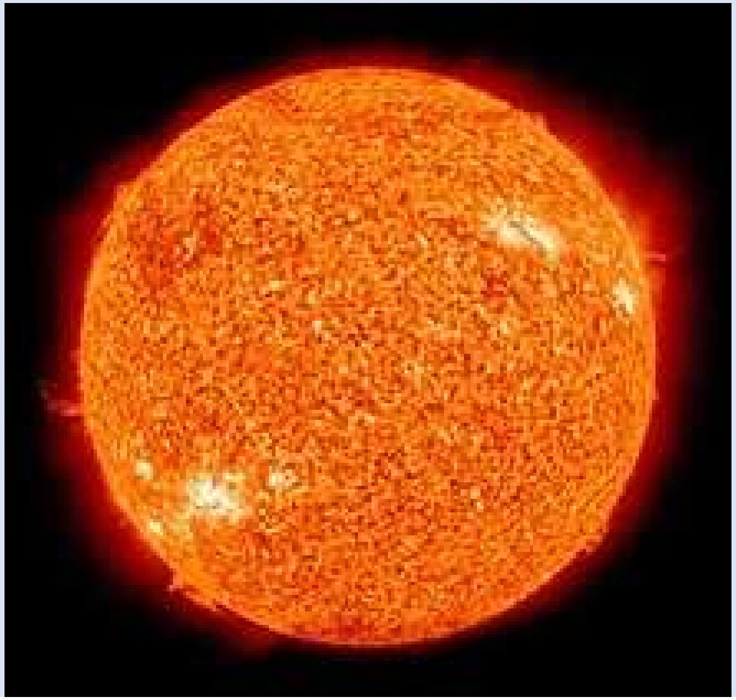
https://youtu.be/v2d-9hjxai8

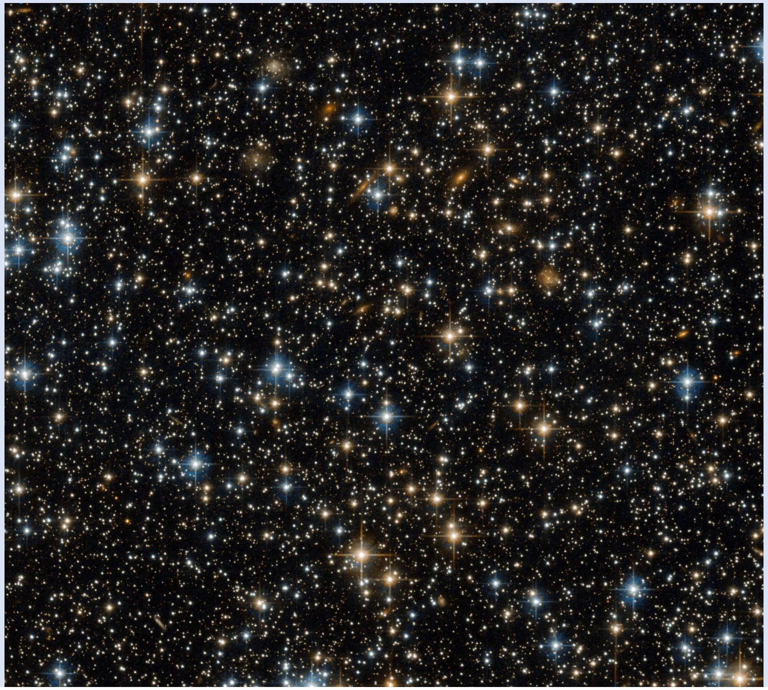
Star

A star is a huge sphere of gas that emits light and heat. Our Sun is the nearest star to the Earth.

The Sun is one of around 100 billion stars that make up our galaxy.

Many of these stars may have planets, known as **exo-planets** orbiting them.

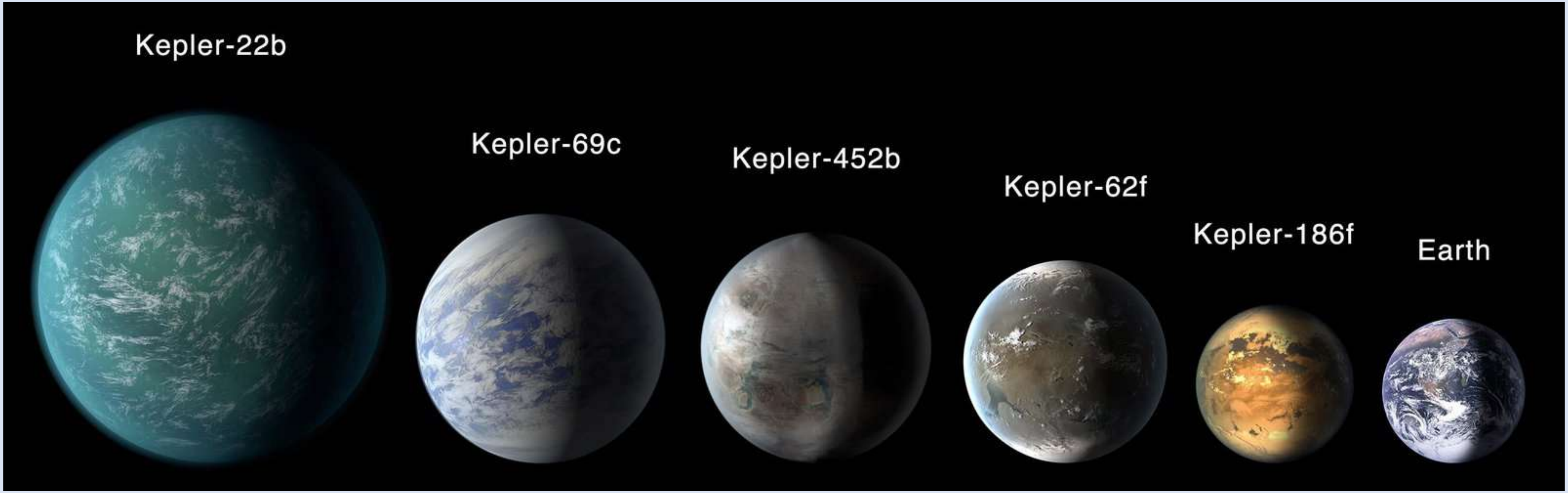




Exoplanet

An exoplanet is a planet outside our solar system.

It is a planet which orbits a star other than our own Sun.



More on **exo-planets** later….

Galaxy

A galaxy is a huge collection of stars, dust and gas, held together by gravity.

Our galaxy is called the Milky Way.

The Universe

The Milky Way galaxy is just one of the millions of galaxies that make up the Universe.

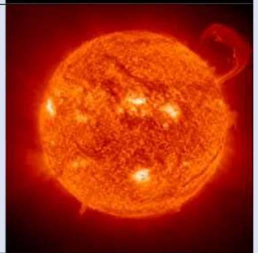
The Universe is made up of everything that exists, including planets, stars, galaxies and all forms of matter and energy.

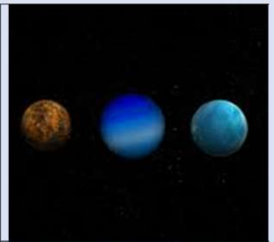
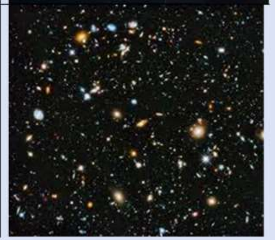
Important Astronomical Objects

Astronomical Object	Description	Picture
Planet		
Moon		
Star		
Solar System		
Exoplanet		
Galaxy		
Universe		

Card Sort

Important Astronomical Objects

Planet	An object which orbits a star.	
Moon	A natural satellite which orbits a planet.	
Star	A huge sphere of gas that emits light and heat.	
Solar System	A star and the objects that orbit it.	

Exoplanet	A planet outside our Solar System.	
Galaxy	A huge collection of stars.	
Universe	Everything that exists including all matter and energy.	

Important Astronomical Objects

Planet	**Universe**	**Solar System**	**Star**
Moon	**Exoplanet**	**Galaxy**	

Astronomical Object	Description
	An object which orbits a star.
	A natural satellite which orbits a planet.
	A huge sphere of gas that emits light and heat.
	A star and the objects that orbit it.
	A planet outside our Solar System
	A huge collection of stars.
	Everything that exists including all matter and energy.

Important Astronomical Objects

Planet	**Universe**	**Solar System**	**Star**
Moon	**Exoplanet**	**Galaxy**	

Astronomical Object	Description
Planet	An object which orbits a star.
Moon	A natural satellite which orbits a planet.
Star	A huge sphere of gas that emits light and heat.
Solar System	A star and the objects that orbit it.
Exoplanet	A planet outside our Solar System
Galaxy	A huge collection of stars.
Universe	Everything that exists including all matter and energy.

The Scale of the Universe

Use the scale of the Universe animation to explore the sizes of objects in space.

https://scaleofuniverse.com/ or video

How Big Is The Universe? Insider Science (3:49)

The Scale of the Universe

Use the scale of the Universe animation to explore the sizes of objects in space. https://scaleofuniverse.com/ Find the information to complete your table. Choose 2 of your own astronomical objects to investigate.

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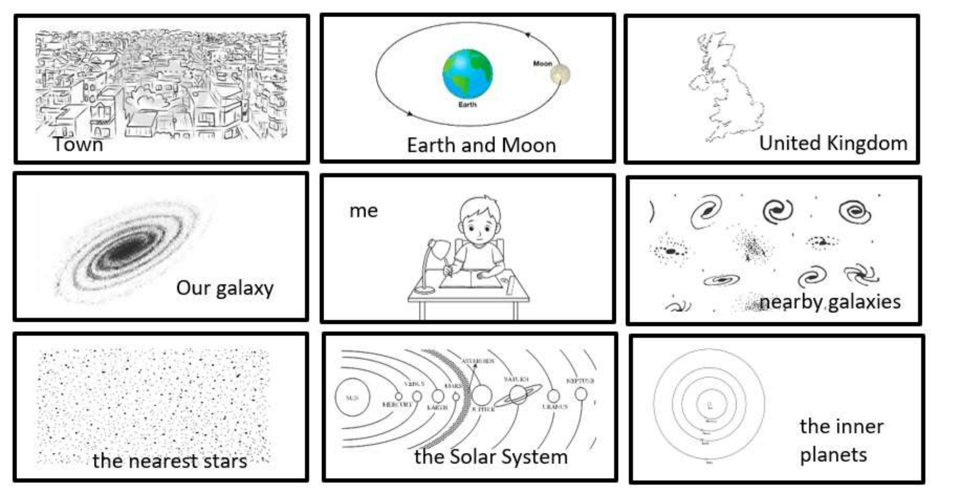
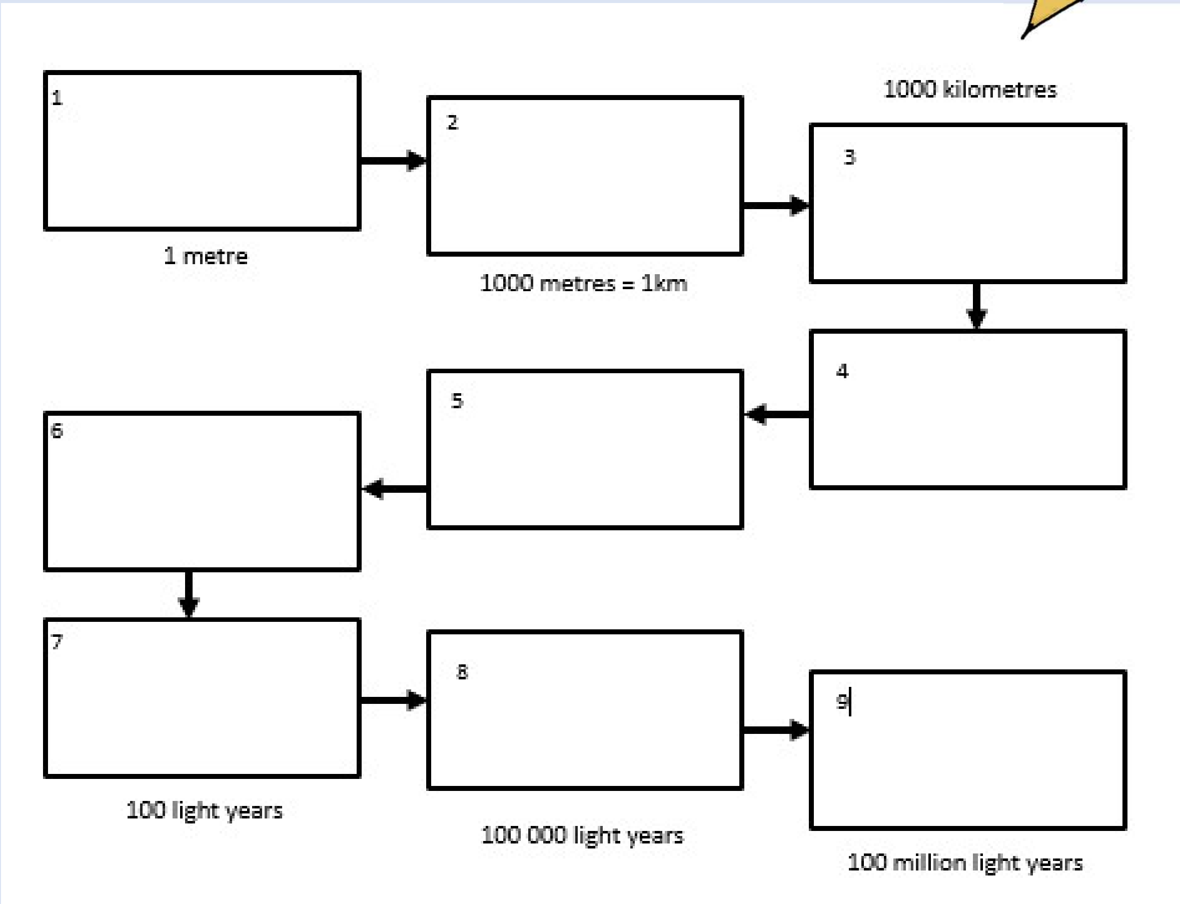
Object	Size	Fact
Moon		
Europa		
Earth		
Sun		
Sirius A		
Milky Way		

The Scale of the Universe

Complete the diagram to show your place in the Universe.



1. Cut out the images.
2. Put them in the correct order
3. Get your teacher to check your work
4. Stick them in



The Scale of the Universe

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Challenge Activities

"Journey Through Space" Story

- Write a creative story or comic strip where you travel outward: Planet → Solar System → Milky Way → Local Group → Universe.
- Include correct terminology and distances where possible.

Further Thinking Questions – Choose one.

- If the Earth were the size of a marble, how big would the Sun be? How far away? What size/distance would the other planets in the solar system be?
- Why do we say space is ‘mostly empty’? What does that actually mean? What’s in the space between?
- If galaxies are moving further apart, what does that tell us about the universe? Research evidence of the expanding universe and redshift.

The Scale of the Universe

More videos about the scale of the Universe…..

Mind Blowing! ...Earth Compared To The Rest Of The Universe - Amazing Graphic Presentation

VFX Artist Reveals the True Scale of the Universe, Corridor Crew (6:34)

Scale of the Universe

20/08/2025

Learning Intentions:

- To state what is meant by the terms: planet, moon, star, Solar System, exoplanet, galaxy and universe.
- To understand the scale of the universe.

Success Criteria

- I can explain what is meant by the terms: planet, moon, star, Solar System, exoplanet, galaxy and universe.
- I can order space objects by size and distance to show my understanding of the scale of the universe.

Beyond the Solar System

20/08/2025

Plenary: Test your memory

Choose **two** word from the list below. What does it mean?

Planet	**Universe**	**Solar System**	**Star**
Moon	**Exoplanet**	**Galaxy**	

Mass & Weight

20/08/2025

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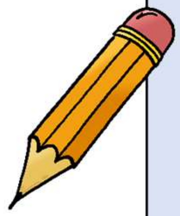


Starter:

1. Put these cosmology terms in order of their size:

Planet
Universe
Star
Solar system
Galaxy
Moon

Smallest → Largest.

________ ________ ________ ________ ________ ________

2. What force keeps the Earth in orbit around the Sun and gives an object weight?

Mass & Weight

20/08/2025

Learning Intentions:

- To describe what is meant by the terms ‘mass’ and ‘weight’.
- To investigate the relationship between mass and weight.
- To write a scientific report.

Success Criteria

- I can explain the difference between mass and weight
- I can state how to measure mass and weight
- I can plan and carry out an investigation independently.

What is mass and weight?

When people say ‘weight’, what unit do you think they’re talking about?”

https://youtu.be/PEQzAbizMYs

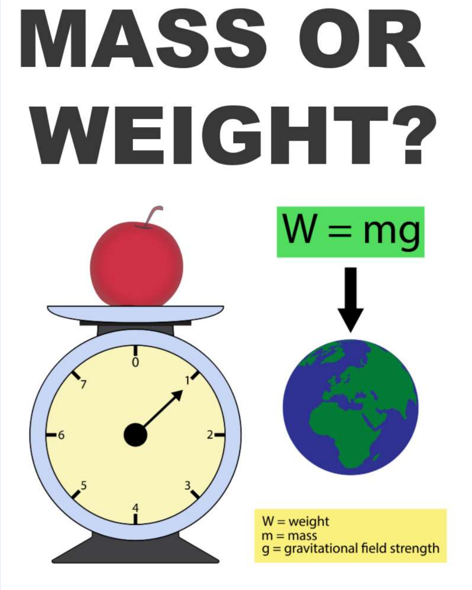
Describe the difference between **mass** and **weight.**

- **What are they?**
- **How are they measured?**
- **Can they change?**

Mass & Weight

The **mass** of an object is a measure of the amount of matter in the object. How much "stuff" there is in it. It does not change if you move the object.

Mass is measured in kilograms (kg) using a balance.



The **weight** of an object is a measure of the **force** exerted on the object due to the pull of gravity on it.

Weight is measured in newtons (N) using a newton balance.

Gravity a pull force that acts on the surface of a planet from the centre. It gives everything its weight. Gravity is measured in newtons per kilogram (N/kg).

Mass

Page 30

- The mass of an object is a measure of the amount of matter in the object. It does not change if you move the object.
- Mass is measured in kilograms (kg) using a balance.

Weight

Page 30

- The weight of an object is a measure of the force exerted on the object due to gravity.
- Weight is measured in Newtons (N) using a newton balance.

Outcome 1 Report

An Outcome 1 in Science is about showing that you can plan and carry out a scientific investigation.

It means you can:

- Choose a question to investigate
- Decide what things you will measure and how
- Carry out the experiment safely
- Collect and record results carefully
- Say whether your results are reliable or not

Outcome 1 Report

Your Outcome 1 will allow you and your teacher to assess your learning and find out what level you are working at.

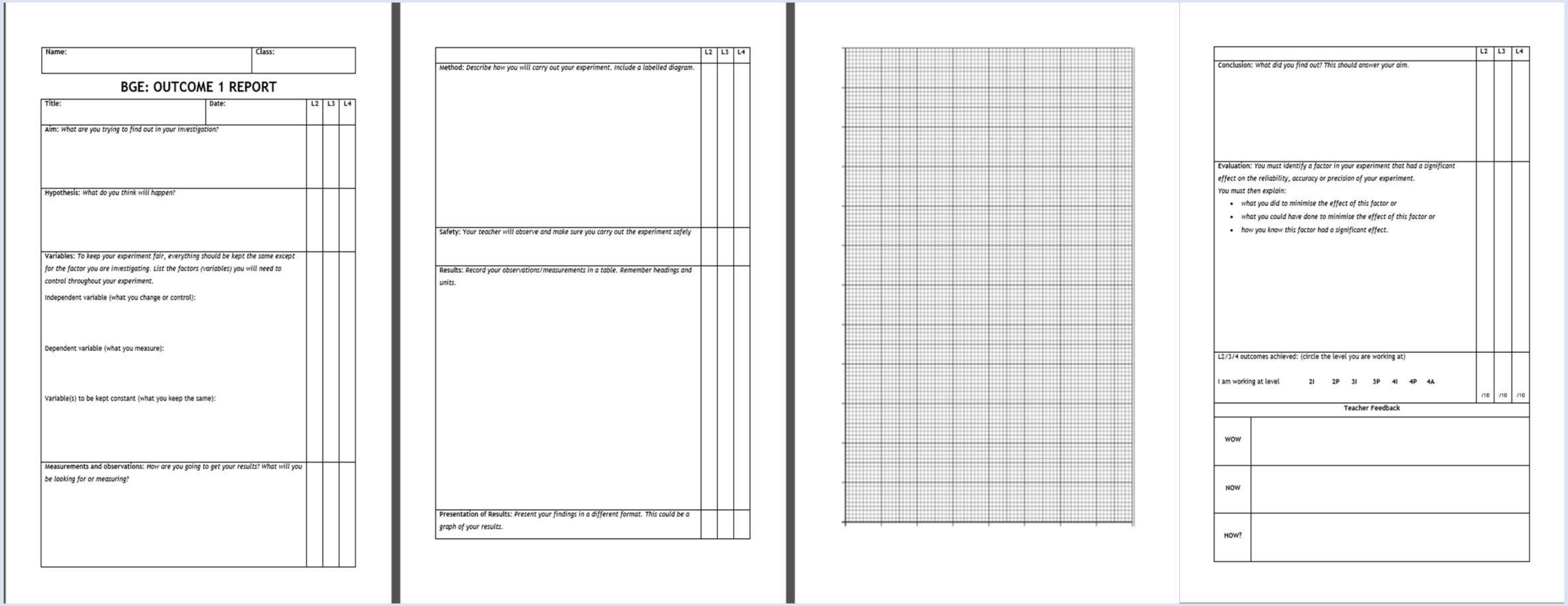
You will be working at level 2, 3 or 4 and you teacher will give you feedback about what you can do to progress to the next level.

L2/3/4 outcomes achieved: (circle the level you are working at) I am working at level 2I 2P 3I 3P 4I 4P 4A	/10	/10	/10

Teacher Feedback	
WOW	
NOW	
HOW?	

Mass & Weight – Outcome 1 Report

- You will be using a template to write your outcome 1 report.


Name:
Class:

BGE: OUTCOME 1 REPORT

Title:	Date:	L2	L3	L4
Aim: *What are you trying to find out in your investigation?*				
Hypothesis: *What do you think will happen?*				
Variables: *To keep your experiment fair, everything should be kept the same except for the factor you are investigating. List the factors (variables) you will need to control throughout your experiment.* Independent variable (what you change or control): Dependent variable (what you measure): Variable(s) to be kept constant (what you keep the same):				
Measurements and observations: *How are you going to get your results? What will you be looking for or measuring?*				

	L2	L3	L4
Method: *Describe how you will carry out your experiment. Include a labelled diagram.*			
Safety: *Your teacher will observe and make sure you carry out the experiment safely*			
Results: *Record your observations/measurements in a table. Remember headings and units.*			
Presentation of Results: *Present your findings in a different format. This could be a graph of your results.*			

	L2	L3	L4
Conclusion: *What did you find out? This should answer your aim.*			
Evaluation: *You must identify a factor in your experiment that had a significant effect on the reliability, accuracy or precision of your experiment. You must then explain:* • *what you did to minimise the effect of this factor or* • *what you could have done to minimise the effect of this factor or* • *how you know this factor had a significant effect.*			
L2/3/4 outcomes achieved: (circle the level you are working at) I am working at level 2I 2P 3I 3P 4I 4P 4A	/10	/10	/10

Teacher Feedback	
WOW	
NOW	
HOW?	

Mass & Weight – Outcome 1 Report

Name: Your name	Class: Your class

BGE: OUTCOME 1 REPORT

Title: Mass and Weight	Date: 14/10/2025	L2	L3	L4
Aim: *What are you trying to find out in your investigation?*				

Investigating Craters – The Variables

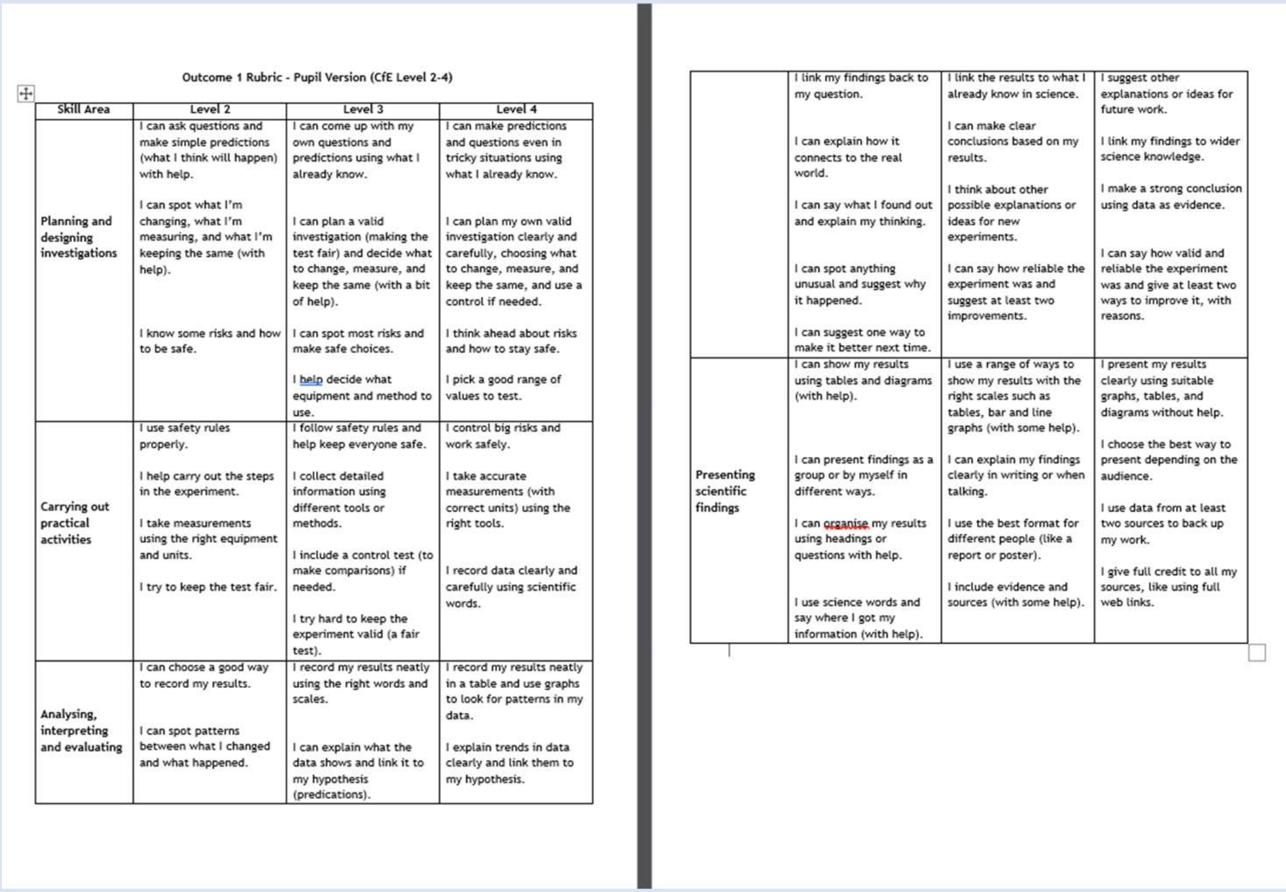
Over the next 2 lessons we will be writing a full science investigation.

- Aim
- Hypothesis
- Method
- Results
- Graph
- Conclusion
- Evaluation

You will be supported throughout this investigation.

Mass & Weight – Outcome 1 Report

- You can read over the outcome 1 rubric to see what skills are expected at each level.



Outcome 1 Rubric - Pupil Version (CfE Level 2-4)

Skill Area	Level 2	Level 3	Level 4
Planning and designing investigations	I can ask questions and make simple predictions (what I think will happen) with help. I can spot what I'm changing, what I'm measuring, and what I'm keeping the same (with help). I know some risks and how to be safe.	I can come up with my own questions and predictions using what I already know. I can plan a valid investigation (making the test fair) and decide what to change, measure, and keep the same (with a bit of help). I can spot most risks and make safe choices. I help decide what equipment and method to use.	I can make predictions and questions even in tricky situations using what I already know. I can plan my own valid investigation clearly and carefully, choosing what to change, measure, and keep the same, and use a control if needed. I think ahead about risks and how to stay safe. I pick a good range of values to test.
Carrying out practical activities	I use safety rules properly. I help carry out the steps in the experiment. I take measurements using the right equipment and units. I try to keep the test fair.	I follow safety rules and help keep everyone safe. I collect detailed information using different tools or methods. I include a control test (to make comparisons) if needed. I try hard to keep the experiment valid (a fair test).	I control big risks and work safely. I take accurate measurements (with correct units) using the right tools. I record data clearly and carefully using scientific words.
Analysing, interpreting and evaluating	I can choose a good way to record my results. I can spot patterns between what I changed and what happened. I link my findings back to my question. I can explain how it connects to the real world. I can say what I found out and explain my thinking. I can spot anything unusual and suggest why it happened. I can suggest one way to make it better next time.	I record my results neatly using the right words and scales. I can explain what the data shows and link it to my hypothesis (predications). I link the results to what I already know in science. I can make clear conclusions based on my results. I think about other possible explanations or ideas for new experiments. I can say how reliable the experiment was and suggest at least two improvements.	I record my results neatly in a table and use graphs to look for patterns in my data. I explain trends in data clearly and link them to my hypothesis. I suggest other explanations or ideas for future work. I link my findings to wider science knowledge. I make a strong conclusion using data as evidence. I can say how valid and reliable the experiment was and give at least two ways to improve it, with reasons.
Presenting scientific findings	I can show my results using tables and diagrams (with help). I can present findings as a group or by myself in different ways. I can organise my results using headings or questions with help. I use science words and say where I got my information (with help).	I use a range of ways to show my results with the right scales such as tables, bar and line graphs (with some help). I can explain my findings clearly in writing or when talking. I use the best format for different people (like a report or poster). I include evidence and sources (with some help).	I present my results clearly using suitable graphs, tables, and diagrams without help. I choose the best way to present depending on the audience. I use data from at least two sources to back up my work. I give full credit to all my sources, like using full web links.

Mass & Weight

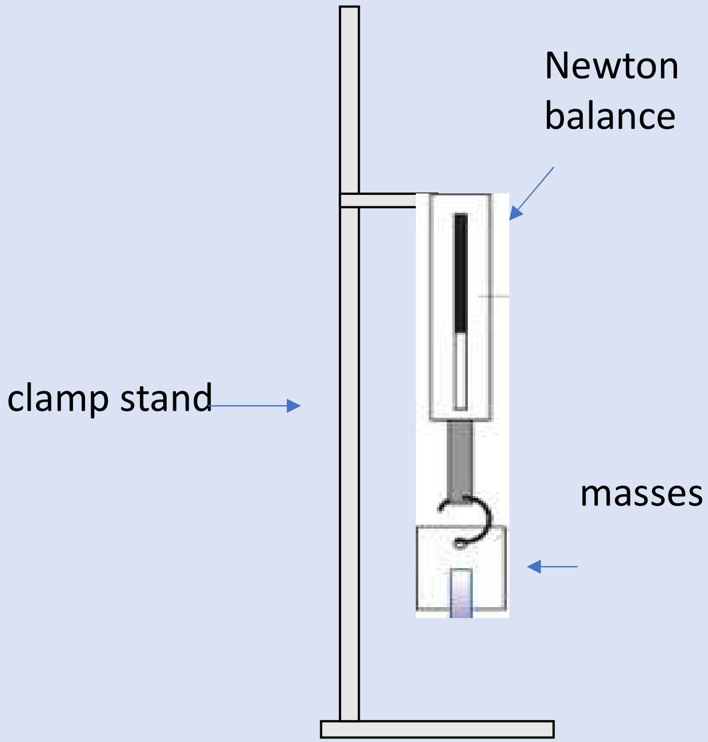
Planning your investigation – the basic instructions

Experiment Instructions

- Investigate the relationship between mass and weight.
- Add masses to the Newton balance and record the weight using the Newton balance.

Safety

- Secure the newton balance with a clamp stand and make sure the clamp is over the base.
- Do not overload the Newton balance – 1kg maximum.
- Use masses carefully – do not drop them!



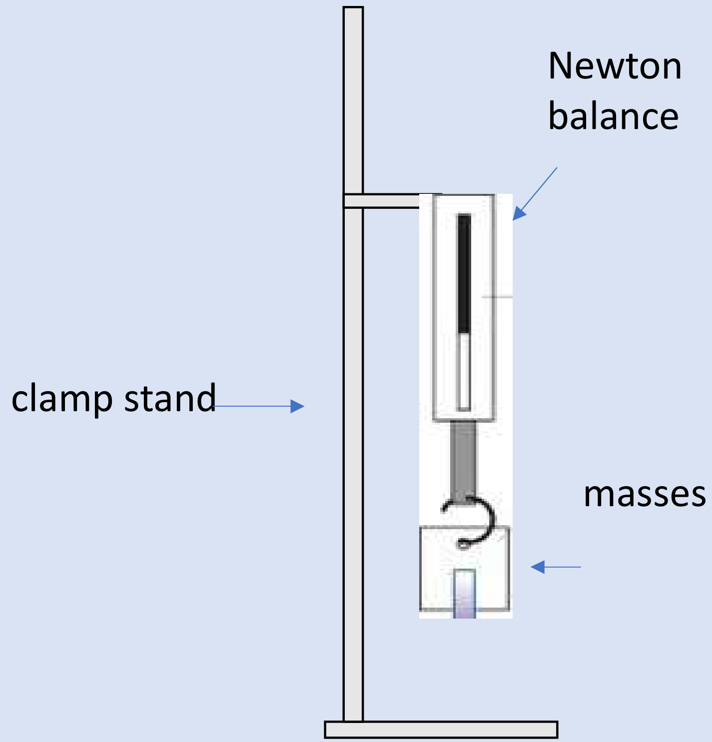
Mass & Weight

Extra Support – not for everyone!

Experiment Instructions

Method:

- Set the Newton balance to zero before starting.
- Hang the first mass of 100 g (0.1 kg) on the hook.
- Record the reading on the Newton balance in newtons (N).
- Repeat with increasing masses 0.2 kg, 0.3 kg, up to 1 kg.
- Record all results in a table.
- Draw a suitable graph of the results.



Mass & Weight– The Variables

Planning your investigation. What factors could you investigate?

Independent variable **What you change or control**	**Dependent variable** **What you measure**	**Variable(s) to be kept constant** **What you keep the same**
• The mass	• The weight (downwards force)	• The newton balance • The position of the mass on the hook (no swinging) • Masses used • Zero balance each time

Mass & Weight

Aim: *What are you trying to find out in your investigation?*

Hypothesis: *What do you think will happen?*

Mass & Weight

Write your aim – What are you trying to investigate?

Aim: To investigate how the ____________________ affects the ______________________________.

Independent variable What you change or control	Dependent variable What you measure	Variable(s) to be kept constant What you keep the same
• The mass	• The weight (downwards force)	• The newton balance • The position of the mass on the hook (no swinging) • Masses used • Zero balance each time

Mass & Weight

Hypothesis: When more mass is added the weight will _______________________.

Mass & Weight

Variables: *To keep your experiment fair, everything should be kept the same except for the factor you are investigating. List the factors (variables) you will need to control throughout your experiment.*

Independent variable (what you change or control):

Dependent variable (what you measure):

Variable(s) to be kept constant (what you keep the same):

Mass & Weight– The Variables

Measurements and observations: *How are you going to get your results? What will you be looking for or measuring?*

Independent variable

What you change or control

The mass

Dependent variable

What you measure

The weight (downwards force)

Mass & Weight

Method: *Describe how you will carry out your experiment. Include a labelled diagram.*

Mass & Weight

Safety: *Your teacher will observe and make sure you carry out the experiment safely*

Safety

- Secure the newton balance with a clamp stand and make sure the clamp is over the base.
- Do not overload the Newton balance – 1kg maximum.
- Use masses carefully – do not drop them!

Mass & Weight

Results: *Record your observations/measurements in a table. Remember headings and units.*

Mass & Weight

Results: *Record your observations/measurements in a table. Remember headings and units.*

Mass (kg)	Weight (N)
0·1	
0·2	
0·3	
0·4	
0·5	
0·6	
0·7	
0·8	
0·9	
1·0	

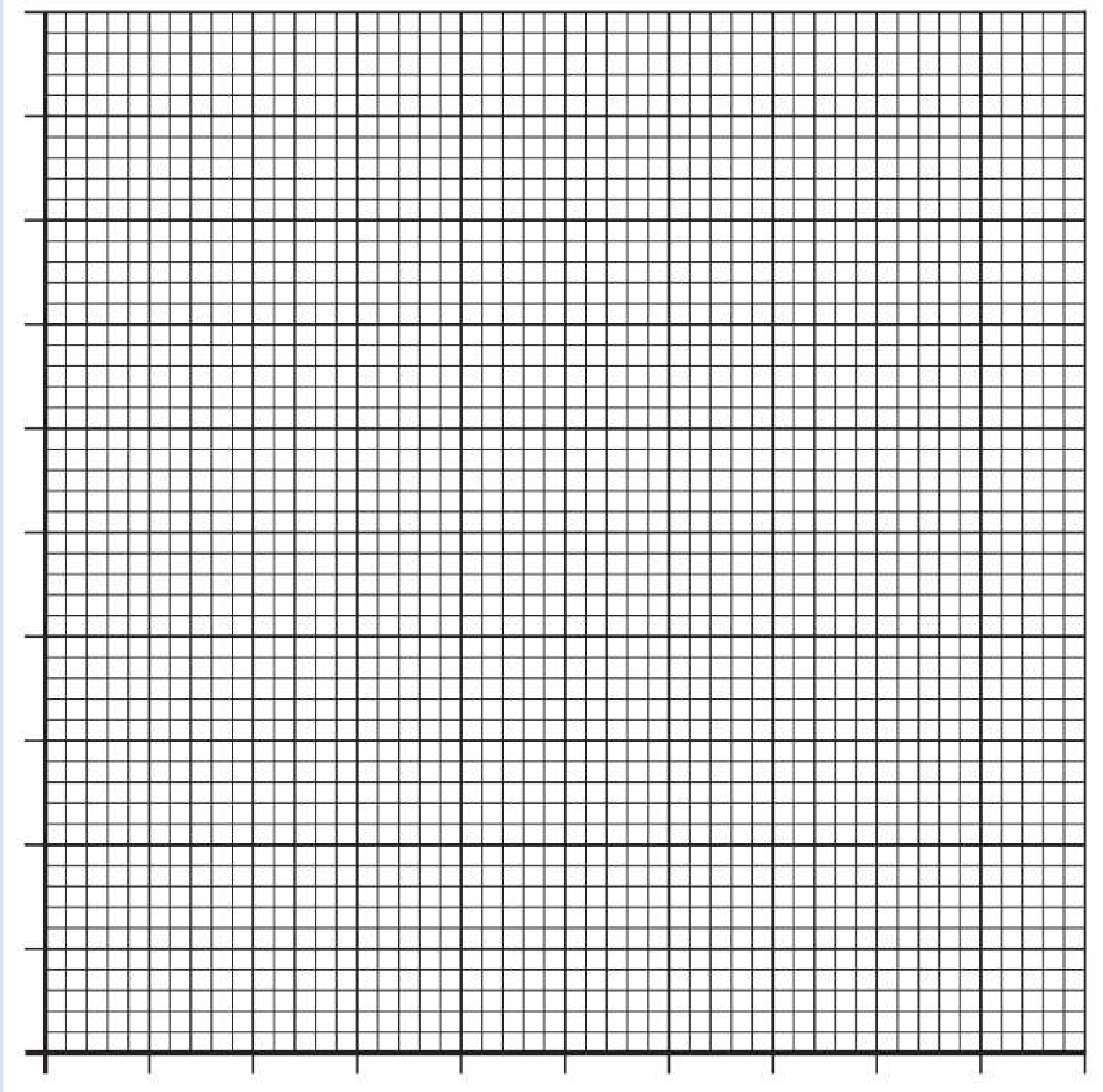
Mass & Weight

Presentation of Results: *Present your findings in a different format. This could be a graph of your results.*

Graph:

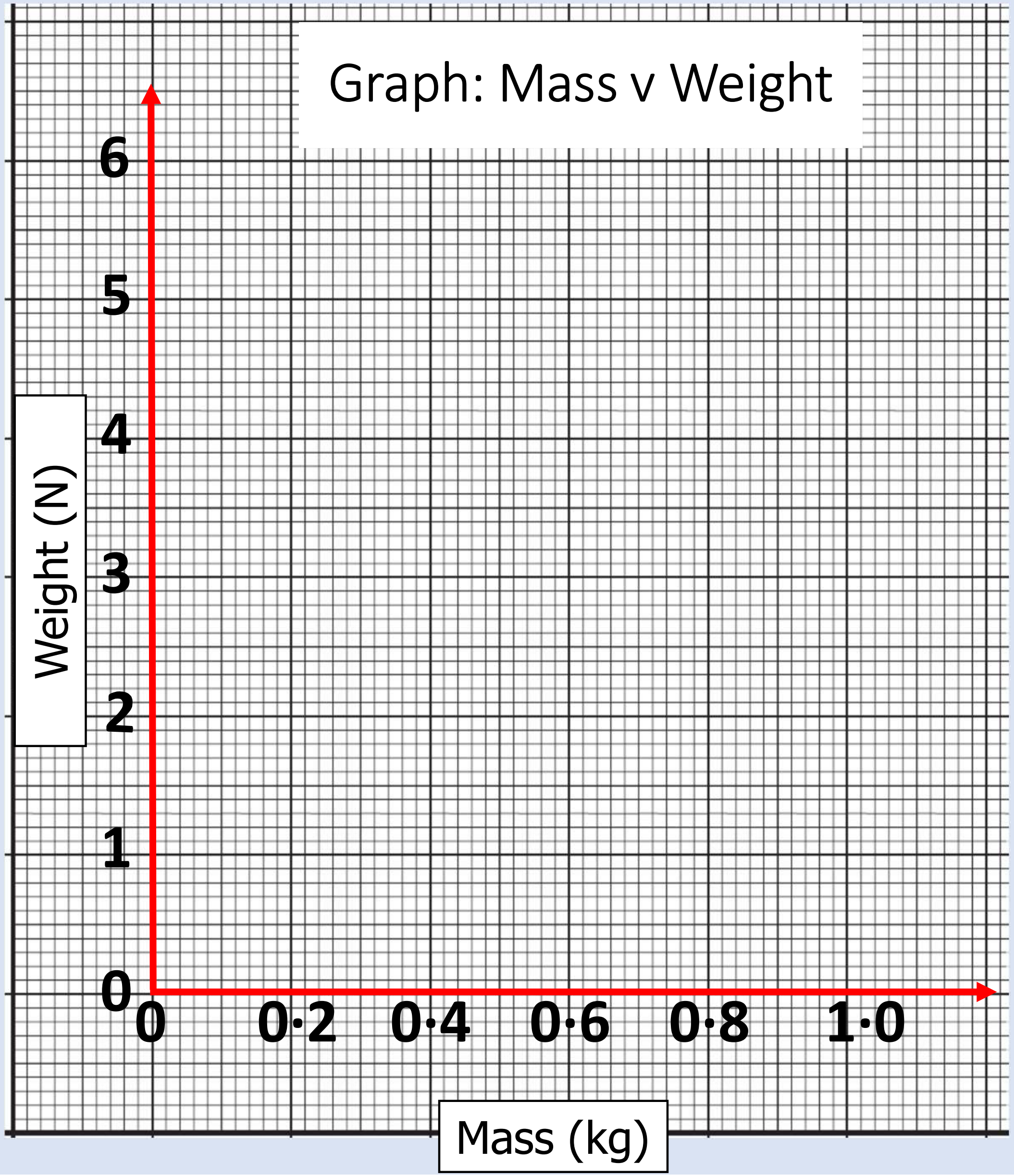
Plot a scatter graph with a best fit line.

Width of crater (cm)



Diameter of marble (cm)

Plot a scatter graph with a **best fit line**.



Mass & Weight

Conclusion: *What did you find out? This should answer your aim.*

Mass & Weight

Evaluation: *You must identify a factor in your experiment that had a significant effect on the reliability, accuracy or precision of your experiment.*

- *You must then explain:*
- *what you did to minimise the effect of this factor or*
- *what you could have done to minimise the effect of this factor or*
- *how you know this factor had a significant effect.*

Mass & Weight

20/08/2025

Learning Intentions:

- To write an Outcome 1 scientific report

Success Criteria

- I can plan an investigation
- I can carry out an investigation safely
- I can write a scientific report to include an Aim

Peer Feedback - Optional

Success Criteria – see pupil rubric

Instructions:

- Carefully read their science report.
- Fill in the NOW WOW HOW feedback sheet
- Return the feedback to your classmate
- Collect and read your peer feedback

Praise – What is good about this piece of work?

Next steps – What needs to be improved?

How can this be improved?

Praise – What is good about this piece of work?

Next steps – What needs to be improved?

<u>How</u> can this be improved?

Mass & Weight

20/08/2025

Plenary:

Read over your feedback carefully.

1. WOW, what is good about this piece of work?
2. NOW what needs to be improved?
3. HOW can this be improved?

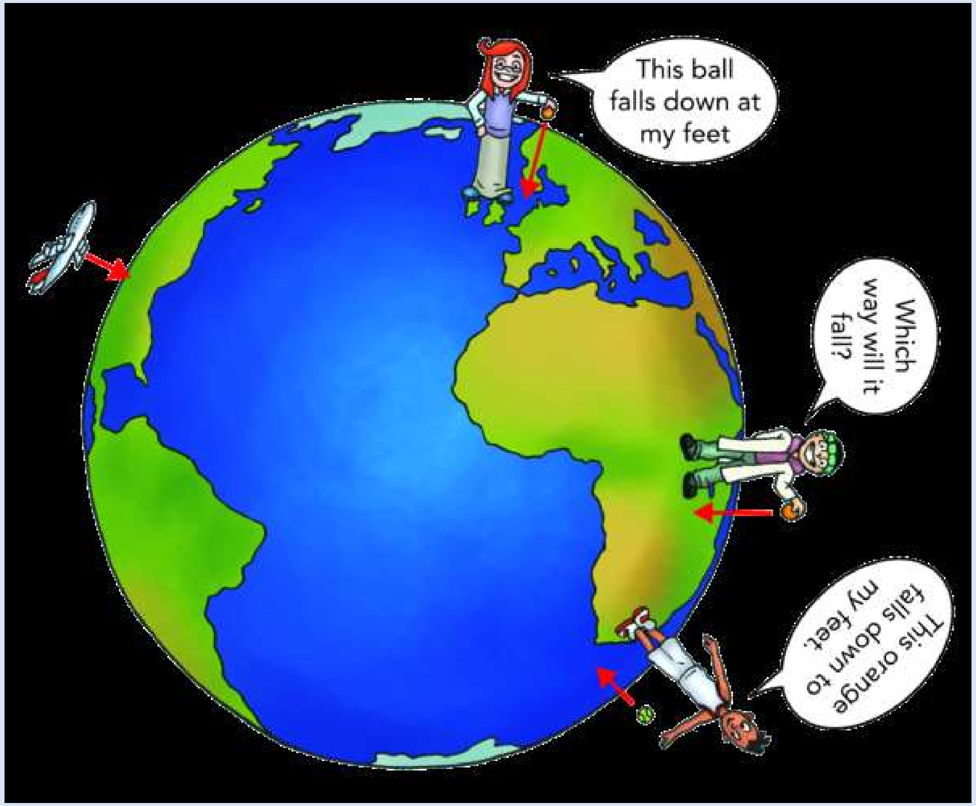
Calculating Weight

20/08/2025

Page 31

Starter: Prior Knowledge

1. What's the difference between mass and weight?
2. What force gives an object weight?
3. What happens to you if you stand on the Moon? How is this different from Earth?



Calculating Weight

20/08/2025

Page 31

Learning Intentions:

To use the relationship W = mg.

To learn that the force of gravity changes on different planets.

Success Criteria

I can use the relationship W = mg to calculate weight.

I can explain why weight changes on other planets.

I can describe the effect gravitational field strength has on weight.

Calculating Weight

The weight of an object depends on the mass of the object and the size of the gravitational field strength.

Calculating Weight

Newtons kilograms the amount of matter the force due to gravity

yes no nothing gravity

	Unit	What does it measure?	Is it always the same?	What makes it change?
Mass				
Weight				

Calculating Weight

We can use the following relationship to calculate the weight of an object:

weight = mass x gravity

This can be written as:

$$W = m \times g$$

The gravitational field strength on Earth is roughly 10 N/kg.

Calculating Weight

$$W = m \times g$$

Name	Symbol	Unit	Unit symbol
Weight	W	newtons	N
Mass	m	kilograms	kg
Gravitational field strength	g	Newtons per kilogram	N/kg

Calculating Weight

Page 32

Calculate the weight of an 800 kg elephant.

W = ?

m = 800 kg

g = 10 N/kg

Identify what you know from the question and what you are being asked to find.
This can be written at the side or underlined in the question.

$$W = m\,g$$

Write out the equation (relationship)

$$W = 800 \times 10$$

Substitute in what you know

$$W = 8000\ N$$

Write the answer with units

Calculating Weight

Page 32

Calculate the weight of an 800 kg elephant.

W = ?

m = 800 kg

g = 10 N/kg

Identify what you know from the question and what you are being asked to find.
This can be written at the side or underlined in the question.

$$W = m\,g$$

Write out the equation (relationship)

$$W = 800 \times 10$$

Substitute in what you know

$$W = 8000\ N$$

Write the answer with units

Class Questions

Page 33

Calculate the weight of the following:

1. A pupil whose mass is 35 kg
2. A car whose mass is 600 kg
3. A 5 kg bag of potatoes
4. A 0.5 kg bag of rice
5. A 0.1 kg bar of chocolate

Show ALL your working and lay it out as shown in the previous question.

The gravitational field strength on Earth is roughly 10 N/kg.

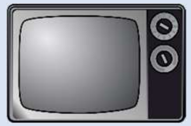
Class Questions

Page 33

1. A pupil whose mass is 35 kg
2. A car whose mass is 600 kg
3. A 5 kg bag of potatoes
4. A 0.5 kg bag of rice
5. A 0.1 kg bar of chocolate

Gravitational field strength

1. Is the force of gravity the same on Earth and in space?
2. Is the force of gravity the same on every planet?



[Why You Weigh More On Jupiter…]

Gravitational field strength

The **gravitational field strength** is different on other planets, the Sun and Moon.

The greater the gravitational field strength the greater your **weight** would be on that planet.

Your **mass** is not affected by gravity and will always stays the same.

	Gravitational field strength (N/kg)
Mercury	4
Venus	9
Earth	10
Mars	4
Jupiter	23
Saturn	9
Uranus	9
Neptune	11
Moon	1.6
Sun	270

Gravitational field strength

Page 35

1. What is the value of gravity on the Earth's Moon?
2. What happens to your weight when you travel from the Earth to the Moon?
3. What happens to your weight when you travel from the Earth to Jupiter?
4. Calculate the weight of a 200 kg object on Mercury.

	Gravitational field strength (N/kg)
Mercury	4
Venus	9
Earth	10
Mars	4
Jupiter	23
Saturn	9
Uranus	9
Neptune	11
Moon	1.6
Sun	270

Practice Questions

Pages 36 & 37

Practice Problems: Calculating Weight

weight = mass x gravity
W = m x g

1. On which planet is gravity strongest?
2. On which three other planets would your weight be similar to what it is on Earth?
3. Imagine you could travel to Mars. Your mass on Earth is 50 kg. State your mass Mars.
4. Calculate the weight of a 10 kg crate on Venus.
5. Calculate the weight of a 0.5 kg packet of cornflakes
   a. on Earth
   b. on the Moon
   c. in Space?
6. Explain why the Sun's gravitational field strength is much bigger than the gravitational field strength of a planet.
7. On which planet do you think you could jump the highest - Mars or Venus? Explain your answer.
8. A small tin of oil has a mass of 0.3 kg.
   a. Calculate the weight of the oil on Earth.
   b. What would be the mass of the tin of oil on Jupiter?
   c. Calculate the weight of the oil on Jupiter.
9. An object on the moon weighs 4.8 N. Calculate its mass.
10. An object on Venus weighs 27 N. Calculate its mass.

Write your own question

On a post it note or whiteboard.

Write a force question for someone else to answer.

Write the question on the front and the answer on the back.

Calculating Weight

20/08/2025

Learning Intentions:

To use the relationship W = mg.

To learn that the force of gravity changes on different planets.

Success Criteria

I can use the relationship W = mg to calculate weight.

I can explain why weight changes on other planets.

I can describe the effect gravitational field strength has on weight.

Calculating Weight

20/08/2025

Plenary:

Your mass on Earth is 60 kg.

Determine your:

1. weight on Mercury
2. mass on Saturn
3. weight on Neptune

	Gravitational field strength (N/kg)
Mercury	4
Venus	9
Earth	10
Mars	4
Jupiter	23
Saturn	9
Uranus	9
Neptune	11
Moon	1.6
Sun	270

Friction

20/08/2025

Page 38

Starter: Prior Knowledge

1. What's the formula to calculate weight?
2. If an object has a mass of 2 kg, what is its weight on Earth?
3. What is friction? What can it do to an object?

Friction

20/08/2025

Page 38

Learning Intentions:

- To learn how friction affects the movement of objects and how it can be useful or a problem.

Success Criteria

- I can describe what friction is and when it occurs.
- I can identify everyday examples where friction is helpful (e.g. brakes, grip) or unhelpful (e.g. slowing things down).
- I can predict and explain how different surfaces affect the amount of friction.

What is Friction?

Page 38

What this video about friction - https://youtu.be/VgZTmT2TEso .

Then answer the questions in your booklet.

What is Friction?

🧠 Comprehension Questions

1. What is friction, and how does it affect moving objects?

   Friction is a force that slows things down when two surfaces rub together

2. Why is it easier to slide on ice than on a rough carpet?

   Ice is smooth and has less friction, so things slide more easily.)

3. Name one situation where friction is helpful and one where it's a problem?

   Helpful: car tyres grip the road; Problem: machines wearing down or getting hot.

What is Friction?

If there was no friction there would be no grip – you could not walk, pencils couldn’t write on paper, you would not be able to run, jump, hold on to a tennis racket.

What is Friction?

Page 39

- Friction is a force between two or more objects. It happens when two objects are in **contact** with each other.
- Friction acts in the **opposite** direction to movement.
- A large frictional force causes an object to slow down more than a small frictional force.

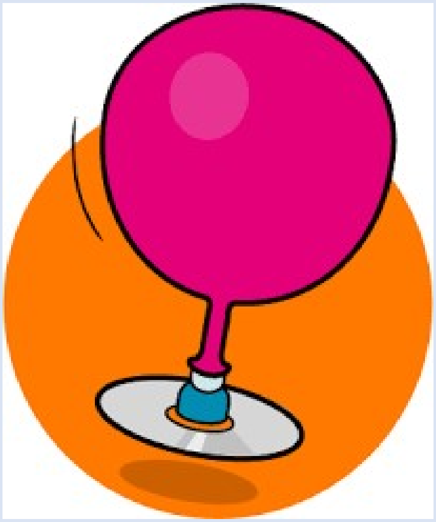
What is Friction?

Hands

When you rub your hands together what do you feel?

Textbooks

What happens when you try to pull the textbooks apart?



Hoovercraft

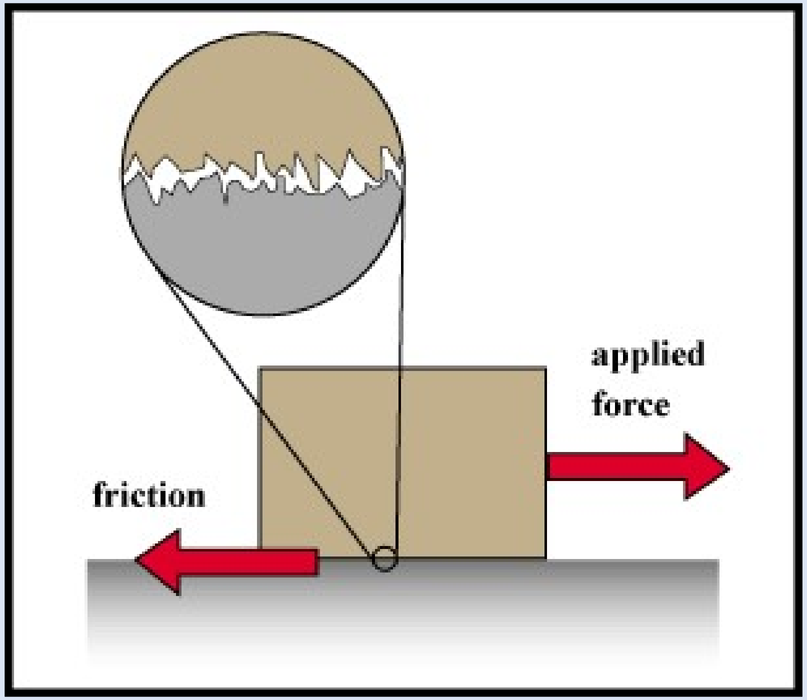
What happens when you let go of the balloon?

[A Demonstration of Friction | Physics – Bitesize Science]

Friction and Surfaces

- Friction is a force which exists when two surfaces touch.

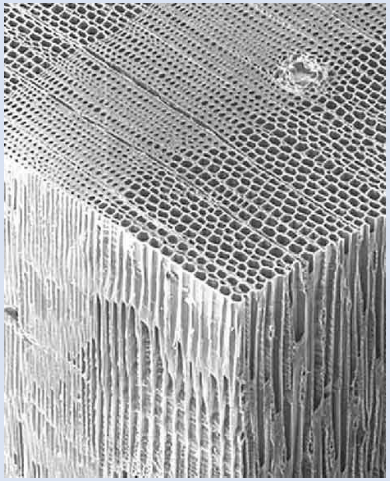
- No surface is completely smooth. When two surfaces touch tiny bumps and ridges on one surface can rest in the hollows of the other.



Investigating the friction of different materials

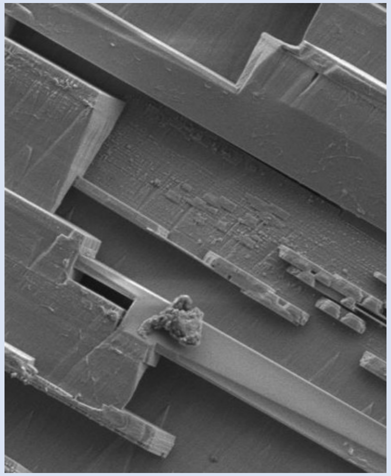
How does the type of material affect friction?

Paper



Wood

Carpet



Metal

Sandpaper

Friction and Surfaces

Aim: *What are you trying to find out in your investigation?*

To investigate how different materials affect the amount of friction between surfaces.

Hypothesis: *What do you think will happen?*

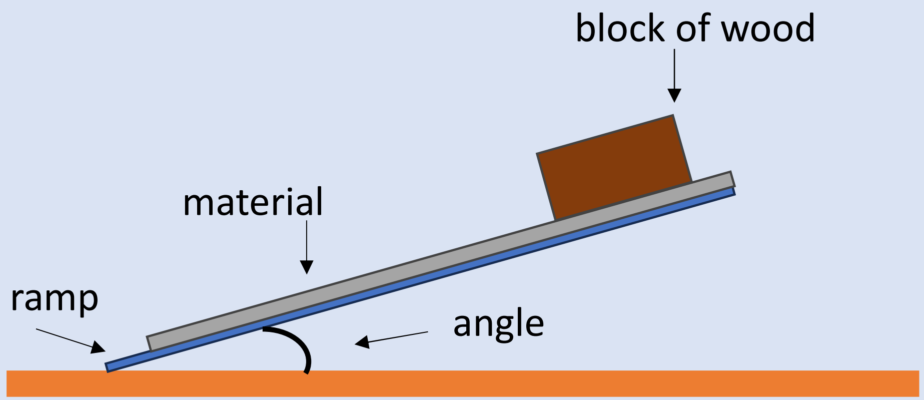
I think that rougher surfaces will increase / decrease friction.

Friction and Surfaces

Experiment Instructions

Method:

- Place a block on the ramp, with the ramp lying horizontal to the bench.
- Carefully lift the ramp at ne end until the block begins to move.
- Hold the ramp int the position where the block starts to move. Measure the angle of the slope with a protractor or a digital inclinometer (on phone).
- Change the surface and repeat the experiment.



Friction and Surfaces

Variables: *To keep your experiment fair, everything should be kept the same except for the factor you are investigating. List the factors (variables) you will need to control throughout your experiment.*

Independent variable (what you change or control):

Dependent variable (what you measure):

Variable(s) to be kept constant (what you keep the same):

Friction and Surfaces

Results: *Record your observations/measurements in a table. Remember headings and units.*

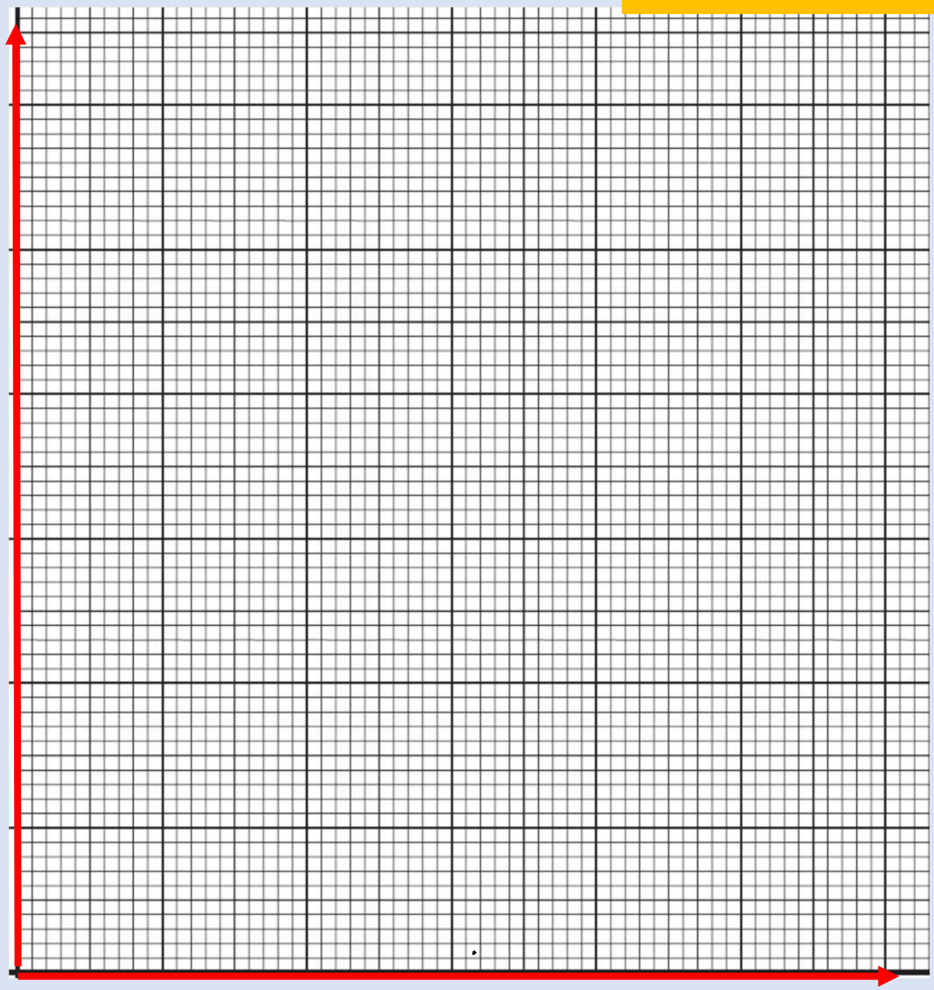
Type of surface	Angle of slope (°)

Friction and Surfaces

Presentation of Results: *Present your findings in a different format. This could be a graph of your results.*

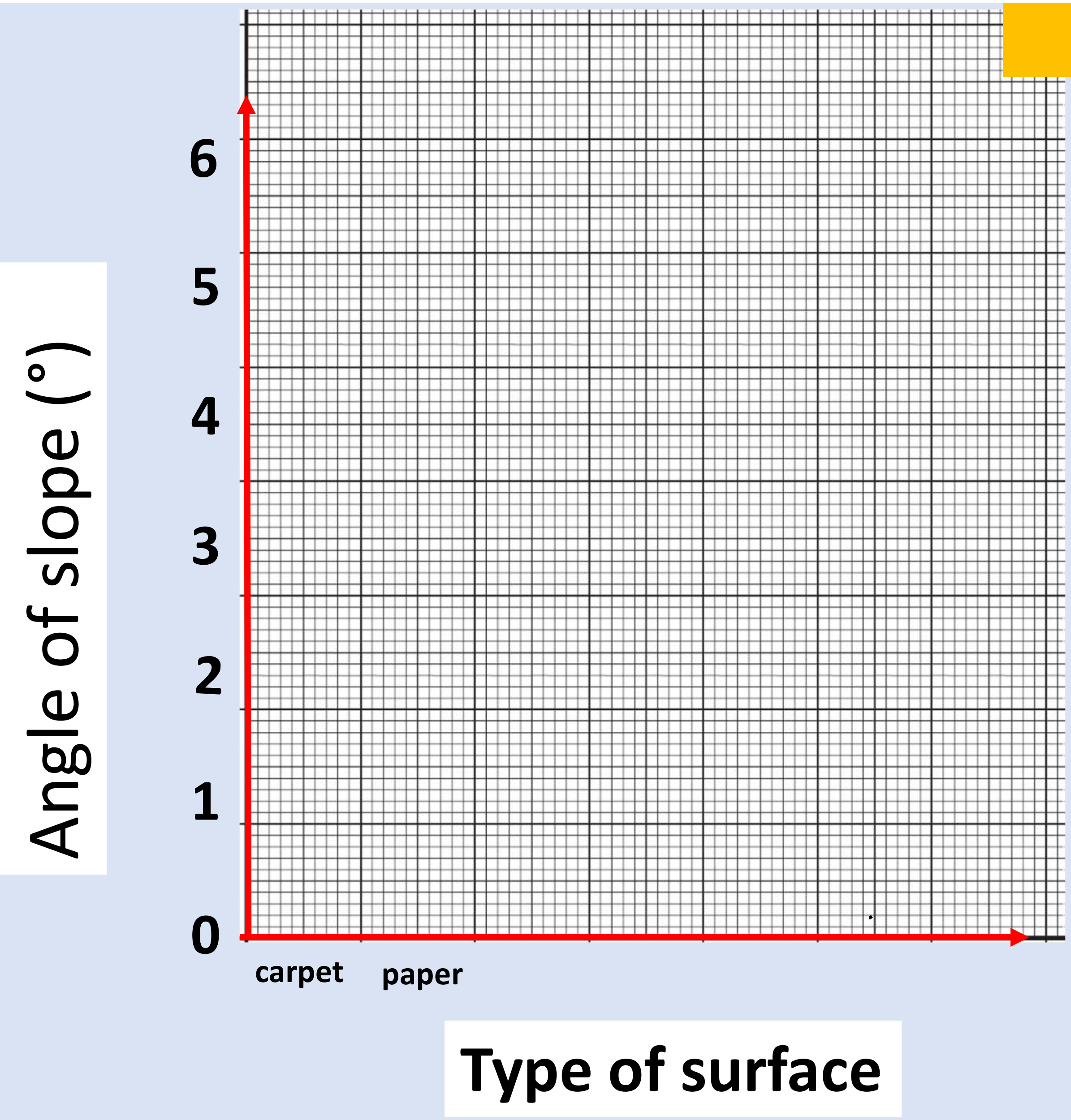
Which graph is the most suitable?

- A line graph
- A bar graph
- A scatter graph with best fit line
- A pie chart



Friction and Surfaces

- A bar graph



Friction and Surfaces

Conclusion: *What did you find out? This should answer your aim.*

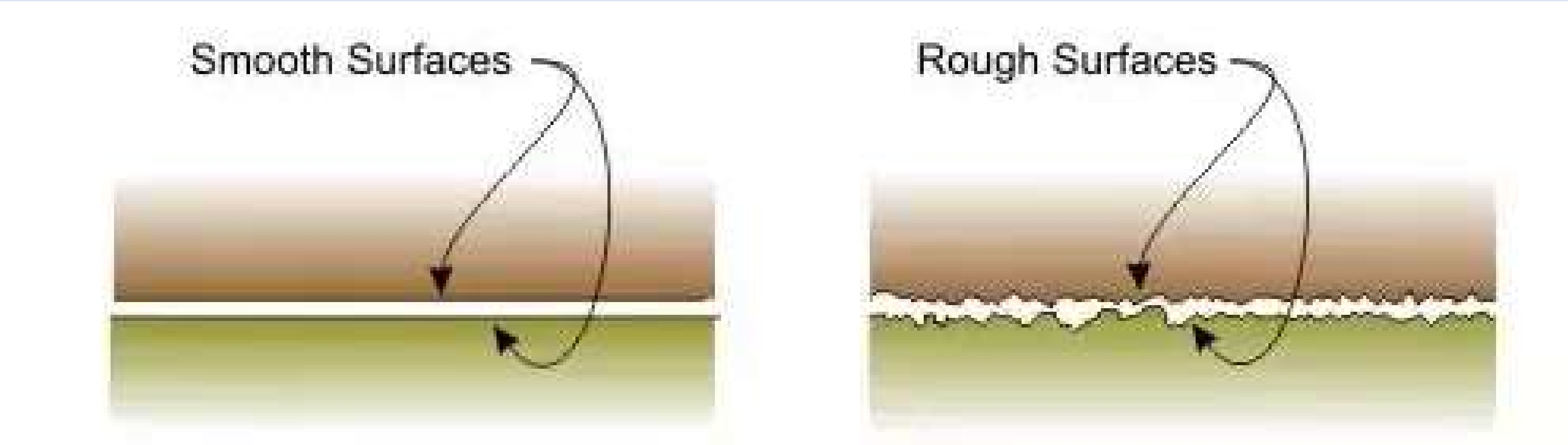
Friction and Surfaces

Evaluation: *You must identify a factor in your experiment that had a significant effect on the reliability, accuracy or precision of your experiment.*

- *You must then explain:*
- *what you did to minimise the effect of this factor or*
- *what you could have done to minimise the effect of this factor or*
- *how you know this factor had a significant effect.*

Friction and Surfaces

- **Smoother** surfaces have **less** friction than rougher surfaces. Less force is needed to make the surfaces slide across each other.
- **Rougher** surfaces have **more** friction than smoother surfaces. More force is needed to make the surfaces slide across each other.



Changing Friction

Page 42

Is Friction being **increased** of **decreased** in these situations?

1. Car tyres on a wet road
2. Wearing rubber-soled shoes
3. Adding oil to a machine
4. Putting sand or grit on an icy path
5. Using brakes on a bicycle
6. Using smooth plastic on a slide

Changing Friction

Page 43

Think of real-life situations where people might want to **increase** friction (for more grip or control) or **decrease** friction (to make movement easier).

List at least **three ways to increase** friction and **three ways to decrease** friction.

✅ Ways to Increase Friction	⬇️ Ways to Decrease Friction
1.	1.
2.	2.
3.	3.


Ways to Increase Friction
ADD TEXTURE
MAKE SURFACES ROUGHER
INCREASE SURFACE AREA
USE TREAD


Ways to Reduce Friction
LUBRICATE
USE BALL BEARINGS
REDUCE CONTACT AREA
STREAMLINE

Changing Friction

✅ Ways to Increase Frictio

1. Add texture

2. Rough surfaces

3. Increase surface area

4. Use treads

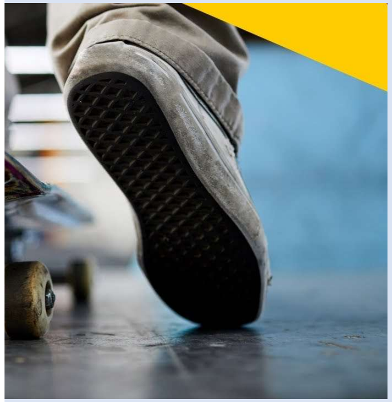
5.Increase weight

Add texture

Rough surfaces

Increase surface area

Use treads



Changing Friction

Lubricate
(oil, wax etc.)

Use ball bearings

Reduce contact area

Streamline

Increase weight

Ways to Decrease Friction

1. Lubricate (oil, wax etc.)
2. Use ball bearings
3. Reduce contact area
4. Streamline
5. Smooth surfaces

Friction

20/08/2025

Learning Intentions:

- To learn how friction affects the movement of objects and how it can be useful or a problem.

Success Criteria

- I can describe what friction is and when it occurs.
- I can identify everyday examples where friction is helpful (e.g. brakes, grip) or unhelpful (e.g. slowing things down).
- I can predict and explain how different surfaces affect the amount of friction.

Friction

20/08/2025

Plenary: True or False

1. Friction always slows things down.
2. Smooth surfaces create more friction than rough ones.
3. Lubrication increases friction.
4. Friction is helpful when walking.

1. True
2. False
3. False
4. True

Air Resistance and Drag

20/08/2025

Starter: Prior Knowledge

1. What is friction?
2. How does surface texture affect friction?
3. Name one way to reduce friction.

Air Resistance and Drag

20/08/2025

Learning Intentions:

- I will learn what air resistance (drag) is and how it affects moving objects.
- I will explore how shape, surface area, and speed change the amount of air resistance.
- I will carry out an investigation to observe the effects of air resistance.

Success Criteria

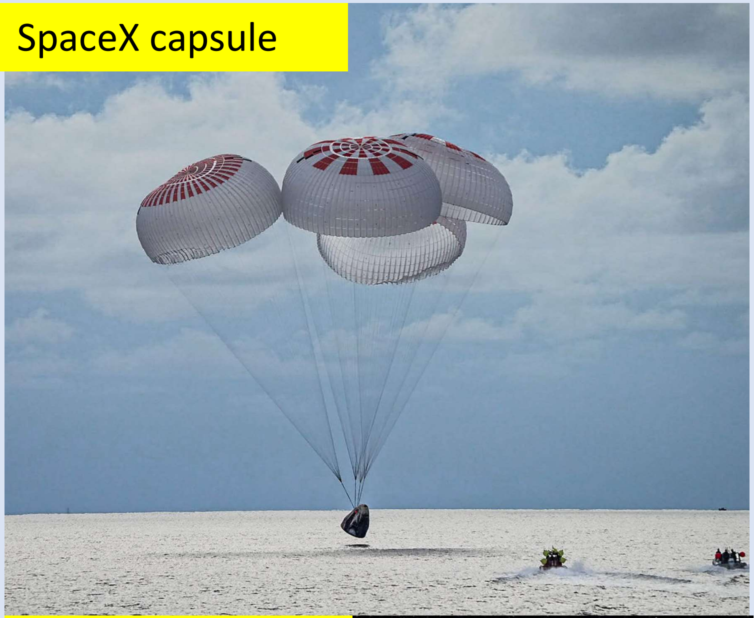
- I can define air resistance as a force that slows objects moving through air.
- I can identify factors that increase or decrease air resistance (e.g. shape, size, speed).
- I can predict and explain the motion of falling objects with different surface areas.
- I can investigate how air resistance affects falling speed.

What is Air Resistance?

1. What is air resistance?

2. Where have you seen or experience air resistance in real life?

SpaceX capsule



Ariane 6 rocket

Air Resistance and Drag

Page 44

- Watch the following video and write down 3 facts.

https://youtu.be/x6ovQErh4Mw

Air Resistance and Drag

A simple demo of air resistance – Which falls slower? Explain why.

Air Resistance and Drag

Page 45

Air resistance is a type of friction that happens when something moves through air. It pushes against the motion of the object, trying to slow it down.

Drag is another word for air resistance — they mean the same thing. However, drag can happen in liquid and air.

The faster an object moves, the more air resistance it feels.

Air Resistance and Drag

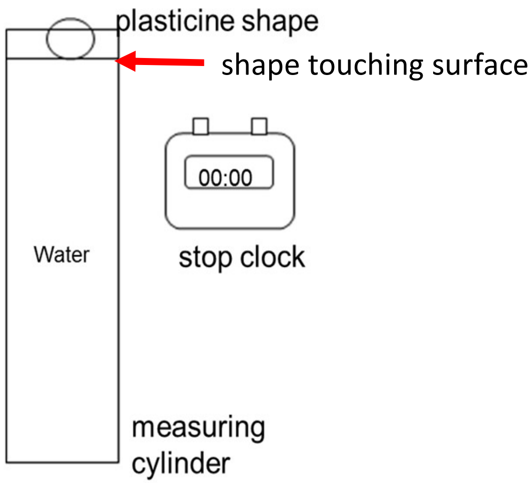
Pages 44 to 48

Complete one of the following investigations:

Title: Streamlining

Aim: To investigate which shape is the most streamlined.

Method:



Title: Air Resistance

Aim: To investigate how increasing the area of the parachute affects the falling time.

Method:

parachute

mass

Repeating your results

Today we will be repeating our measurement three times and calculating an average. – Why do we want to do this?

To get more accurate and reliable results by reducing errors. Our results will be closer to the true value.

Think about how you will draw your results table with repeat measurements in it.

How do we calculate an average (mean) time?

The **mean** is the **average** of the numbers.

To calculate: **add up** all the numbers, then **divide** by how many numbers there are.

Example: Find the average of

6 2 7 2 3

Step 1: **add up** all the numbers

6 + 2 + 7 + 2 + 3 = 20

Step 2: **divide** by how many numbers there are

20 ÷ 5 = 4

The average is 4.

Air Resistance and Drag

Pages 44 to 48

Your teacher will give you an information sheet so you can plan and complete your experiment in your group.

Title: Streamlining

Aim: To investigate which shape is the most streamlined.

Important Safety Instructions

- Place the measuring cylinder on a flat surface to prevent tipping.
- Clean up spills immediately – Water on the floor can be slippery.
- Work close to the sink.

Title: Air Resistance

Aim: To investigate how increasing the area of the parachute affects the falling time.

Important Safety Instructions

- Stand on a stable surface – Never climb on chairs or desks without supervision.
- Watch your surroundings – Make sure the drop zone is clear before releasing the parachute.

The next few slides a for Teacher use to show to groups who need support.

Streamlining

Aim: *What are you trying to find out in your investigation?*

To investigate which shape is the most streamlined.

Hypothesis: *What do you think will happen?*

Streamlining

Variables: *To keep your experiment fair, everything should be kept the same except for the factor you are investigating. List the factors (variables) you will need to control throughout your experiment.*

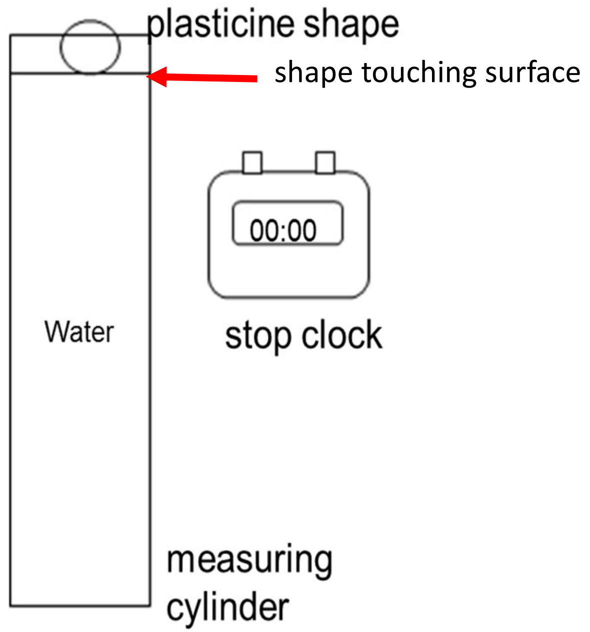
Independent variable (what you change or control):

Dependent variable (what you measure):

Variable(s) to be kept constant (what you keep the same):

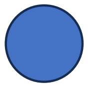
Streamlining

Method: *Describe how you will carry out your experiment. Include a labelled diagram.*



Streamlining

Results: *Record your observations/measurements in a table. Remember headings and units.*

Shape of Plasticine	Time taken to fall (s)			
	1	2	3	Average
				

Remember:

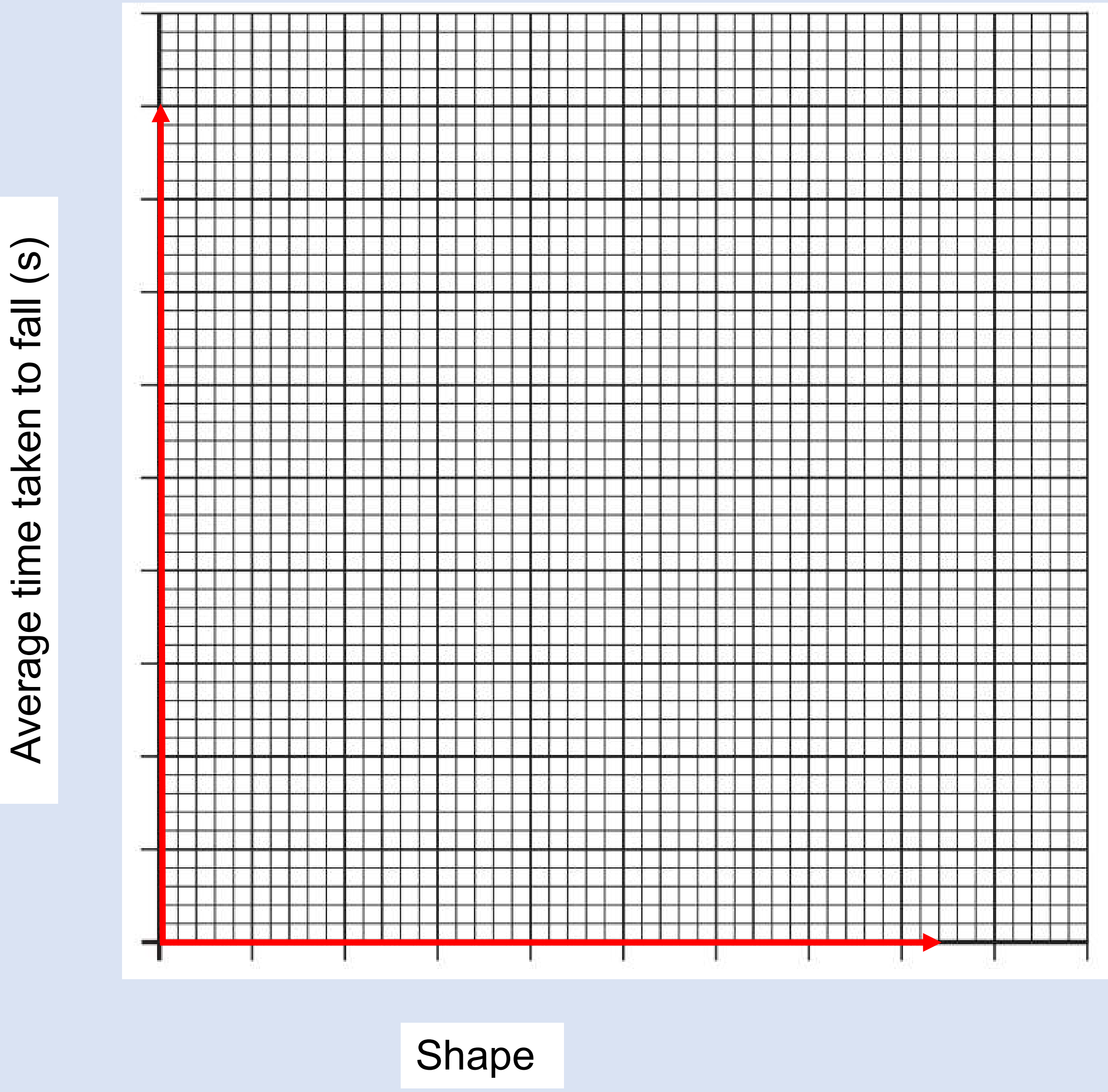
The **mean** is the **average** of the numbers.

To calculate: **add up** all the numbers, then **divide** by how many numbers there are.

Streamlining

Page 47

Extension: Plot a bar graph



Streamlining

Conclusion: *What did you find out? This should answer your aim.*

Streamlining

Evaluation: *You must identify a factor in your experiment that had a significant effect on the reliability, accuracy or precision of your experiment.*

- *You must then explain:*
- *what you did to minimise the effect of this factor or*
- *what you could have done to minimise the effect of this factor or*
- *how you know this factor had a significant effect.*

Streamlining

20/08/2025

Challenge Question Streamling Experiment: Can you make a shape which travels down in …..

a. 3.0s

b. 1.0 s

c. under 0.5s

Draw the shape when you hit the target time.

Parachutes

Aim: *What are you trying to find out in your investigation?*

To investigate how increasing the area of the parachute affects the falling time.

Hypothesis: *What do you think will happen?*

Parachutes

Variables: *To keep your experiment fair, everything should be kept the same except for the factor you are investigating. List the factors (variables) you will need to control throughout your experiment.*

Independent variable (what you change or control):

Dependent variable (what you measure):

Variable(s) to be kept constant (what you keep the same):

Parachutes

Method: *Describe how you will carry out your experiment. Include a labelled diagram.*

Air Resistance and Drag

Results: *Record your observations/measurements in a table. Remember headings and units.*

Area of parachute (cm^2)	Time taken to fall (s)			
	1	2	3	Average
100				
400				
900				

Remember:

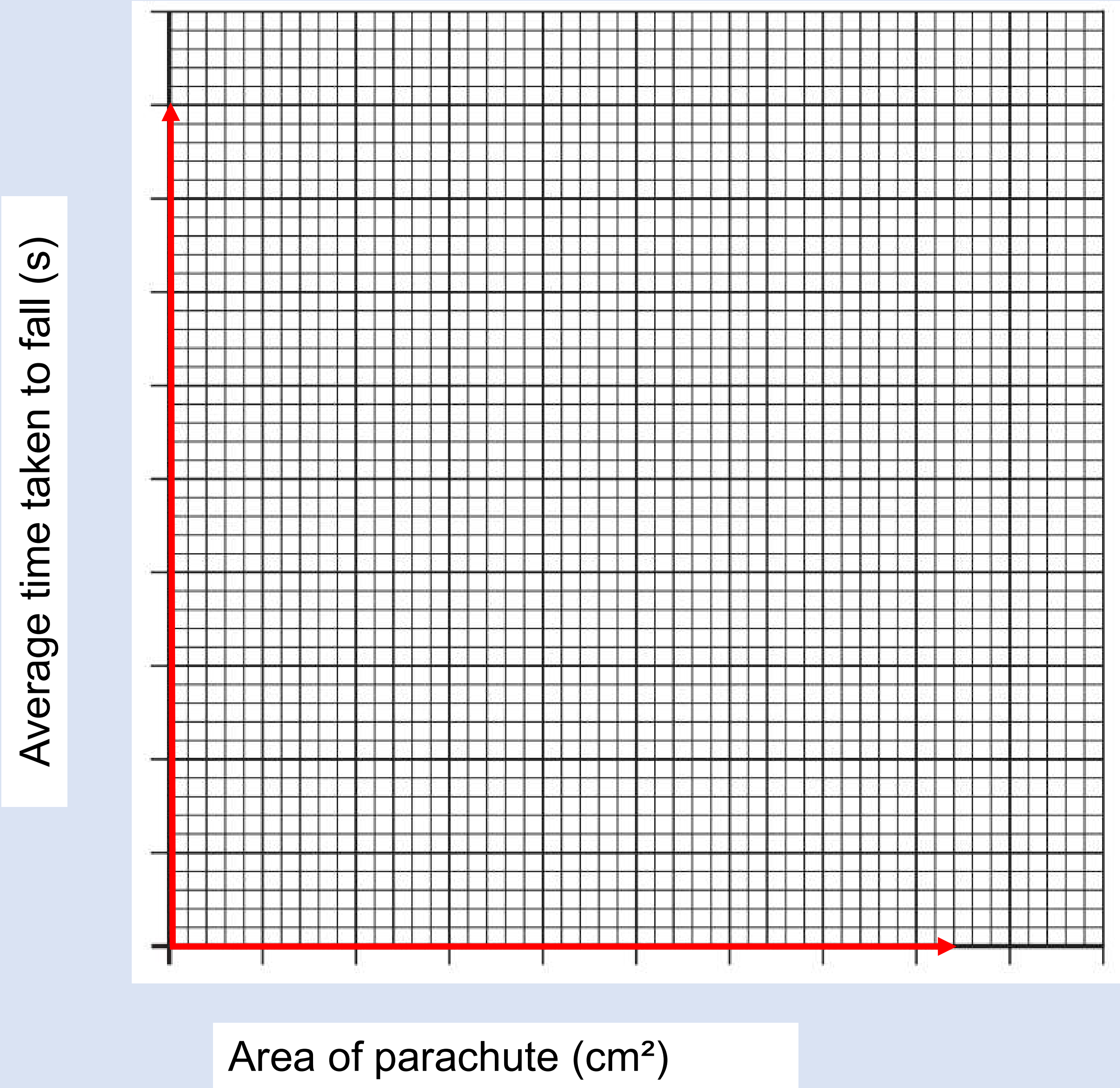
The **mean** is the **average** of the numbers.

To calculate: **add up** all the numbers, then **divide** by how many numbers there are.

Parachutes

Page 47

Extension: Plot a scatter graph with a best fit line.



Parachutes

Conclusion: *What did you find out? This should answer your aim.*

Parachutes

Evaluation: *You must identify a factor in your experiment that had a significant effect on the reliability, accuracy or precision of your experiment.*

- *You must then explain:*
- *what you did to minimise the effect of this factor or*
- *what you could have done to minimise the effect of this factor or*
- *how you know this factor had a significant effect.*

Parachutes

20/08/2025

Challenge Question Parachutes Experiment:

Lesson continues...

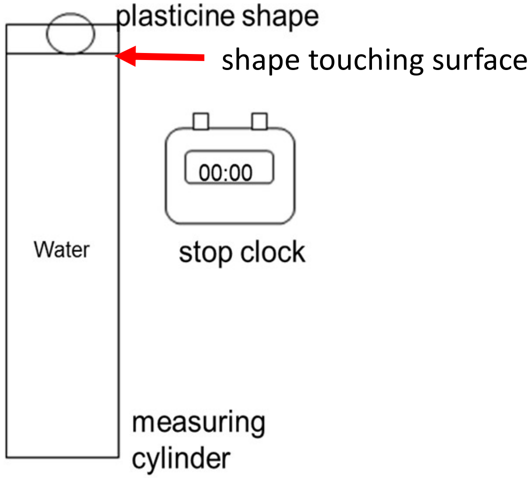
Air Resistance and Drag

Share your conclusions with the class.

Title: Streamlining

Aim: To investigate which shape is the most streamlined.

Method:



Title: Air Resistance

Aim: To investigate how increasing the area of the parachute affects the falling time.

Method:

parachute

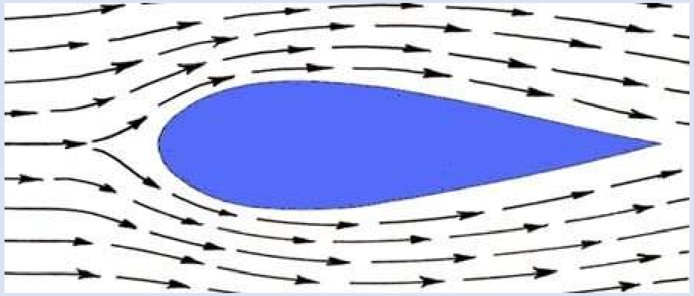
mass

Air Resistance and Drag

Page 49

Streamlining means shaping an object to reduce air or water resistance (drag), helping it move faster.

Streamlined shapes face less friction, while wide or flat shapes (like parachutes) feel more drag and slow down.

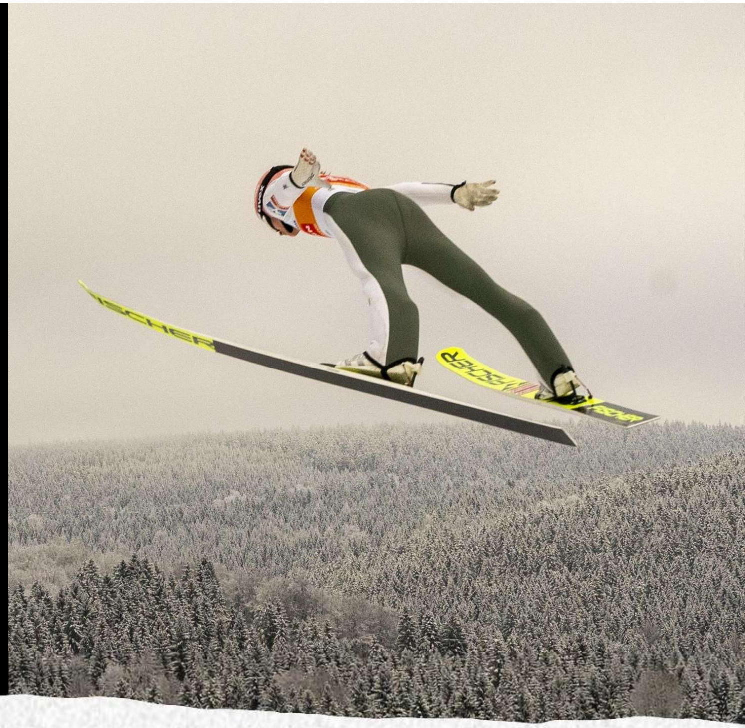




Examples of drag - streamlining (an aerodynamic shape) to increase speed.

Examples of drag - spee decreasing

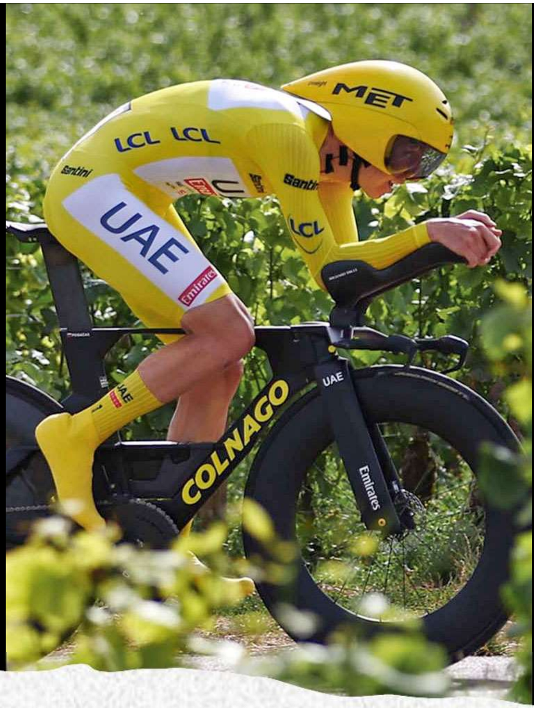
Compare each mode of transport

Compare each mode of transport

Compare each mode of transport

Compare each mode of transport



Compare each mode of transport

Challenge Questions: Streamlining and Drag

1. What does it mean to streamline an object?
2. Why do streamlined objects move faster?
3. What is drag?
4. Which shape feels more drag: a smooth cone or a flat wide sheet?
5. Why does a parachute fall slowly?
6. How can we reduce drag on a moving object?
7. Give one example of a streamlined object in real life.
8. What forces slow an object down in air or water?

Air Resistance and Drag

20/08/2025

Learning Intentions:

- I will learn what air resistance (drag) is and how it affects moving objects.
- I will explore how shape, surface area, and speed change the amount of air resistance.
- I will carry out an investigation to observe the effects of air resistance.

Success Criteria

- I can define air resistance as a force that slows objects moving through air.
- I can identify factors that increase or decrease air resistance (e.g. shape, size, speed).
- I can predict and explain the motion of falling objects with different surface areas.
- I can investigate how air resistance affects falling speed.

Air Resistance and Drag

20/08/2025

Plenary: How does the shape of the plane match its speed…?

Space Observation and Exploration

20/08/2025

Page 50

Starter: Prior Knowledge

1. What forces slow an object down in air or water?

2. Draw a force diagram to show the forces acting on spacecraft returning to Earth.

3. How do we explore space?

Space Observation and Exploration

20/08/2025

Page 50

Learning Intentions:

- To state the methods used to observe and explore space.
- To describe the impact that space observation and exploration has had on our understanding of the universe and planet Earth.

Success Criteria

- I can name different ways we observe space (e.g. telescopes, satellites).
- I can explain how space exploration has helped us understand Earth's weather, climate, or resources.

Space Observation and Exploration

Until the middle of the twentieth century, the only way to explore space was through observing it by eye.

Galileo was an Italian astronomer who first used a telescope to look at the sky.

Space Observation

Many ground based observatories were built to observe light coming from space using telescopes.

Scotland has a number of working observatories. The most recent is the Scottish Dark Sky Observatory in the Galloway Forest park. The lack of light pollution in that area makes it ideal for observing the night sky.

Space Observatories

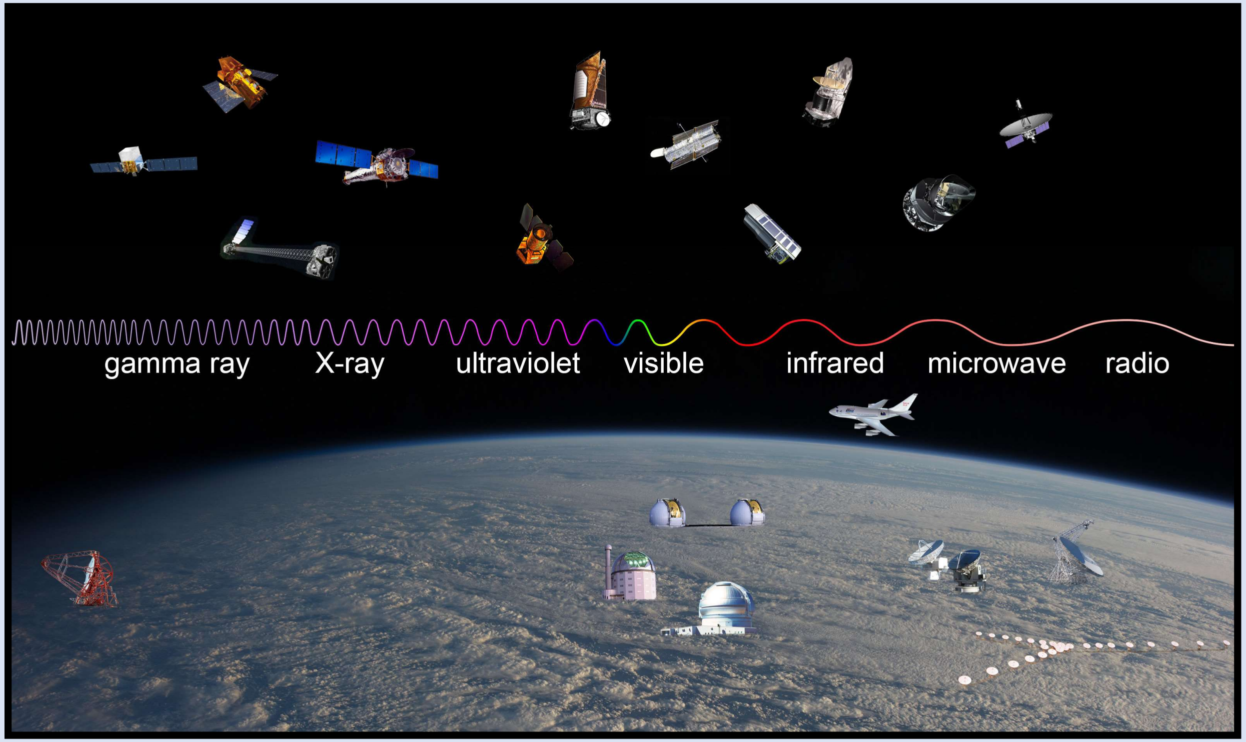
In 1968, America launched the first telescope into orbit.

These telescope (space observatories) eliminate the problems caused by light pollution.

Light pollution is when the observation of stars and planets is made more difficult due to the night sky in town and cities being brightened by street lights and other artificial lights.

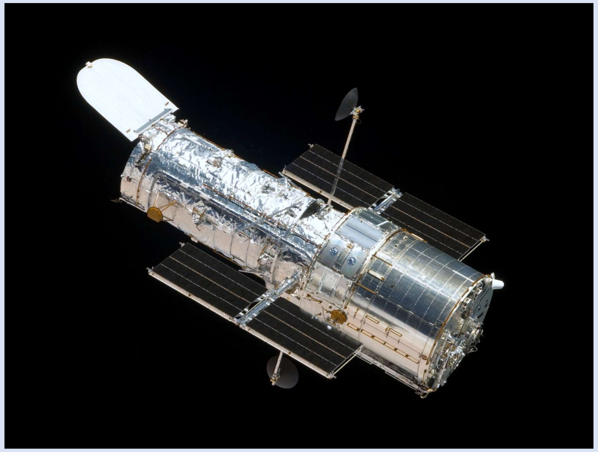
Space Observatories - Telescopes

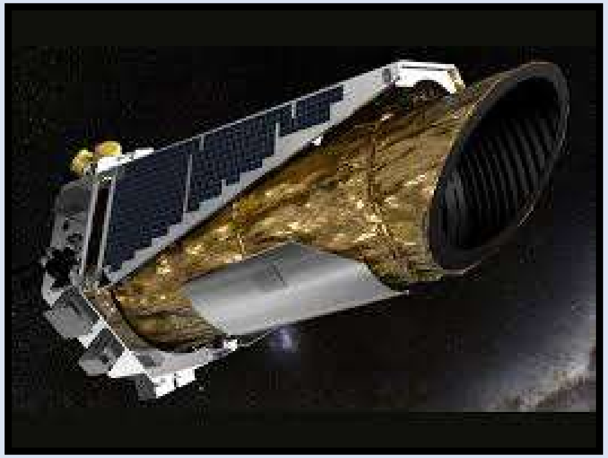
Space observatories such as the Hubble Space Telescope and the Kepler Observatory have significantly improved astronomers' understanding of the Universe.



Telescopes are used to detect radiation from all sections of the electromagnetic spectrum.

Space Observatories - Telescopes





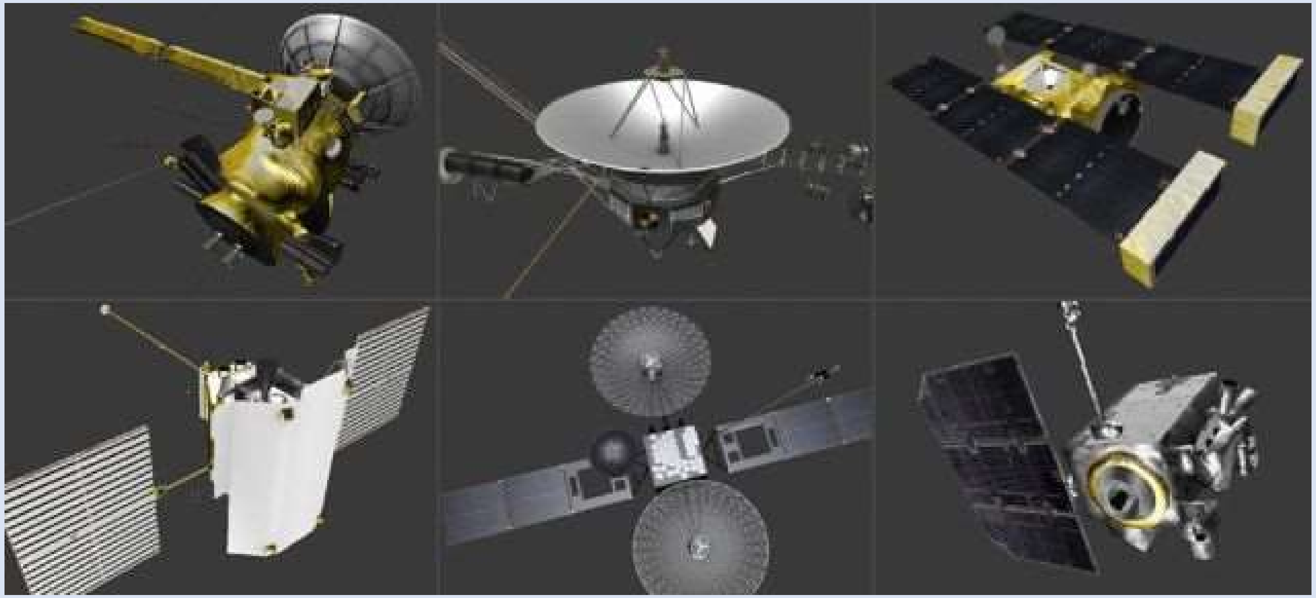
The Hubble telescope can view light from all parts of the electromagnetic spectrum. Images taken from the Hubble telescope have helped astronomers understand how the Universe has changed over time. It was launched into low Earth orbit in 1990 and remains in operation.
This is the first image taken by the Hubble telescope.

The Kepler observatory was launched in 2009 and is designed to discover Earth – sized planes orbiting around other stars. The Kepler telescope was retired in 2018. It detected 2,662 planets.

Space Probes

Space Probes are a robotic unmanned spacecraft used to explore space. Many nations have sent space probes into space to explore other planets, moons, asteroids and comets.

Missions involving space probes last for several years due to the large distances they need to travel.

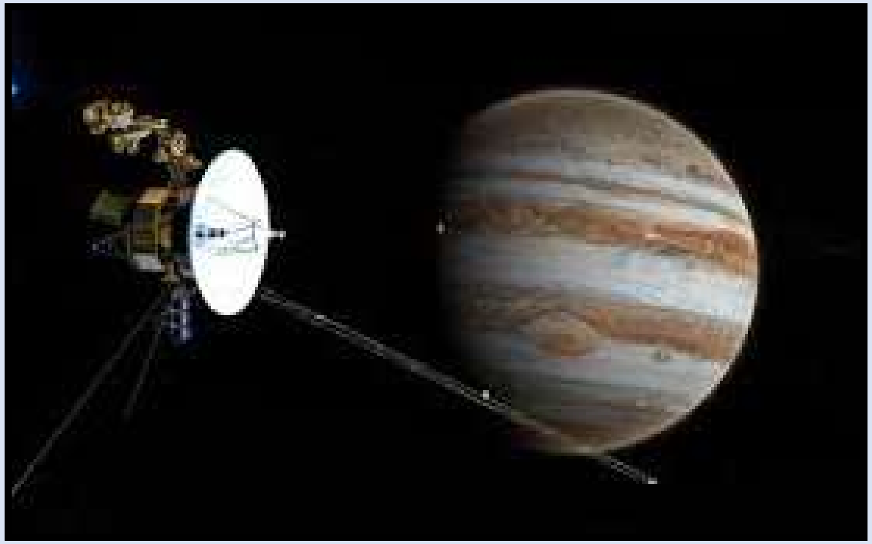


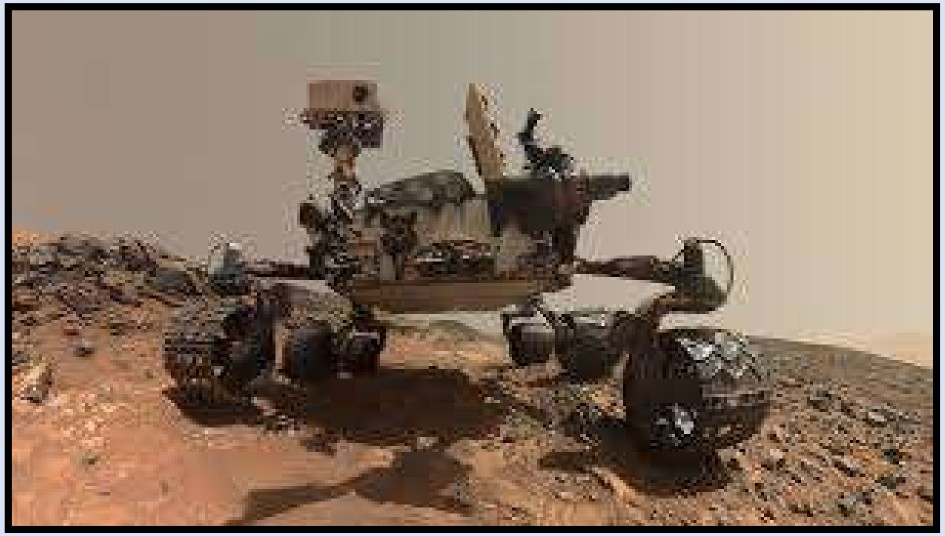
Space Probes

Voyager 1 is the longest lasting NASA mission to date. It was launched in September 1977 and has explored Jupiter, Saturn and their moons.

It is now travelling out with our Solar System into interstellar space. It still send data back to Earth.

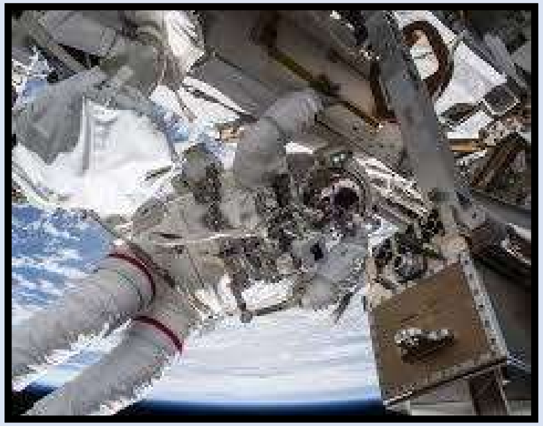
Some probe land robots on planets. The robotic rover, Curiosity has been on Mars since 2012 studying its climate and geology.





Manned Space Mission

- is space travel with a crew or passengers aboard the spacecraft.



- The first human in space was Yuri Gagarin, who flew the Vostok 1 spacecraft, launched by the Soviet Union in 1961.
- Humans have flown to the Moon nine times from 1968 to 1972 in the United States Apollo program.
- Humans have been continuously present in space on the International Space Station since November 2000.

Space Observation and Exploration

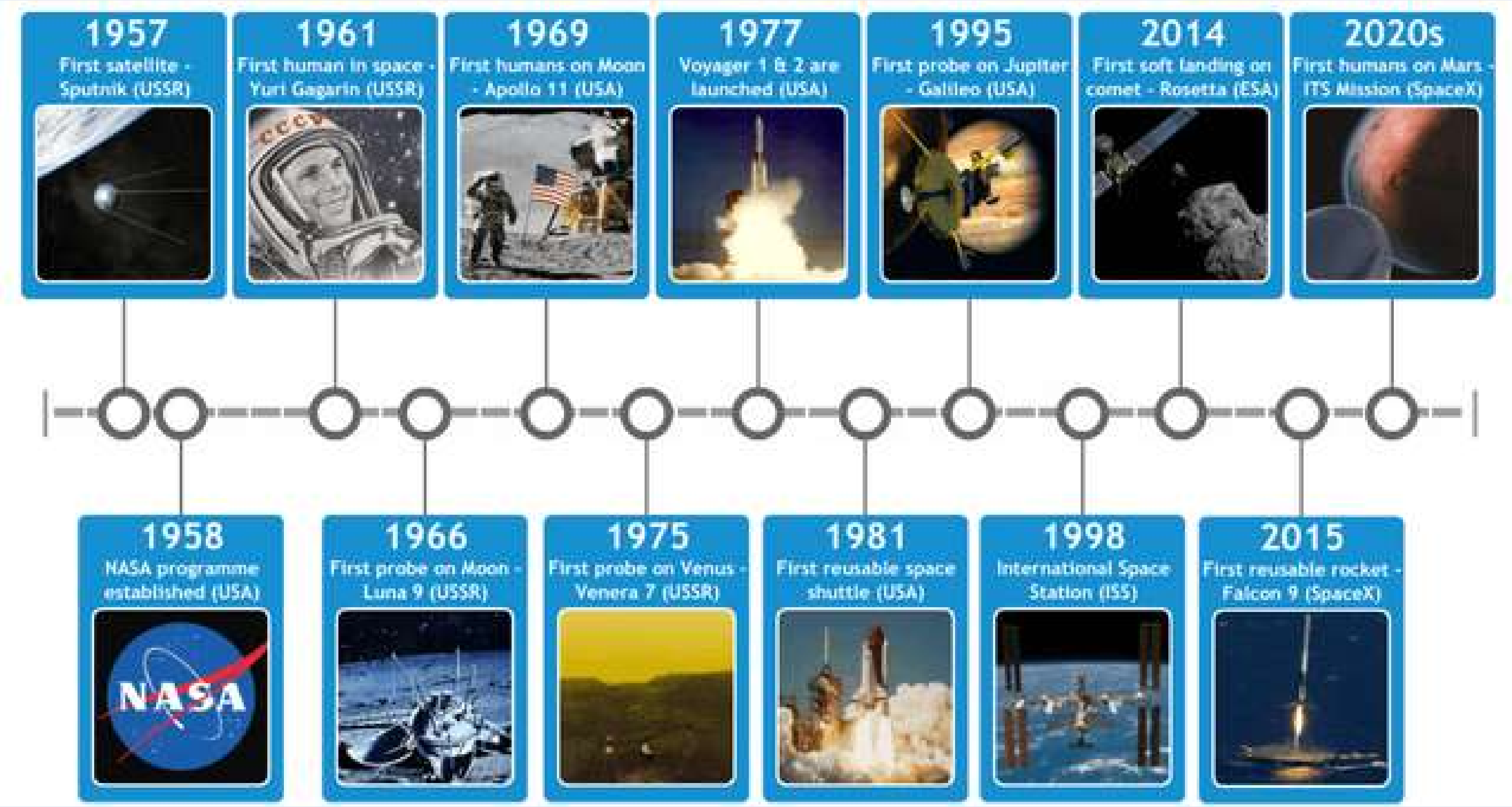
Page 50

Space can be explored through:

- Observation __________ using telescopes on Earth and in space
- Space probes __________
- Manned space mission __________

Space Exploration Timeline

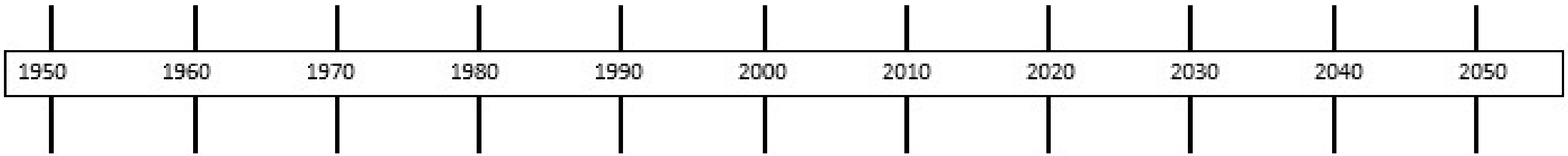
Quick history of space exploration: https://www.youtube.com/watch?v=PLcE3AI9wwE



Space Exploration Timeline

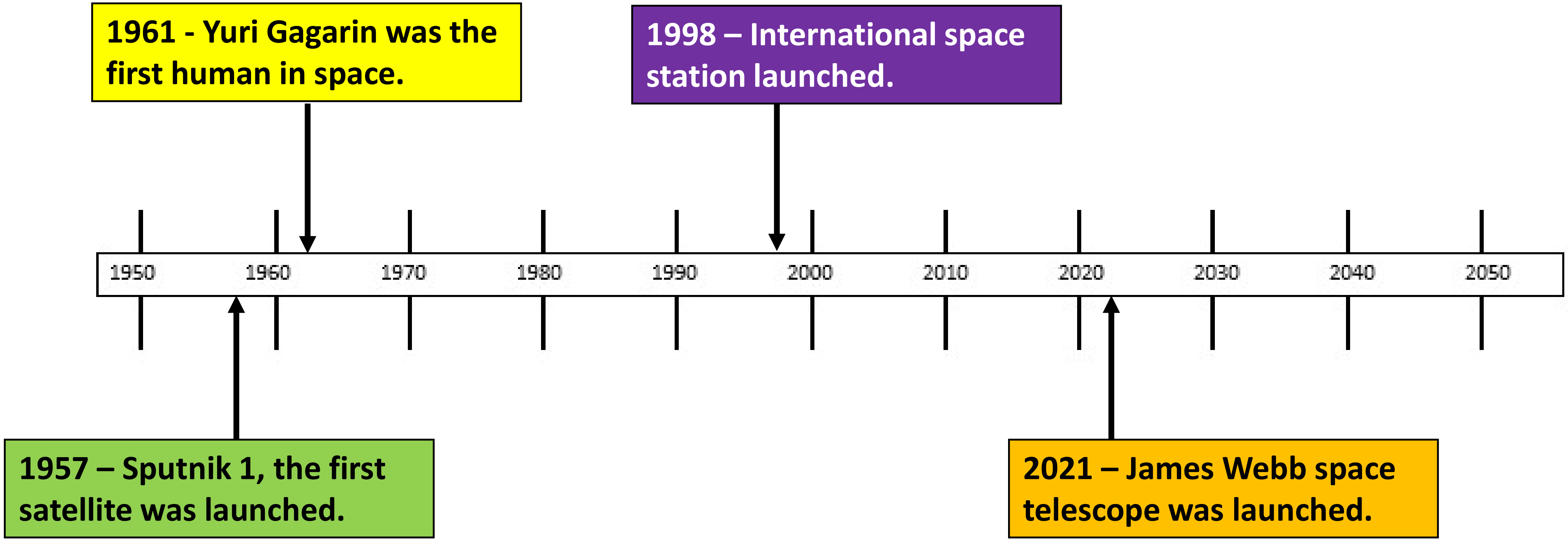
Create your own space exploration timeline. You can focus on a specific type of exploration (space probes, manned mission etc.) or choose events which interest you.

Search online to research the major events and add them to your timeline.



Space Exploration Timeline

A few things to get you started.....



Space Exploration Timeline

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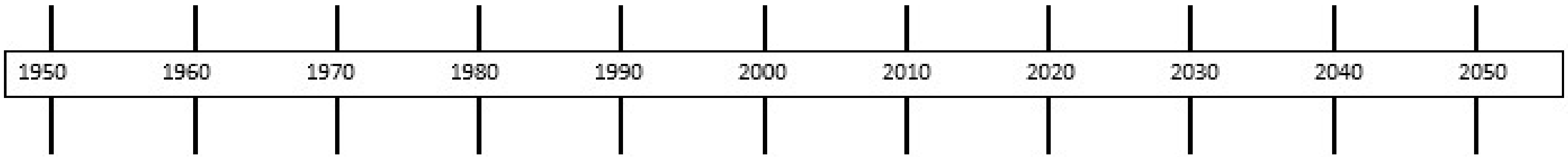

Space Exploration

20/08/2025

Learning Intentions:

- To state the methods used to observe and explore space.
- To describe the impact that space observation and exploration has had on our understanding of the universe and planet Earth.

Success Criteria

- I can name different ways we observe space (e.g. telescopes, satellites).
- I can explain how space exploration has helped us understand Earth's weather, climate, or resources.

Space Exploration

20/08/2025

Plenary:

1. List the three way we explore space.

2. Write down one fact or mission you found out about today?

3. What will you do to improve your timeline next lesson?

Space Exploration

20/08/2025

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Starter: Prior Knowledge

1. Which works better: telescopes on Earth or telescopes in space – and why?
2. Explain why there aren’t many manned space mission compared to space probes.

Space Exploration

20/08/2025

Page 52

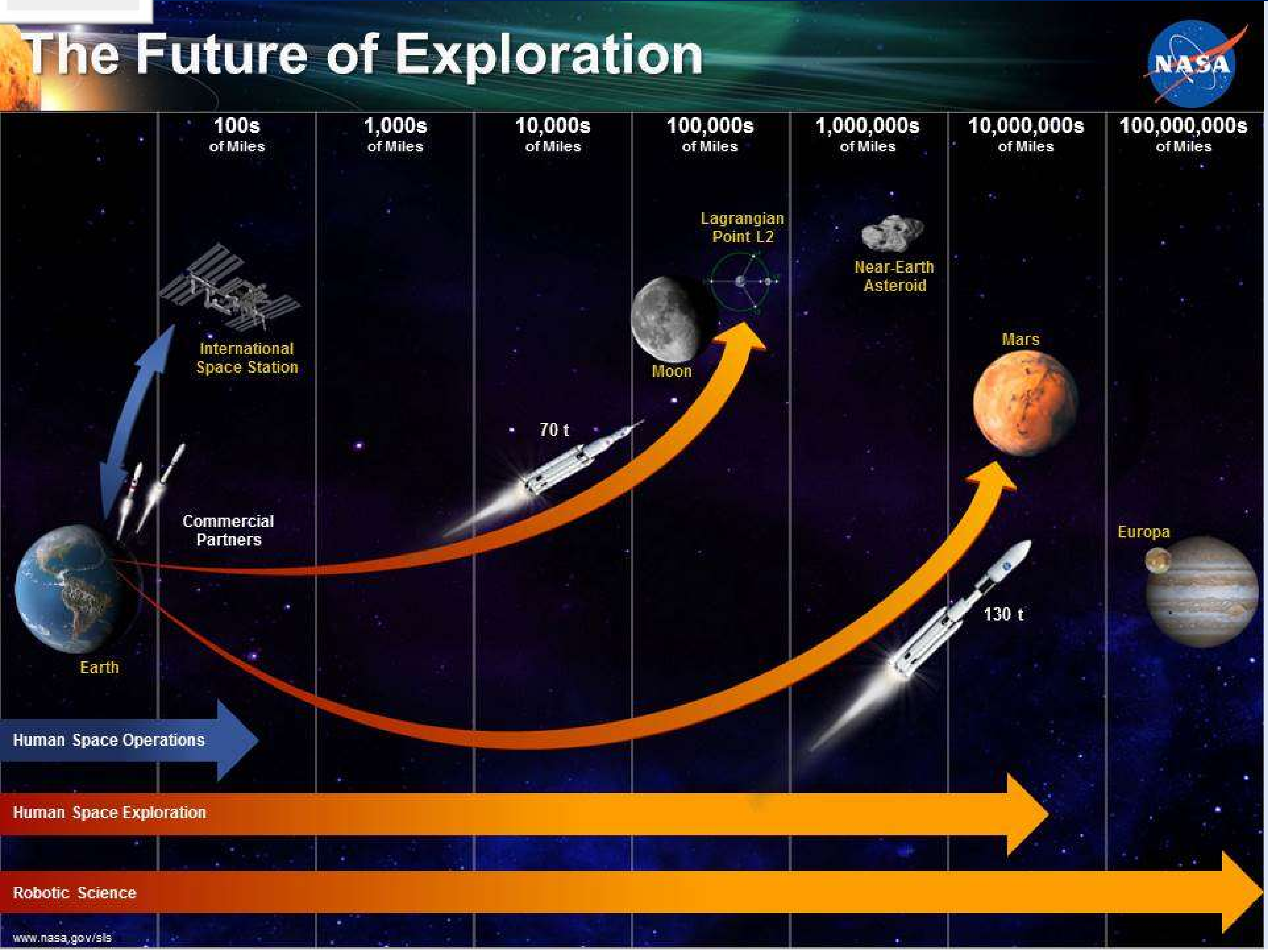
Learning Intentions:

- To describe the impact that space observation and exploration has had on our understanding of the universe and planet Earth.
- To evaluate benefits and challenges of space travel.

Success Criteria

- I can name different ways we observe space (e.g. telescopes, satellites).
- I can explain how space exploration has helped us understand Earth's weather, climate, or resources.
- I can give an opinion on whether space travel is worth it, with a reason.

The Future of Space Exploration

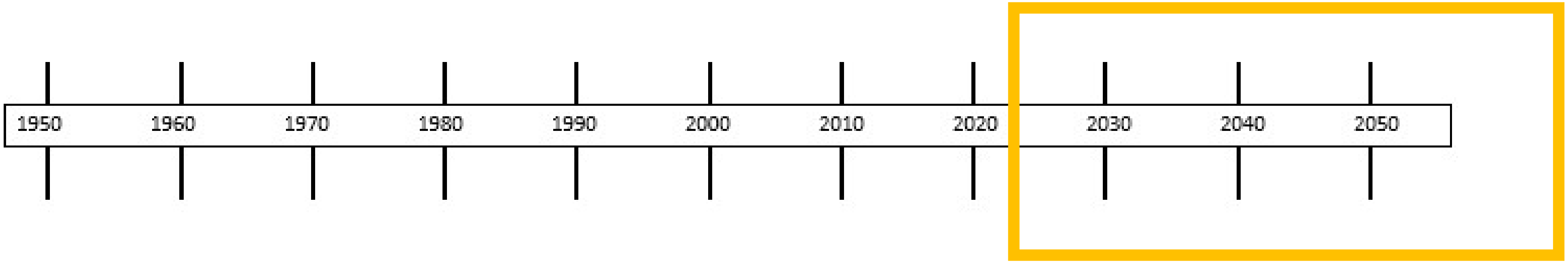


The future of space exploration involves both telescopic exploration and the physical exploration of space by unmanned robotic space probes and human spaceflight.

The Future of Space Exploration

Think about future

Research important current or future events and add them to your timeline.



Extension: Space Probes Research

Choose one space probe. Carry out some basic research into your probe, answering at least the following:

- What is a space probe?
- What… did the probe look like?
- Who… sent it up?
- When… what date?
- Where… was it launched from?
- Why… was it sent up?
- Where … is your probe now?

Include some photographs to make your research look interesting!

List of space probes:

Sputnik – there was more than one!
Pioneer – there was more than one!
Voyager - there was more than one!
Mariner - there was more than one!
Mars Rover - there was more than one!
Rosetta
New Horizons
Galileo

There are also space telescopes to go looking into space …

Hubble Space Telescope
Kepler Space Telescope
James Webb Telescope

The Future of Space Exploration

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Challenge Question:

How has space travel improved life on Earth and changed our understanding of the universe?

Prompts to Guide Thinking:

- What everyday technologies have come from space travel?
- How has space exploration helped us understand Earth better (e.g. climate, weather)?
- What new discoveries have we made about space since the first missions?
- How has our view of the universe changed over time (e.g. from geocentric to Big Bang)?
- What have space telescopes and probes revealed about planets, stars, and galaxies?

Suggested sources:

ESA, NASA websites, BBC Bitesize, National Geographic Kids

The Future of Space Exploration

Structure help:

- **Introduction:** What is space travel?
- **Part 1:** Benefits on Earth (tech, health, communication)
- **Part 2:** Understanding of the universe (key discoveries)
- **Conclusion:** Why this matters today

Space Exploration

20/08/2025

Learning Intentions:

- To state the methods used to observe and explore space.
- To describe the impact that space observation and exploration has had on our understanding of the universe and planet Earth.

Success Criteria

- I can name different ways we observe space (e.g. telescopes, satellites).
- I can explain how space exploration has helped us understand Earth's weather, climate, or resources.

Beyond the Solar System

20/08/2025

Plenary:

1. What are the **benefits** of space exploration?

2. What are the **risks** of space exploration?

Success Criteria

- ❑ I can state the methods used to observe and explore space.
- ❑ I can describe the impact that space observation and exploration has had on our understanding of the

Tick me at the end if ***you can*** …

Revision

20/08/2025

Starter: Prior Knowledge

Revision

20/08/2025

Revision Tasks:

1. Knowledge organiser
2. Quiz
3. Problem Solving Practice
4. Challenge Questions

Revision

20/08/2025

Learning Intentions:

- To review key concepts and prepare for assessment.

Success Criteria

- I can complete knowledge organiser and quiz.
- I can know what I need to do to prepare for my assessment.

Revision

20/08/2025

Plenary:

Forces & Space Assessment

20/08/2025

Starter: Get organised for your Forces & Space Assessment.

Equipment needed:

- Pencil or pen
- Rubber
- Ruler
- Calculator
- Test Paper

Assessment Expectations

No talking to or distracting others.

If you have a question raise your hand and wait for your teacher to come to you.

When finished:

Hand your assessment to your teacher

Log on to Teams and complete the task set

Feedback & Intro to AVU

20/08/2025

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Starter: Prior Knowledge

1. What was the most interesting thing you learned in this unit?

2. Was there anything you found difficult or confusing?

3. Do you have any ideas to make the lessons better?

Or complete learner feedback form!

QR code here if available.

Feedback & Intro to AVU

20/08/2025

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Learning Intentions:

- To receive feedback from assessment
- To start AVU research on Exoplanets.

Success Criteria

- I know what level I'm working at
- I know my next steps and what I need to do to improve
- I can explain what is required for life to survive on a planet.

Praise – What is good about this piece of work?

Next steps – What needs to be improved?

<u>How</u> can this be improved?

Introduction to AVU: Life Beyond Earth

Humans often wonder if there is life in space……

Life does not mean human-like life. Bacteria and plants are also forms of life!

If there is life in other parts of the universe, it may not be of a similar form to life on Earth at all.

Life Beyond Earth

We know of only one planet in the universe that contains life……….

Earth

Requirements of life

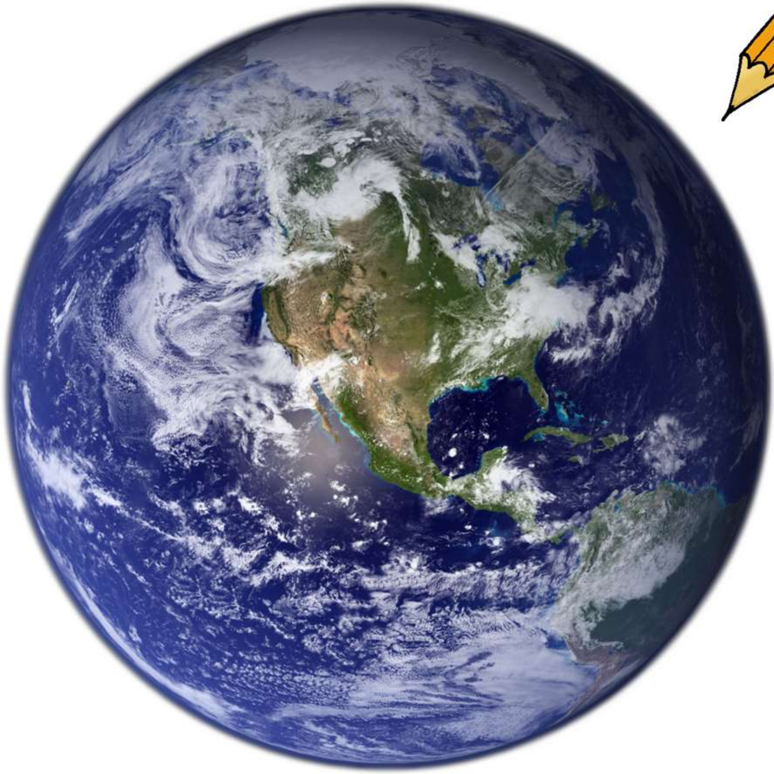
What is required for life on Earth?

Requirements for Life

Page 55

The requirements for life on Earth are:

- Liquid water
- Oxygen – to allow respiration
- Food - nutrients
- Energy from the sun – to provide warmth.



Candidates for life in our solar system

Page 55

There are very few places in the Solar System, other than on Earth, that life could have evolved and still be thriving today. A few possibilities are ____Europa (Jupiter's moon)____, ____Titan (Saturn's moon)____ and ____Mars____.

Find out why these areas may support life

Candidates for life in our solar system

Europa

Europa is one of Jupiter's moons.

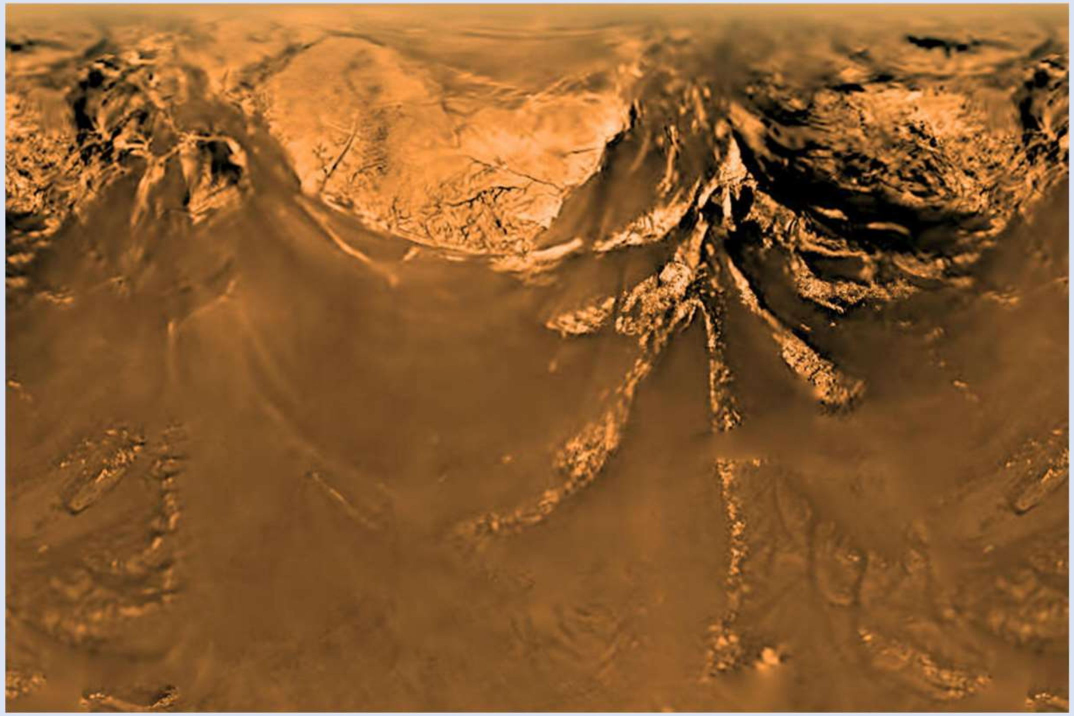
There may be a large volume of liquid water below the icy surface which could support some form of life.

https://www.bbc.co.uk/bitesize/guides/zmwfr82/revision/4

Candidates for life in our solar system

Titan

Titan is the largest of Saturn's moons. Its atmosphere is pure methane and life as we know it on Earth would never survive there. However, it is possible that life could evolve to respire using methane rather than oxygen.



Candidates for life in our solar system

Mars

Mars is like Earth but has no signs of life. It has water ice at both poles. Features on its surface, such as valleys, may have been created by historic liquid water.

Life in the rest of the universe

There is no real evidence of life in our Solar System.

- Could there be life outside our solar system?
- Where could scientists look?

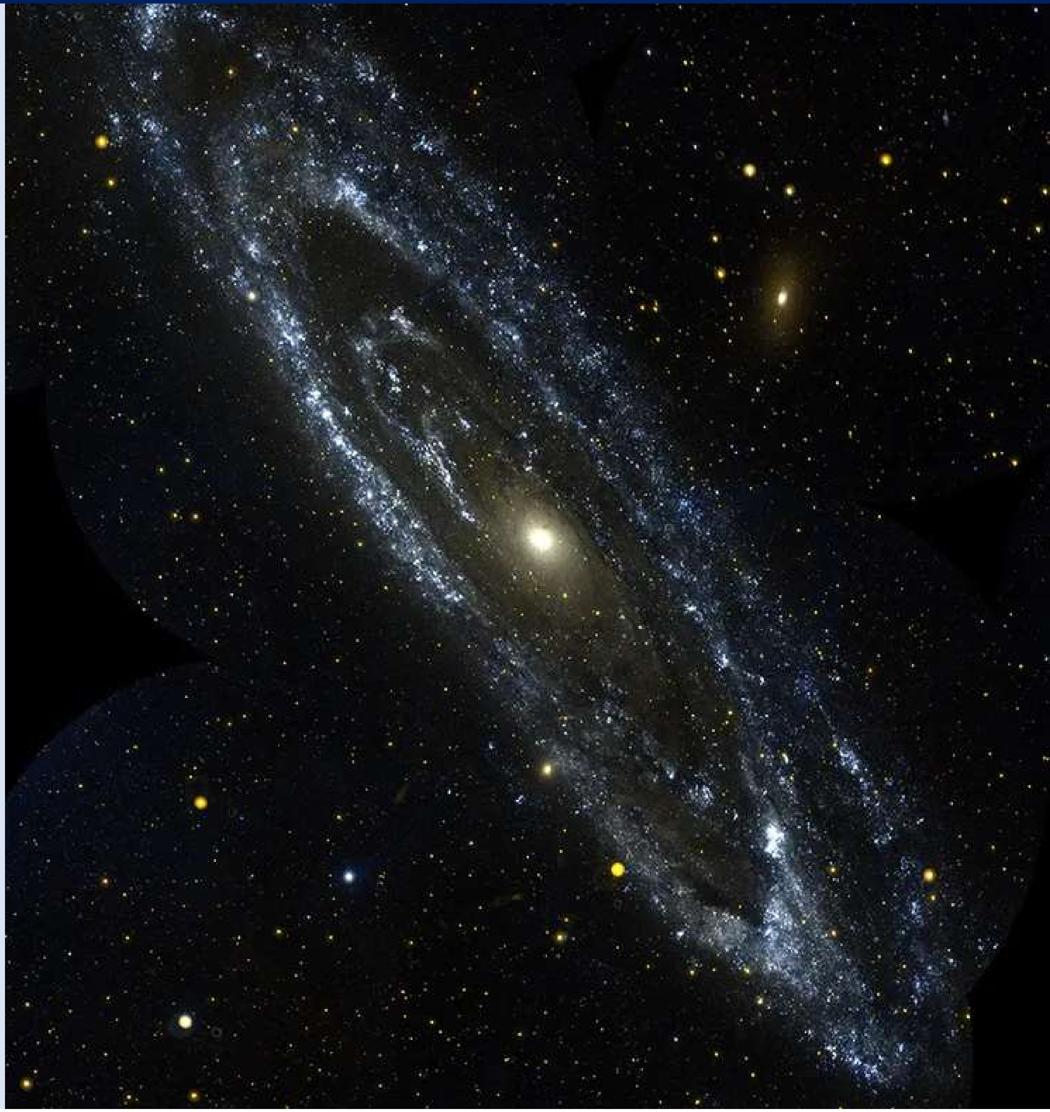
Life in the rest of the universe

There are billions of stars in our galaxy and an estimated 200 billion galaxies in the universe.

Each one of these stars may have planets and moons.

These **exoplanets** and moons may harbour life.

What is an **exoplanet**?



Exoplanets

Page 56

An exoplanet is a planet outside our solar system.

It is a planet which orbits a star other than our own Sun.

Life in the rest of the universe

What is the likelihood of finding life on another planet?

Introduction to Exoplanets-ROE

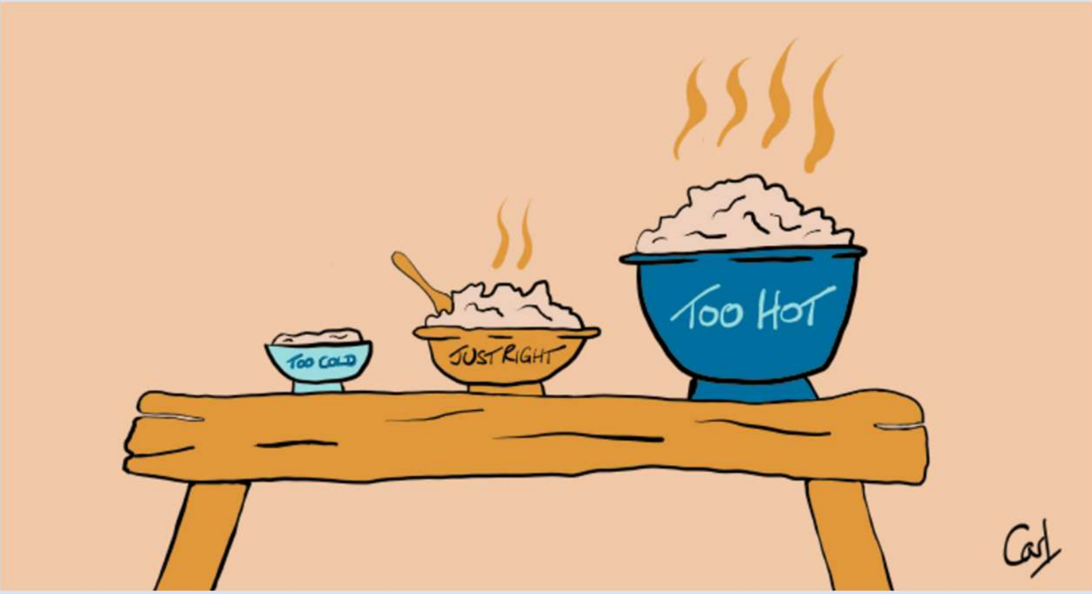
How many have we found now?

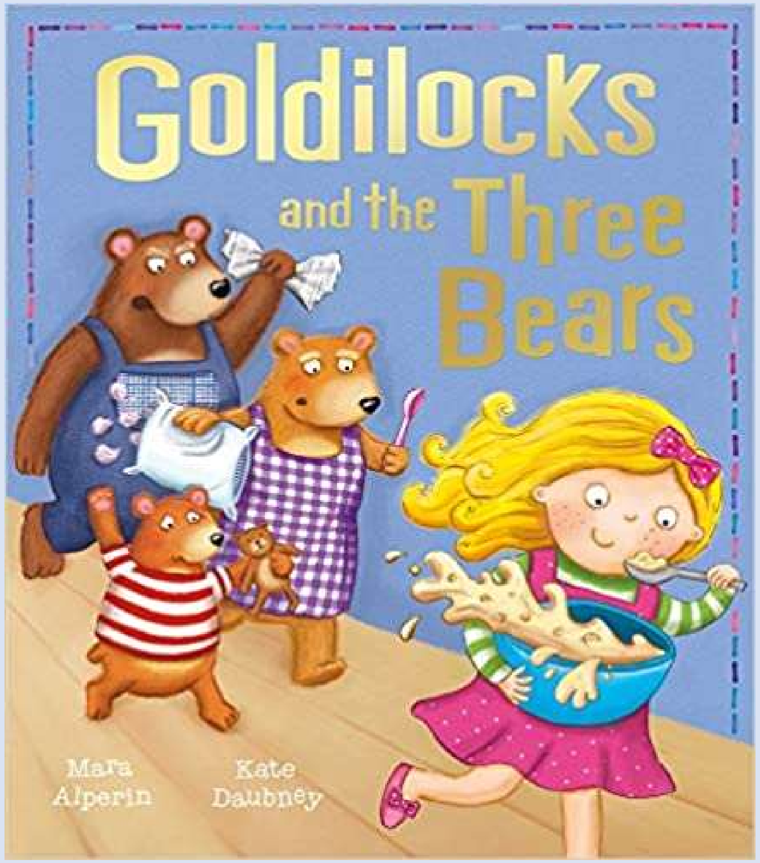
NASA Discovery Dashboard

The Habitable Zone

The **habitable zone** is the name given to an area around a star which is 'just right' for life.

Why is it also called the **Goldilocks zone?**

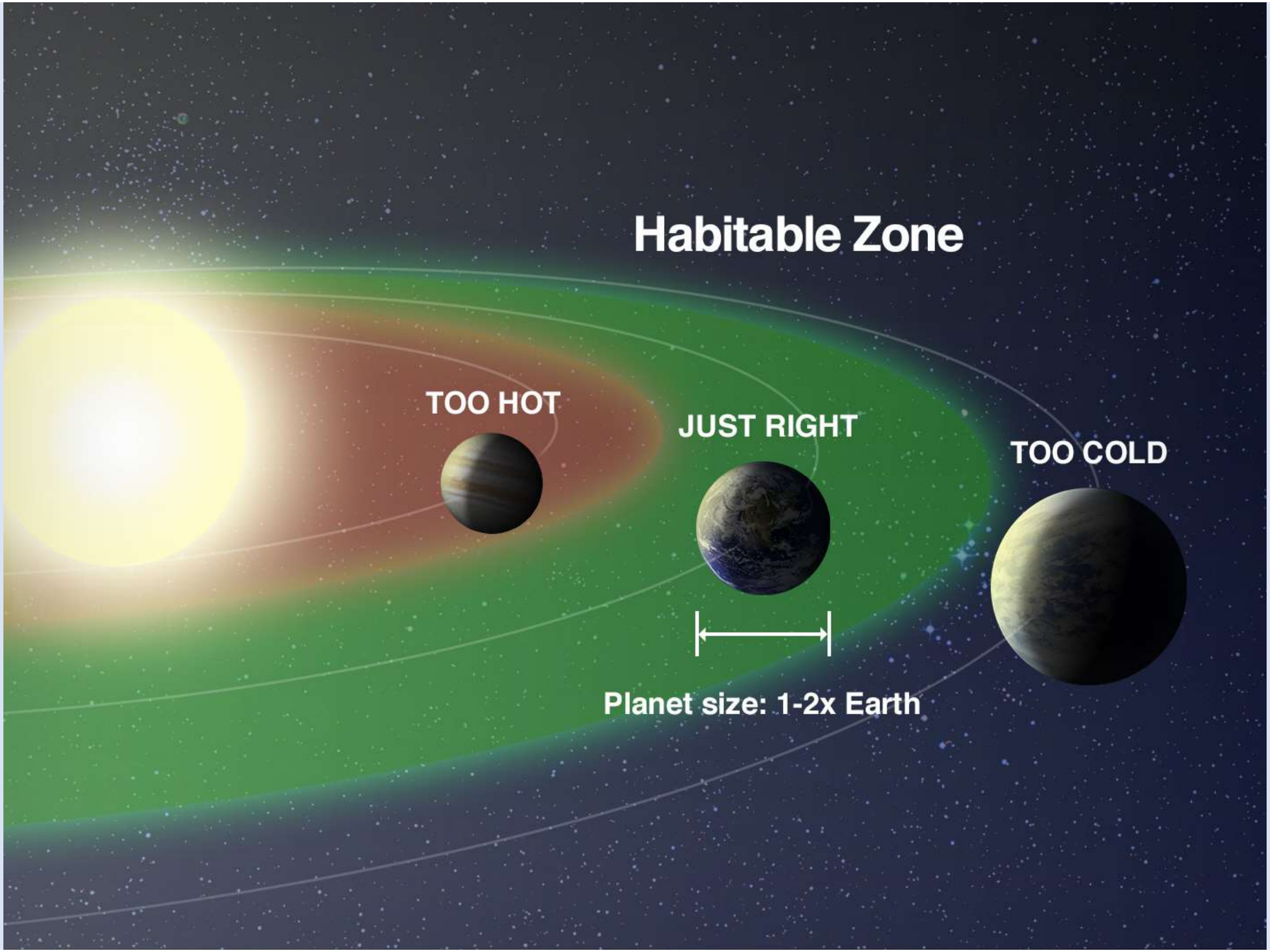




The Habitable Zone

The ___habitable___ zone (Goldilocks zone) is the name given to an area around a star which is 'just right' for life.

This area is not too ___hot___ or too ___cold___ for liquid water to exist on a planet.


Habitable Zone
TOO HOT
JUST RIGHT
TOO COLD
Planet size: 1-2x Earth

Looking for exoplanets

Discovering exoplanets is extremely difficult. They are so far away that we cannot simply look through a regular telescope and see them.

This means that exoplanet-hunting astronomers need to use some clever techniques!

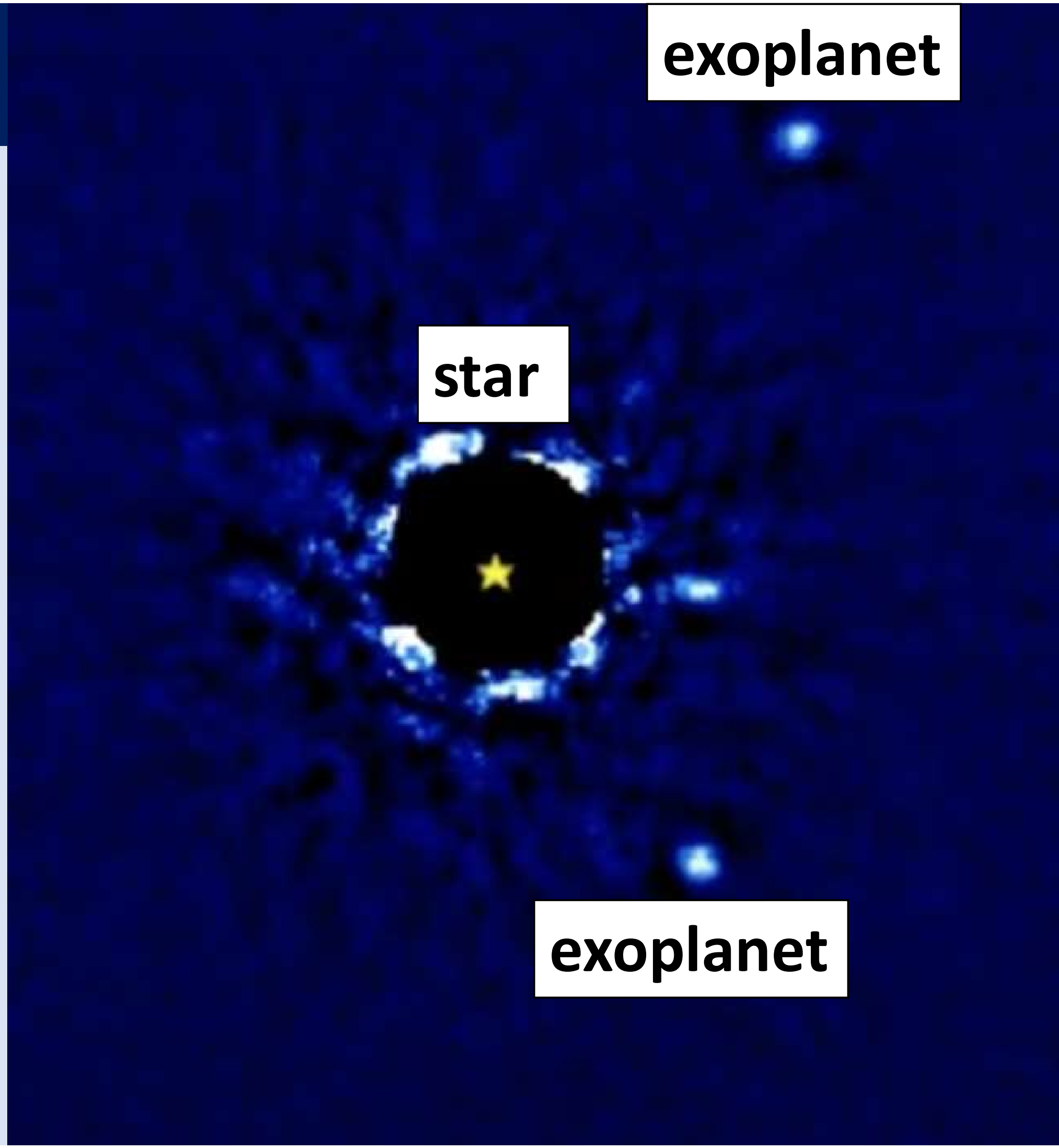
How to Find an Exoplanet:
minutephysics 2.35

Exoplanets 101 | National Geographic (3:53)

Direct Imaging

Exoplanets are very small, and faint compared to the stars that they orbit, this makes seeing them through a regular telescope difficult.

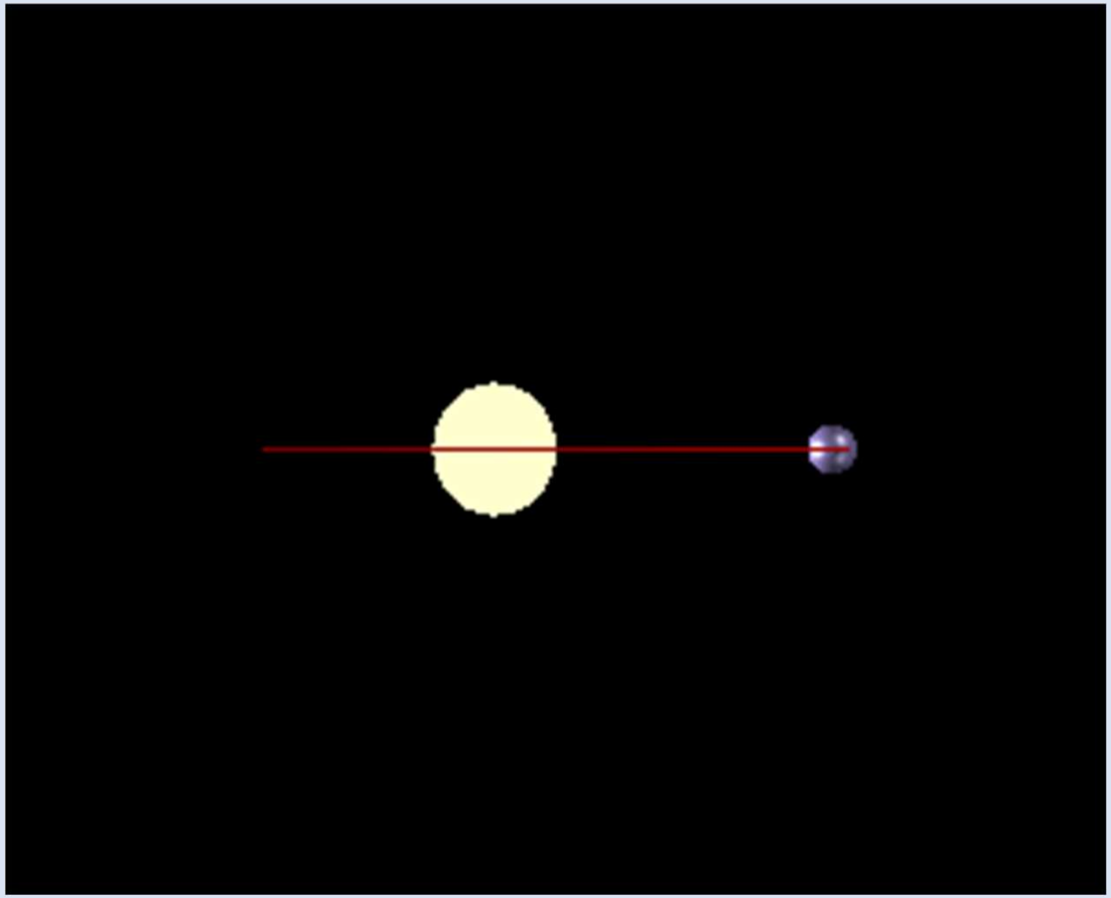
Scientist can block the light from the star to help see the exoplanets that are orbiting it.



Wobble Method

As a planet orbits a star, the planet's gravity pulls on the star, making the star wobble.

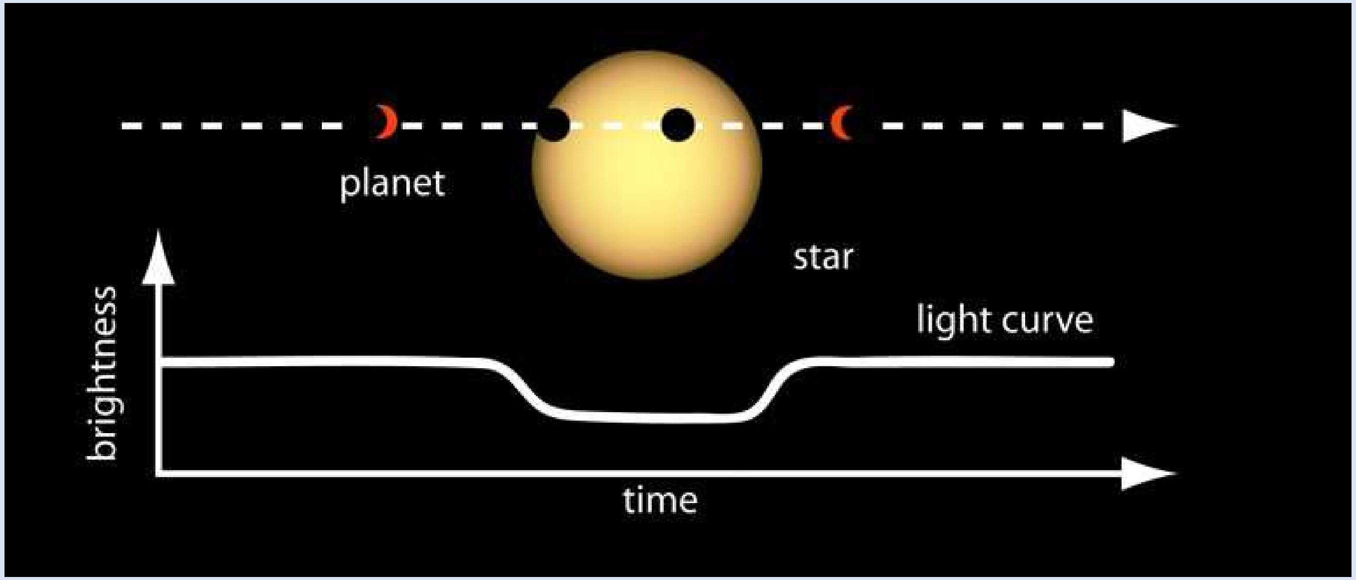
This wobble is evidence of an exoplanet.



Transit Method

The transit method is where astronomers detect very small changes in the brightness of stars.

When a planet passes in front of its star, it causes the light level from the star to drop slightly. The changes are observed over many years to prove a planet is orbiting a star.



Simulation: https://svs.gsfc.nasa.gov/13022

Finding Exoplanets

Page 56

Exoplanets are very far away. They are also very ____small____ and ___faint___ compared to the stars that they orbit. This makes seeing them through a regular telescope ______difficult______.

Finding Exoplanets

Page 56

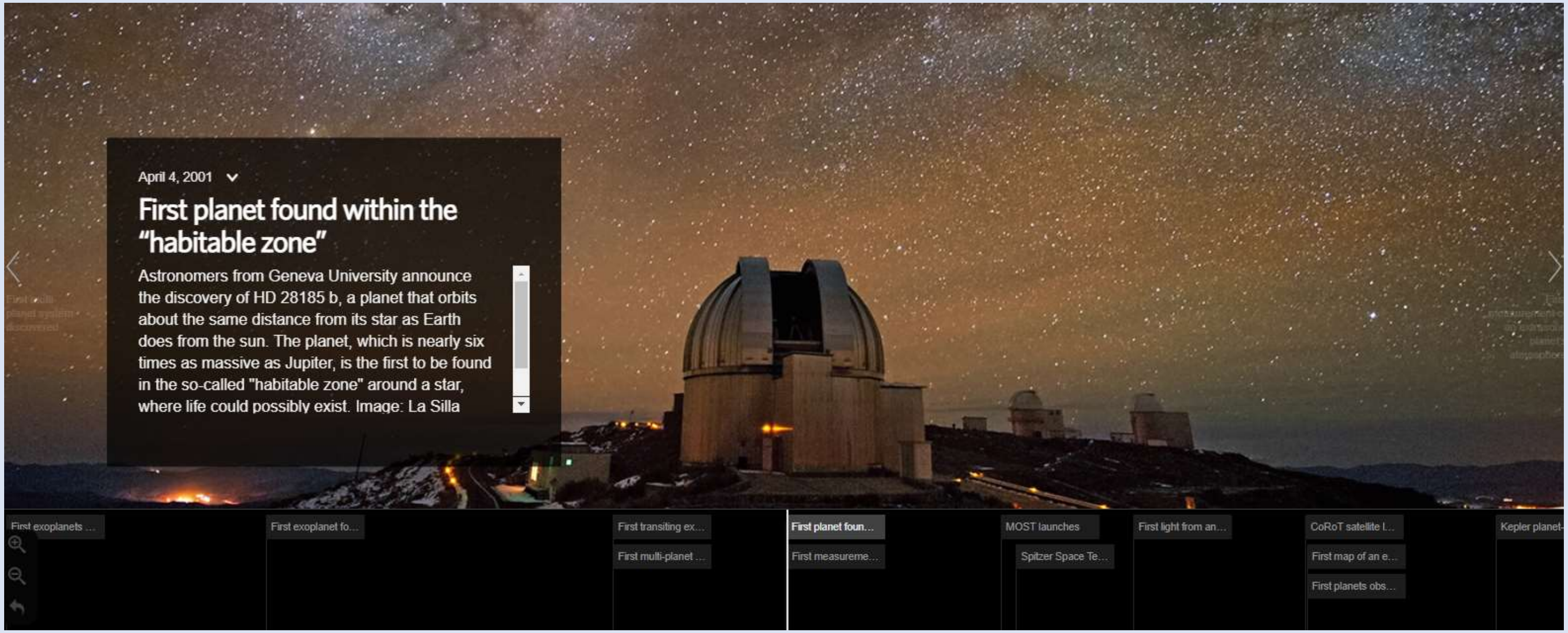
Detection Method	How it works
Direct imaging	Taking a picture of an exoplanet with a telescope
Wobble method	As the exoplanet orbits a star, the exoplanet’s gravity pulls on the star, making the star wobble.
Transit method	Astronomers detect very small changes in the brightness of stars as an exoplanet passes in front of a star and blocks out a little bit of the star's light.

The Planet Hunters

Observing from Earth and from orbit.

Finding Exoplanets

Explore the NASA Exoplanet Exploration Historic Timeline.



Find out about the Hubble Space Telescope, MOST, Spitzer Space Telescope, CoRoT satellite launched, Kepler Space Telescope, TESS

The Planet Hunters

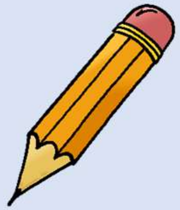
Why do we search?

Whether life exists beyond Earth is one of the most profound questions of all time. The answer will change us forever, whether it reveals a universe rich with life, one in which life is rare and fragile, or even a universe in which we can find no other life at all.
The hunt for an answer also is revealing important details about our own place in the universe – where we came from, how life came about and, perhaps, where we're headed.
The goal of NASA's Exoplanet Program is to find unmistakable signs of current life.

A habitable exoplanet - what are we looking for?

The conditions for a habitable exoplanet are:

Page 57



liquid water

rocky
(not a gas giant)

A **suitable temperature**
(not too hot or too cold).

food
(conditions which allow food to grow)

oxygen

An **energy** source
(our energy comes from the Sun).

[TED talk - What a planet needs to sustain life | Dave Brain].

Life elsewhere in the Universe

Page 56

Class Question

Use all the information in this section to explain, with reasons, whether you think there is life elsewhere. Think about the requirement for life, what is meant by life and the size of the Universe.

____

____

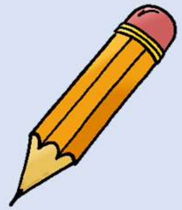
____

____

Different Exoplanets

Extension

Page 57



[What Is an Exoplanet? NASA (4:34)]

[Exoplanet Types: Worlds Beyond Our Solar System (1:42)]

[Exoplanets: Weird, Wondrous Worlds (1:59)]

Facts from the NASA Exoplanet series:

Looking for Exoplanets

20/08/2025

Plenary:

Congratulations! You have now completed "Space".

Think about the whole topic and complete one of the thoughts below.

The part I enjoyed the most was……

One thing I need to remember is…………..

I was successful when I …………..

Expectations and Outcomes Learner Evaluation

- **<u>Topic:</u>** Space

Page 2

Experience and Outcomes	Date Completed (dd/mm/yy)	Evaluation How happy are you with it? (☺ ? ☹)
I can state that day and night are caused by the Earth rotating on its axis.		
I can state that the Earth orbits the Sun once in one		

Looking for Exoplanets

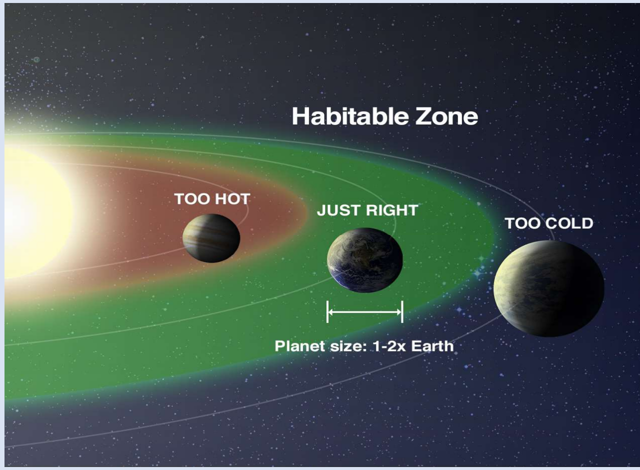
20/08/2025

Extra

Starter:

1. Some exo-planets orbit stars in an area known as the habitable zone or 'Goldilocks zone'. State what is meant by the habitable zone.

2. State 4 basic requirements for an exo-planet to support life.



AVU: Exoplanets

20/08/2025

Page 7

Starter: Prior Knowledge

AVU: Exoplanets

20/08/2025

Page 4

Learning Intentions:

Success Criteria

AVU: Exoplanets

20/08/2025

Page 7

Starter: Prior Knowledge

AVU: Exoplanets

20/08/2025

Learning Intentions:

Success Criteria

Extension Tasks

Space Tourism

Extension

Page 33&34

Design a travel poster advertising space tourism.

Identify a favourite exoplanet, planet or moon.

Imagine what the surface and conditions of that exoplanet might be like.

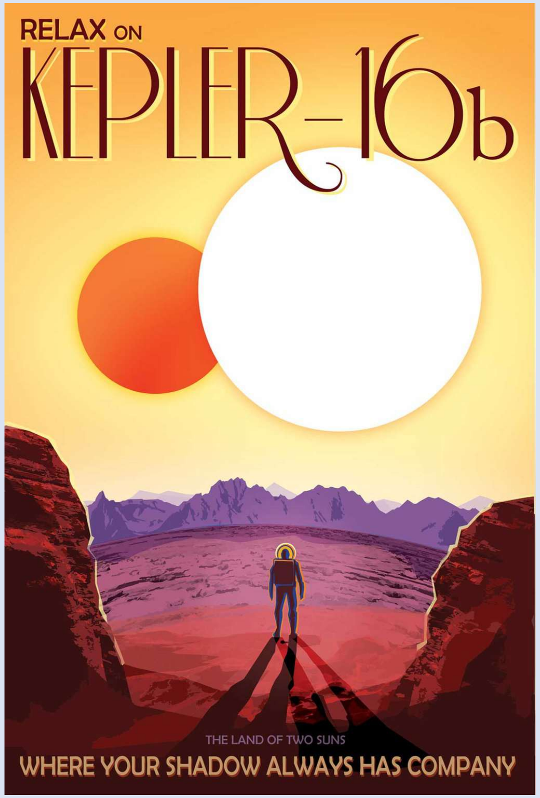
Design a travel poster highlighting the key characteristics of the exoplanet.

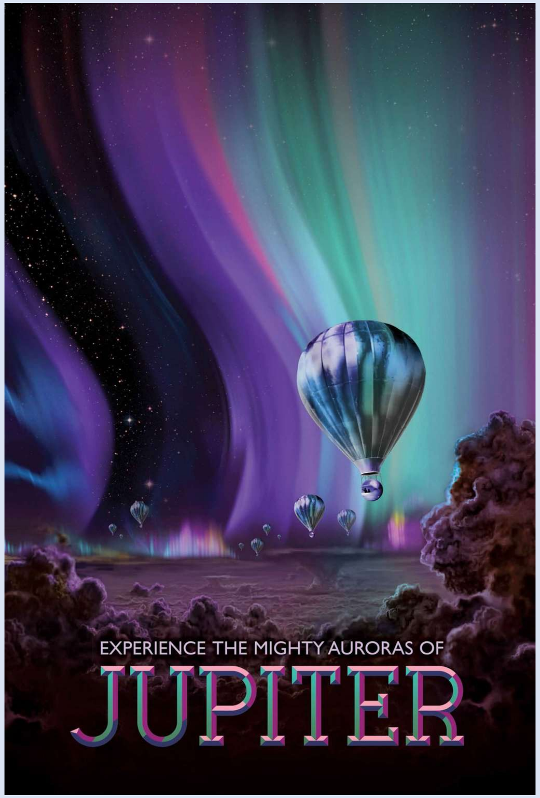
Check out NASA's travel posters and be creative!

Space Tourism

Extension

Page 33&34

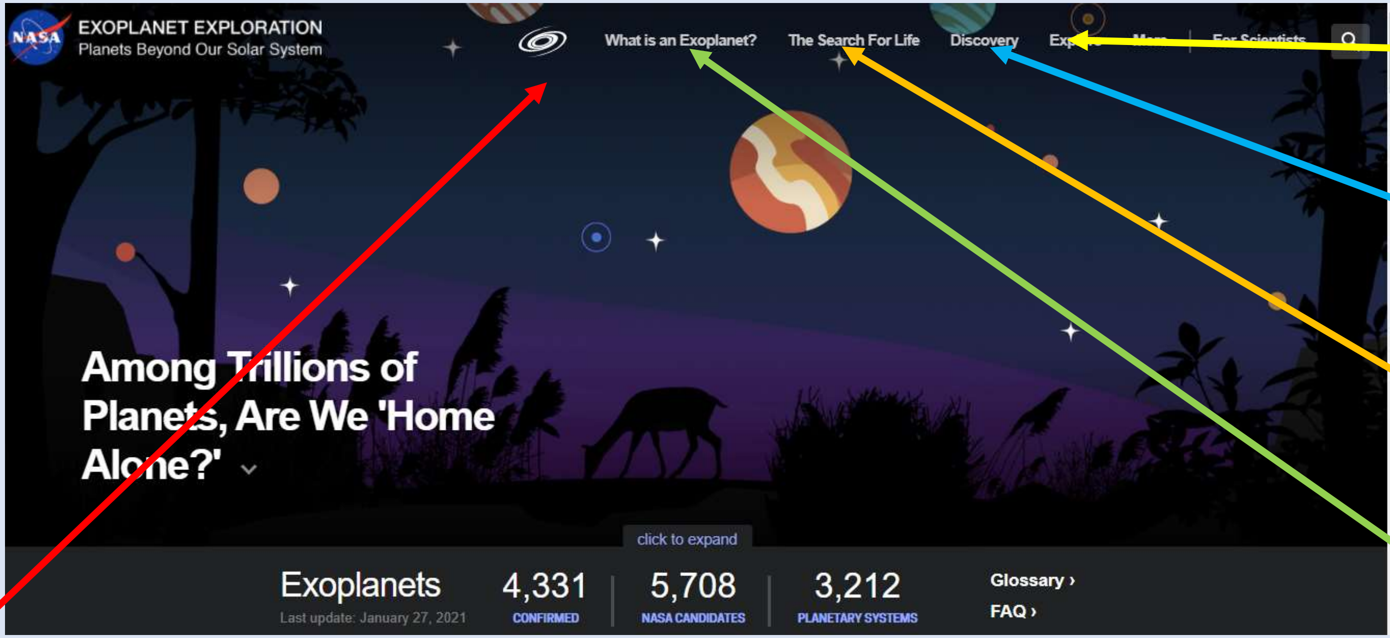




Exoplanets - NASA

Find out about exoplanets using the NASA exoplanets website. Click on the tabs across the top and explore. Make any relevant notes in your jotter.

https://exoplanets.nasa.gov/



Explore

Discovery

The Search For Life

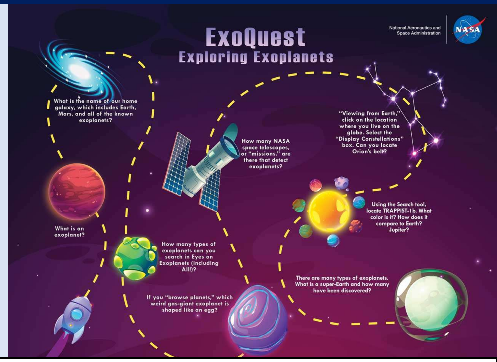
What is an Exoplanet?

Explore the "Eyes on Exoplanets" animation – you will need to use it to complete the next task

Eyes on Exoplanets - ExoQuest

Using the Eyes on Exoplanets animation, explore the universe and complete the ExoQuest. Take the interactive ExoQuest quiz or answer the questions below.

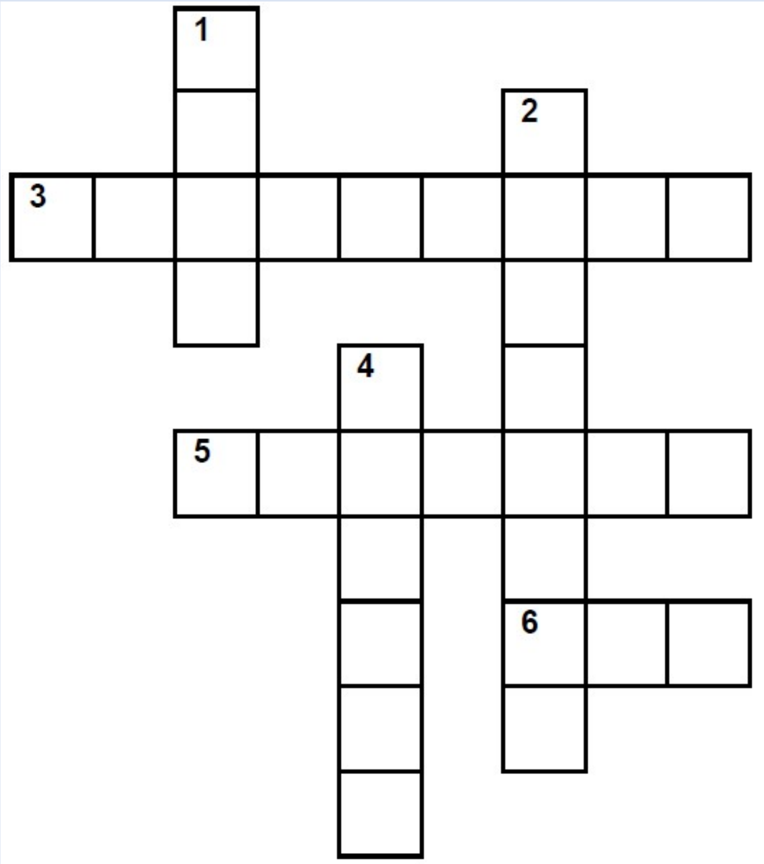
https://exoplanets.nasa.gov/

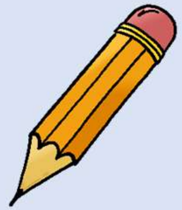


1. What is an exoplanet?
2. What is the name of our home galaxy, which includes Earth, Mars and all of the known exoplanets?
3. How many types of exoplanets can you search in Eyes on Exoplanets (including All!)?
4. If you “browse planets,” which weird gas-giant exoplanet is shaped like an egg?
5. How many NASA space telescopes, or “missions,” are there that detect exoplanets?
6. “Viewing from Earth,” click on the location where you live on the globe. Did you find it?
7. Select the “Display Constellations” box. Can you locate Orion’s belt?
8. Using the Search tool, locate TRAPPIST-1b. What colour is it shown as? How does it compare to Earth? Jupiter?
9. There are many types of exoplanets. What is a Super-Earth and how many have been discovered?

Eyes on Exoplanets - ExoQuest

Complete the crossword of astronomical terms.





Clues Across

3. A planet outside our solar system.
5. These orbit a star.
6. The star in our solar system.

Clues Down

1. A natural satellite.
2. All the space we can observe.
4. Our one is called the Milky Way.

Plenary - complete one of the sentences below

I was successful when I ....

A question I have about today's lesson is ....

Today I learnt ....

The part of the lesson I enjoyed the most was......

The skills I used in today's lesson were..........

One thing I need to remember from today's lesson is..............