Earth and Space Tips and Tricks

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Learning Outcomes

1. Students should be able to describe the relationships between various celestial objects including moons, asteroids, comets, planets, stars, solar systems, galaxies and space

2. Students should be able to explore a scientific model to illustrate the origin of the universe

3. Students should be able to interpret data to compare the Earth with other planets and moons in the solar system, with respect to properties including mass, gravity, size, and composition

4. Students should be able to develop and use a model of the Earth-sun-moon system to describe predictable phenomena observable on Earth, including seasons, lunar phases, and eclipses of the sun and moon

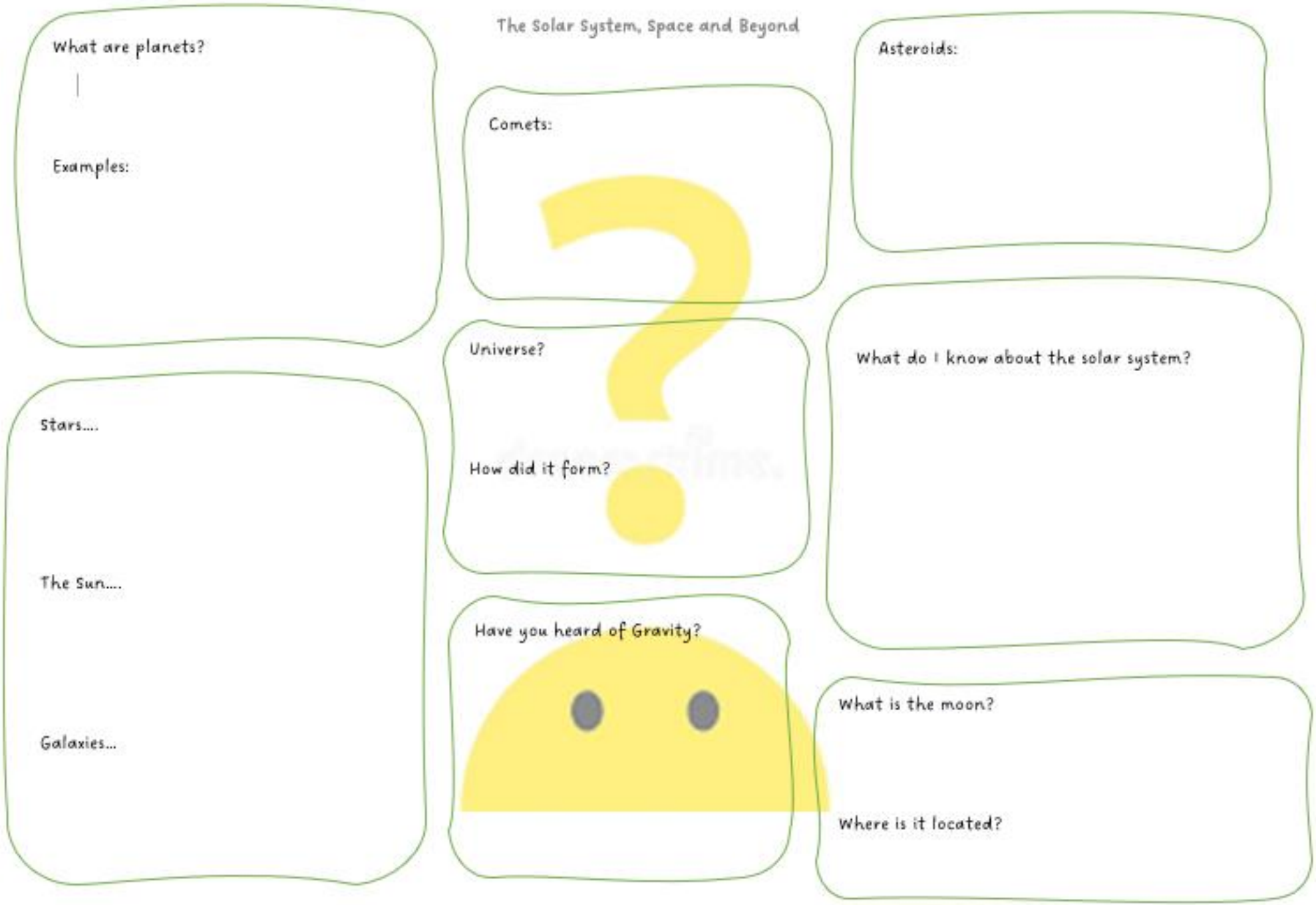
8. Students should be able to examine some of the current hazards and benefits of space exploration and discuss the future role and implications of space exploration in society

Key Skills


KEY SKILLS
BEING LITERATE
MANAGING MYSELF
STAYING WELL
MANAGING INFORMATION & THINKING
BEING NUMERATE
BEING CREATIVE
WORKING WITH OTHERS
COMMUNICATING

ES1 – Celestial Bodies

- Assessment of Prior Knowledge



Researching

Planet Fact files

- Group or individual projects
- Research a planet and display findings on A4 poster

- Make a model of their assigned planet

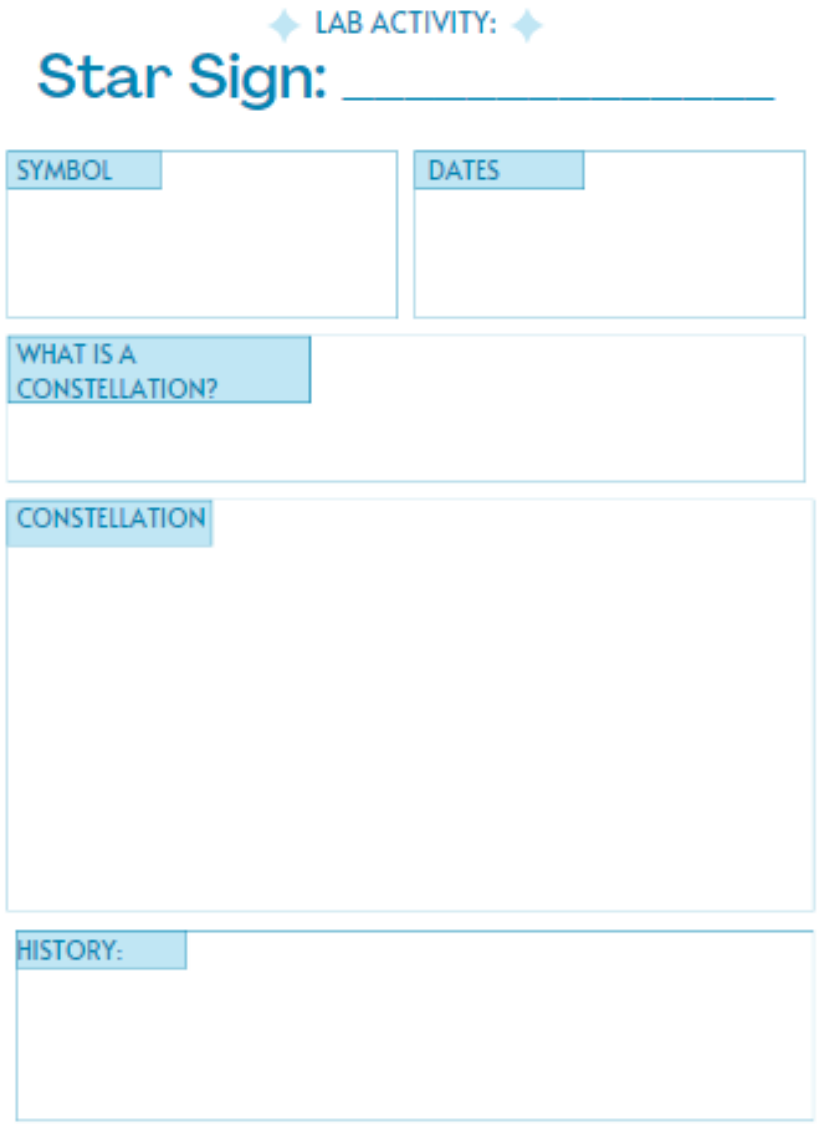
Research

- Twinkl

Solar System Fact Hunt

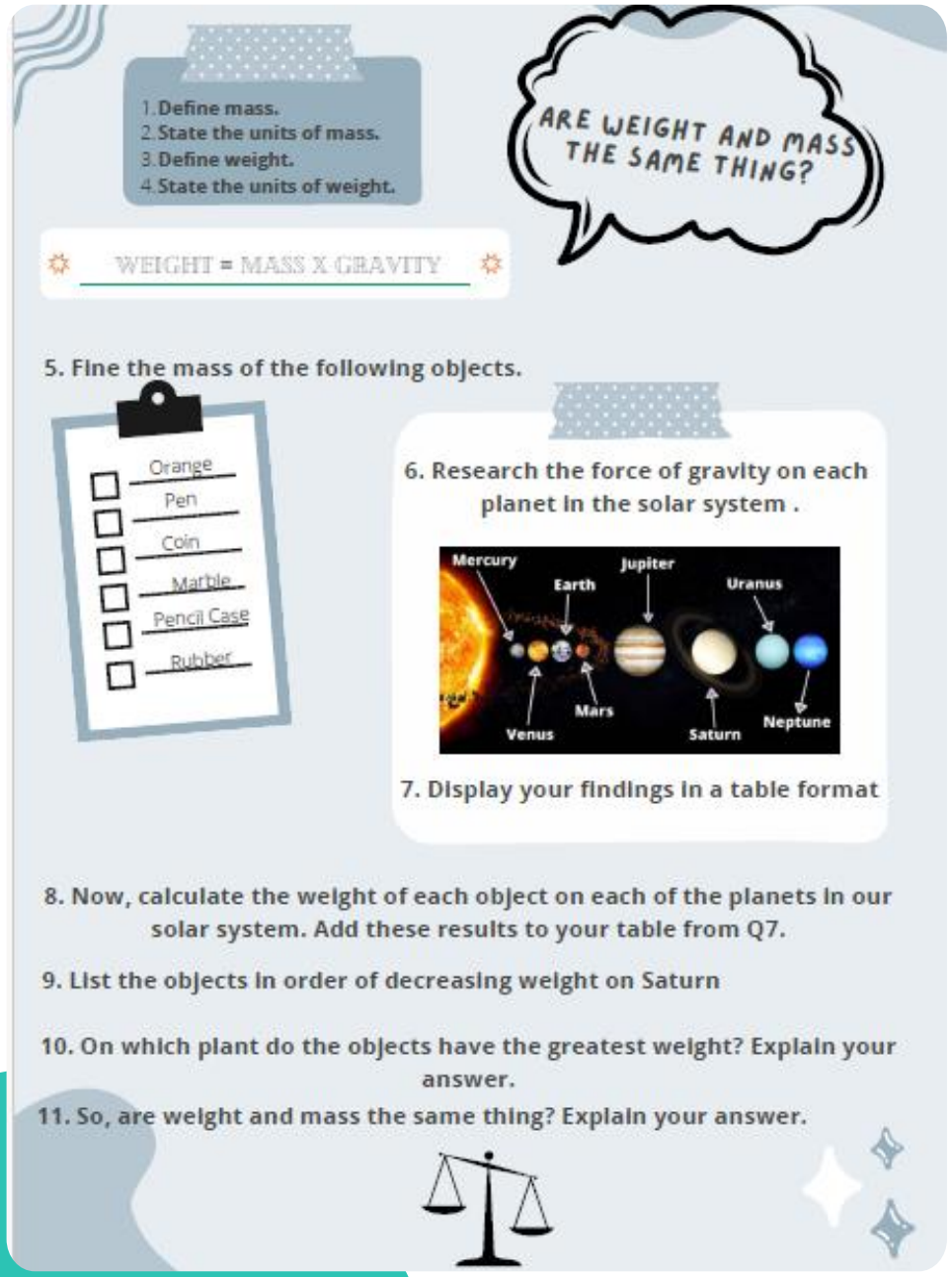
Use books, the Internet or the Solar System Fact Cards to find the answers to the following questions.

Which planet orbits closest to the Sun?	Which planet has the highest maximum temperature?
Which planet's atmosphere contains the highest percentage of carbon dioxide?	How much bigger is Earth than Mars?
Which planet has the shortest day?	Which planets are made of gas?
Which planet has the most moons?	What is the Earth's atmosphere made mostly of?



Constellations

- Homework activity
- Extension activity
- Relevance to their interests…



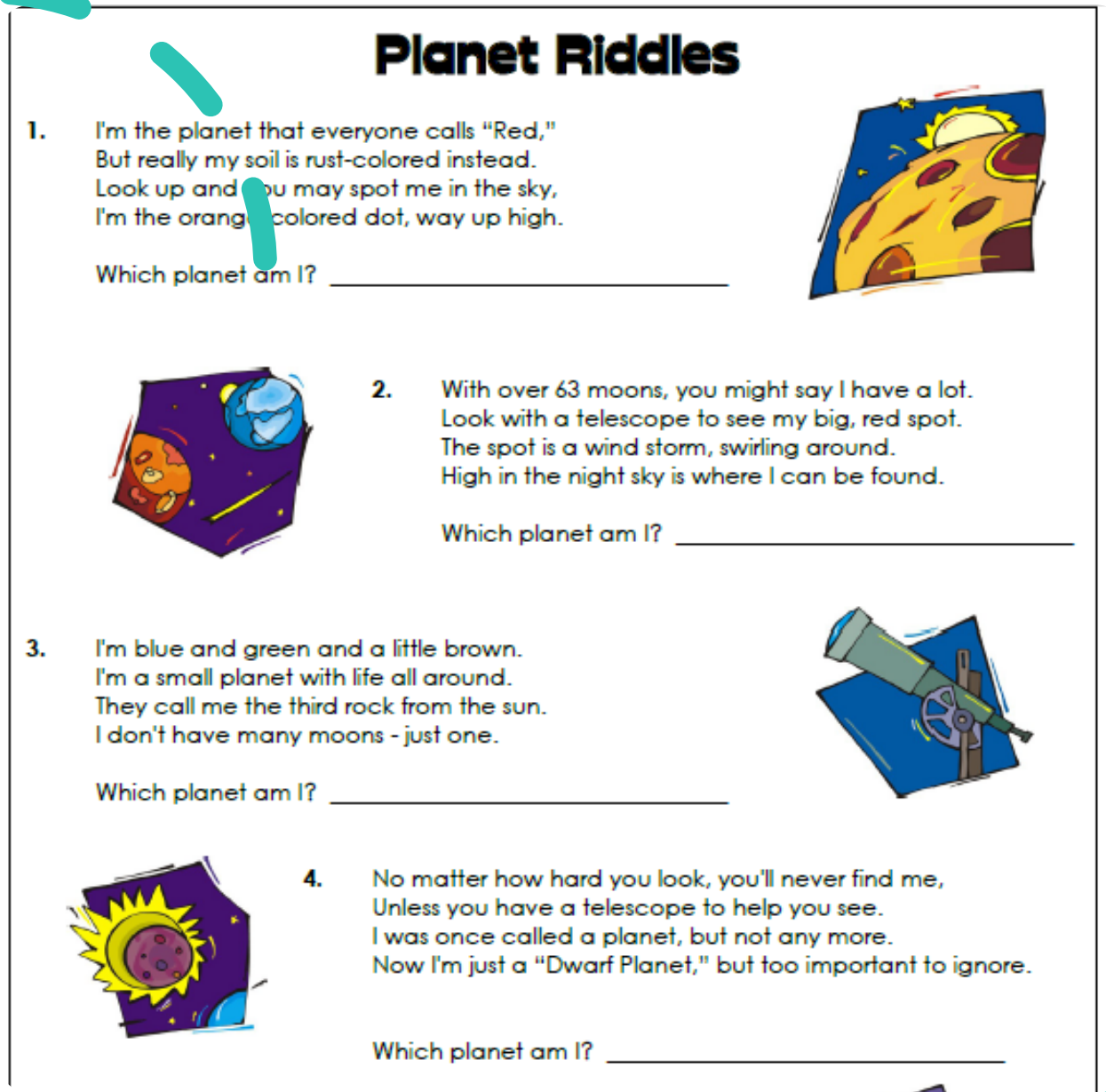
Weight vs Mass

- Link to PW2 – forces
- Link to PW1 - measurement

Planet Riddles

Literacy link

- https://www.superteacherworksheets.com/



Planet Riddles

1. I'm the planet that everyone calls "Red,"
But really my soil is rust-colored instead.
Look up and you may spot me in the sky,
I'm the orang colored dot, way up high.

Which planet am I? _____

2. With over 63 moons, you might say I have a lot.
Look with a telescope to see my big, red spot.
The spot is a wind storm, swirling around.
High in the night sky is where I can be found.

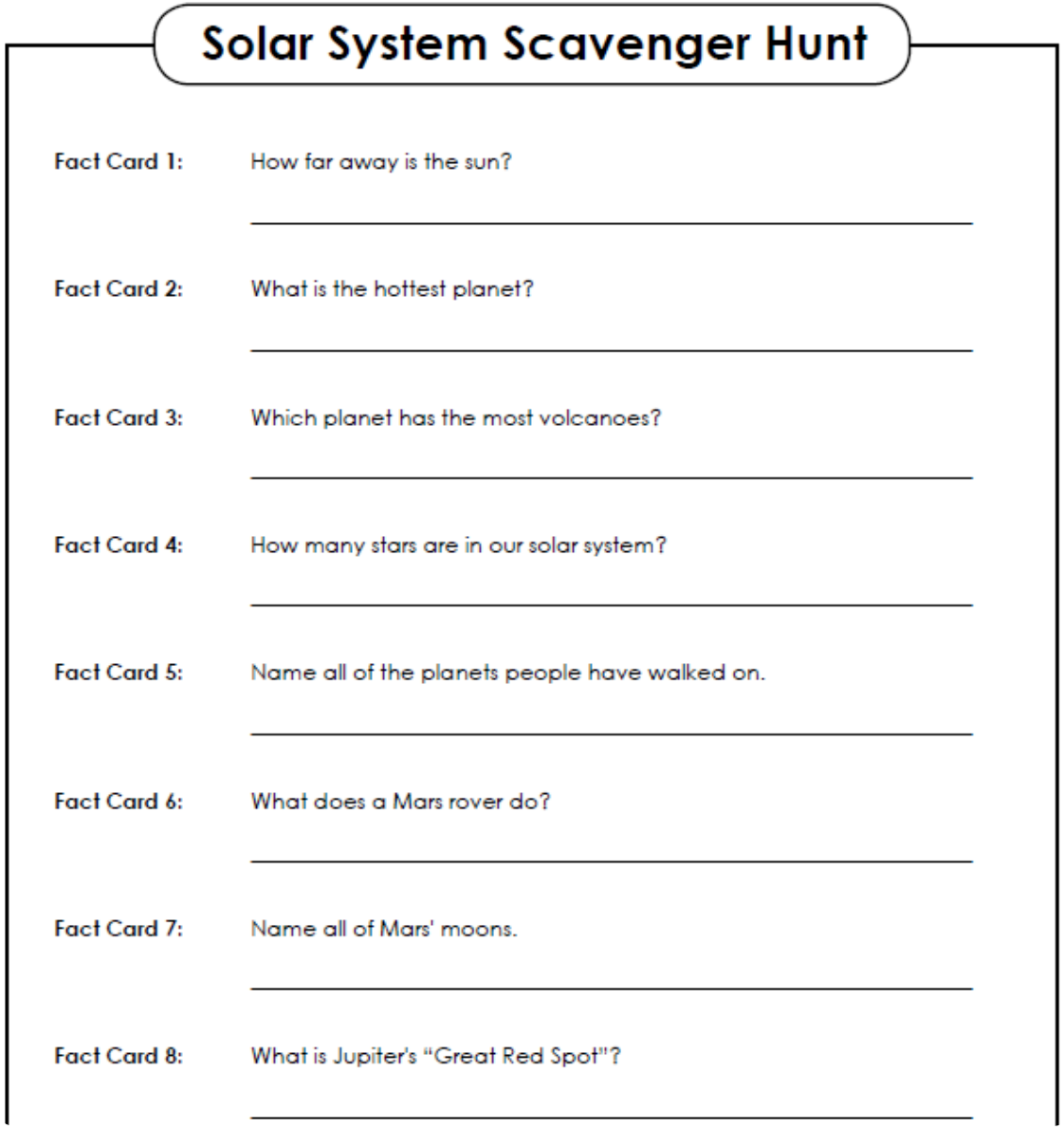
Which planet am I? _____

3. I'm blue and green and a little brown.
I'm a small planet with life all around.
They call me the third rock from the sun.
I don't have many moons - just one.

Which planet am I? _____

4. No matter how hard you look, you'll never find me,
Unless you have a telescope to help you see.
I was once called a planet, but not any more.
Now I'm just a "Dwarf Planet," but too important to ignore.

Which planet am I? _____



Solar System Scavenger Hunt

Fact Card 1: How far away is the sun?

_____

Fact Card 2: What is the hottest planet?

_____

Fact Card 3: Which planet has the most volcanoes?

_____

Fact Card 4: How many stars are in our solar system?

_____

Fact Card 5: Name all of the planets people have walked on.

_____

Fact Card 6: What does a Mars rover do?

_____

Fact Card 7: Name all of Mars' moons.

_____

Fact Card 8: What is Jupiter's "Great Red Spot"?

_____

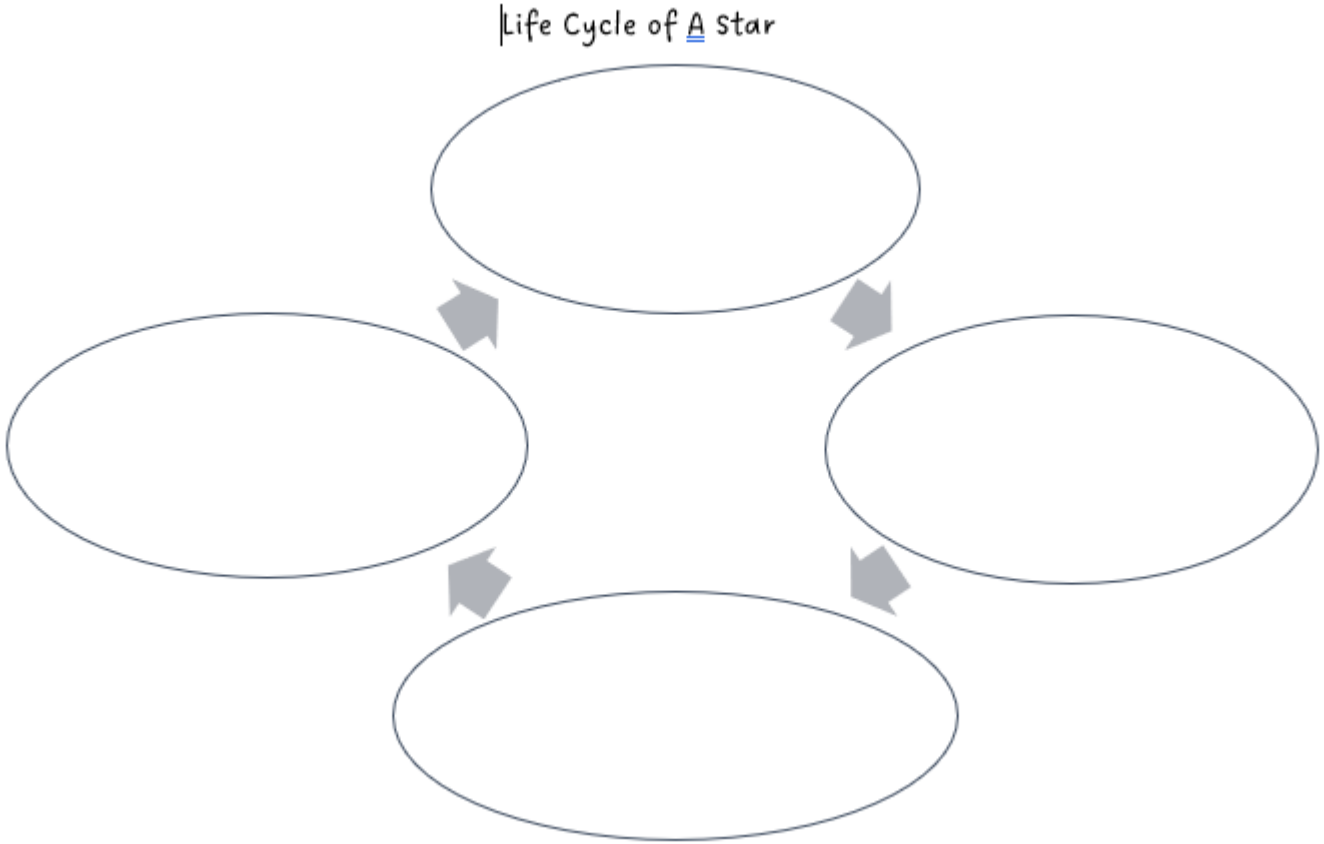
Scavenger Hunt

- https://www.superteacherworksheets.com/

Super Teacher Worksheets

Life Cycle of a Star

- Numeracy link

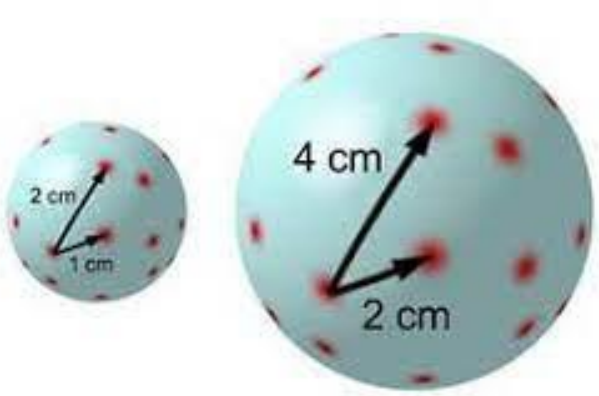


Nature of Science Investigation

- How the size of a meteorite effects the diameter of a crater formed
- How the distance of the meteorite effects the diameter of the crater formed
- Students identify independent, dependent and control variables
- Decide how to best display the data
- Use a vernier callipers to measure the diameter of the crater – measurement.
- https://www.geological-digressions.com/make-your-own-meteorite-crater-comparing-experiment-with-the-real-world/

ES2 – Origin of The Universe

Modelling the Big Bang Theory



Understanding Big Bang Theory and Its Evidence

Background Information

In the 1920s astronomer Edwin Hubble whom the Hubble Space Telescope is named after noticed something odd about the color of star light from distance Galaxies and it forever changed how we look at our universe today.

What he discovered is known today as **red shift** and was used to determine if the universe was static (not moving) or expanding. By carefully observing the light from galaxies at different distances from Earth, he determined that the farther something was from Earth, the faster it seemed to be moving away. This relationship with light and its stretching has become known as Hubble's Law, and it is just one piece of a big puzzle known as the Big Bang Theory.

Developed over many years and by many people, the theory states that about 15 billion years ago the universe was compressed into an infinitely small space, even smaller than an atom itself. At some point and for unknown reasons, it is believed the spec exploded in a sudden burst of energy and began to expand in all directions. Over time tiny bits of matter formed, hydrogen and helium to start, which clumped together to form the first stars and galaxies. It is believed that as a result of this explosion, all of these objects are still moving away from each other.

In this experiment, you'll create a simple model to learn how the universe expands over time to help explain Hubble's Law.

Balloon model of the Big Bang Theory Materials

- 1 balloon
- Pen or pencil
- Permanent marker
- Ruler
- Lab Sheet

Procedure

- Prepare the model of the universe. Dots represent galaxies in space. The balloon represents space.
- Start from the center and place the dots in varying intervals along the balloon. You can use the front and back of the balloon.

- The "M" represents the Milky Way Galaxy – the galaxy where we find Earth
- To model the universe expanding, have one student slowly fill the balloon with one breath.
- Observe what happens to the distance between the galaxies
- Measure the distance between the galaxies and record below
- Repeat the process for a total of 3 trials

Understanding Big Bang Theory Lab Sheet

Name: _____

Record your measurements below.

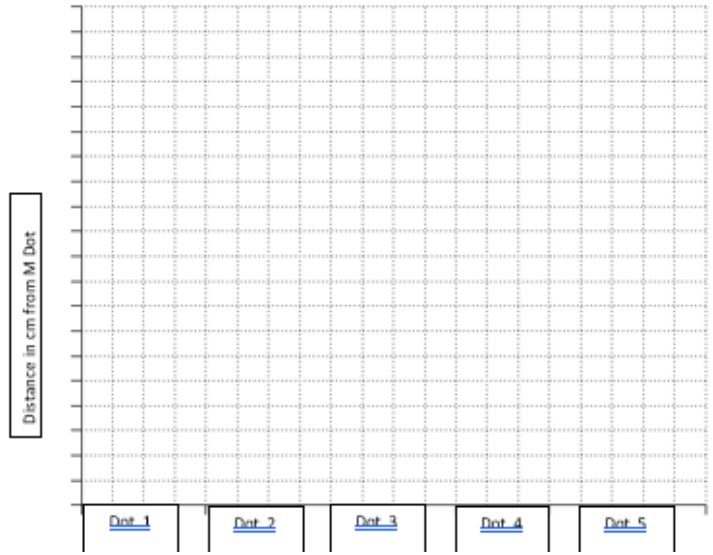
Distance From (M) "Milky Way" Galaxy in cm	Time 1 (upstretched)	Time 2	Time 3
Dot 1			
Dot 2			
Dot 3			
Dot 4			
Dot 5			

How did the distance from the Milky Way dot (M) to each of the other galaxies change each time you stretched the balloon?

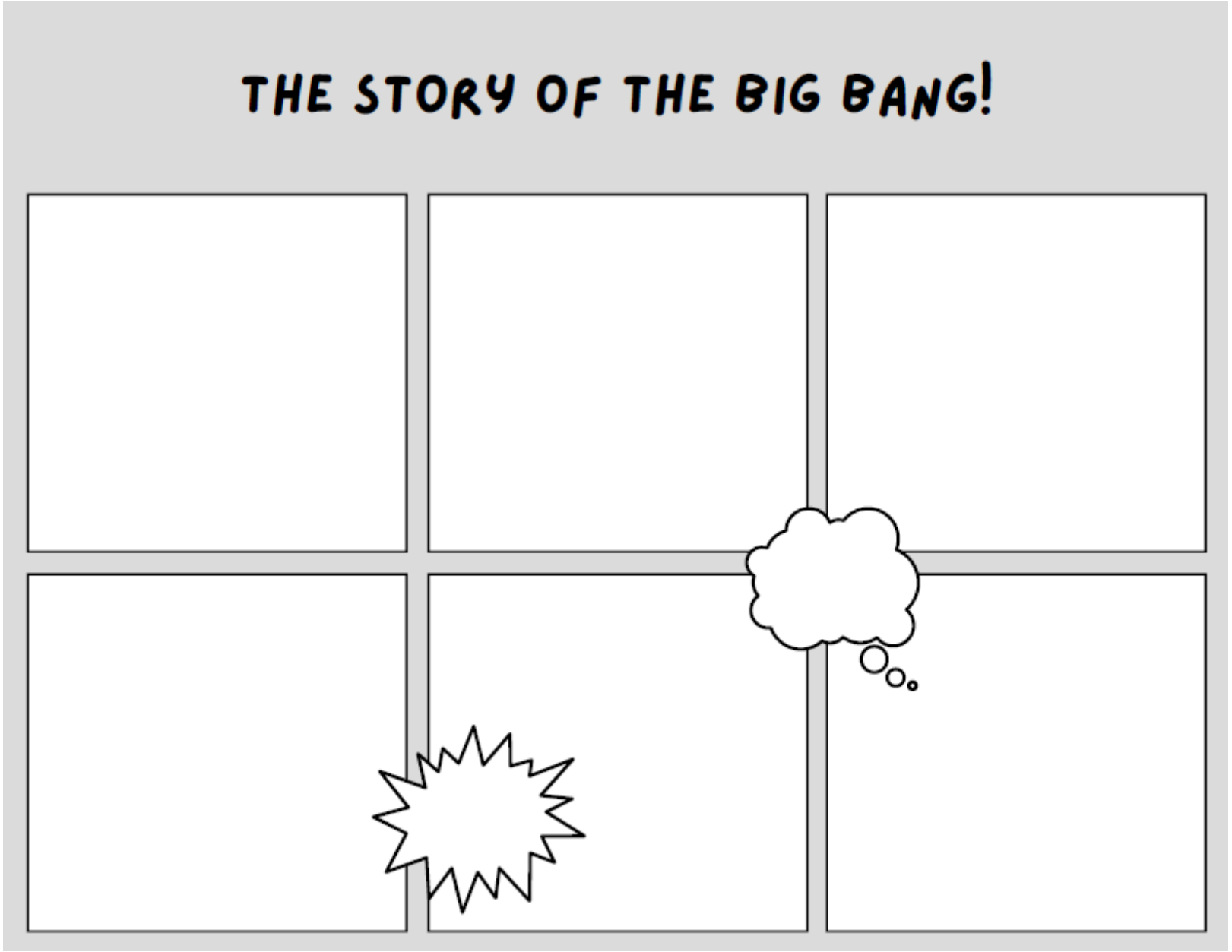
_____
_____
_____
_____

Bar Graph Color Key

- Time 1
- Time 2
- Time 3



Comic Strip Project



TBL- Team Based Learning

TBL Lesson Plan

Learning Outcome:

- Students should be able to explore a scientific model to illustrate the origin of the universe
- Students should be able to appreciate how scientists work and how scientific ideas are modified over time

At the end of this unit, students need to be able to:

Outline a model to explain the origin of the universe, list the events that took place and evidence for their chosen theory.

Past exam questions:

During your studies you learned about a scientific model that helps us understand the origin of the universe.

(a) **Name the model you studied.**

Outline two pieces of evidence that support this model.

Scientists estimate that our solar system began to form about 4.6 billion years ago.
Scientists also estimate that our universe formed 13.8 billion years ago.

Describe two things that scientists believe happened during the early formation of the universe – before the formation of solar systems.

Application Exercises:

There are many theories about how our universe began.

a) Name a model that you studied.
b) Create a time-line for the formation of the universe until the present day. In your timeline include 5 significant events with at least two time stamps.
c) Describe the evidence that supports your chosen theory.

Big Bang Theory MCQ

1. What scientific theory is commonly accepted as the explanation for the origin of the universe?

A) Stellar Evolution

B) Geologic Catastrophism

C) Big Bang Theory

D) Quantum Entanglement

2. According to the Big Bang Theory, the universe began as a:

A) Singularity

B) Massive black hole

C) A single star that exploded

D) Dense nebula

3. What is the estimated age of the universe based on current scientific understanding?

A) 4.6 billion years

B) 13.8 billion years

C) 1 million years

D) 100 billion year

4. In the context of the Big Bang Theory, the element hydrogen played a significant role in the early universe. What other element is believed to have formed shortly after hydrogen?

A) Oxygen

B) Carbon

C) Helium

D) Nitrogen

6. The formation of the solar system occurred approximately how long after the big bang theory?

A) First few seconds

B) 380,000 years later

C) 300 million years later

D) 9 billion years later

7. As the universe expanded, the temperature:

A) Cooled

B) Heated up

C) Stayed the same

D) Fluctuated up and down

8: Hubble's Law states that:

A) Galaxies are moving away from each other. The farther away a galaxy is the slower it is moving away from us.

B) Galaxies are moving away from each other. The farther away a galaxy is the faster it is moving away from us.

C) Galaxies are moving away from each other. The farther away a galaxy is the faster it is moving towards us.

D) Galaxies are moving towards each other. The farther away a galaxy is the slower it is moving towards us.

9. What holds the universe together?

A) The solar system

B) The Sun

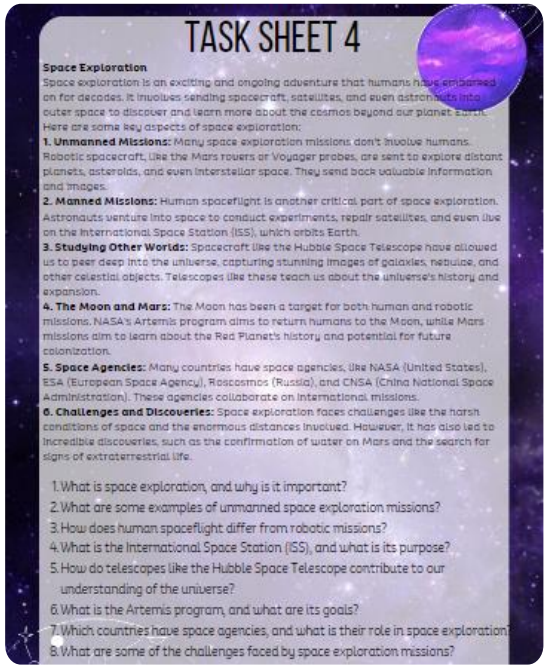
C) Gravity

D) A strong force

ES3 – Interpreting Data

Task Sheets

- Made using Chatgpt
- Pasted into a Canva template
- Students work in pairs to answers the questions based on the data presented.



TASK SHEET 4

Space Exploration

Space exploration is an exciting and ongoing adventure that humans have embarked on for decades. It involves sending spacecraft, satellites, and even astronauts into outer space to discover and learn more about the cosmos beyond our planet Earth. Here are some key aspects of space exploration:

1. Unmanned Missions: Many space exploration missions don't involve humans. Robotic spacecraft, like the Mars rovers or Voyager probes, are sent to explore distant planets, asteroids, and even interstellar space. They send back valuable information and images.

2. Manned Missions: Human spaceflight is another critical part of space exploration. Astronauts venture into space to conduct experiments, repair satellites, and even live on the International Space Station (ISS), which orbits Earth.

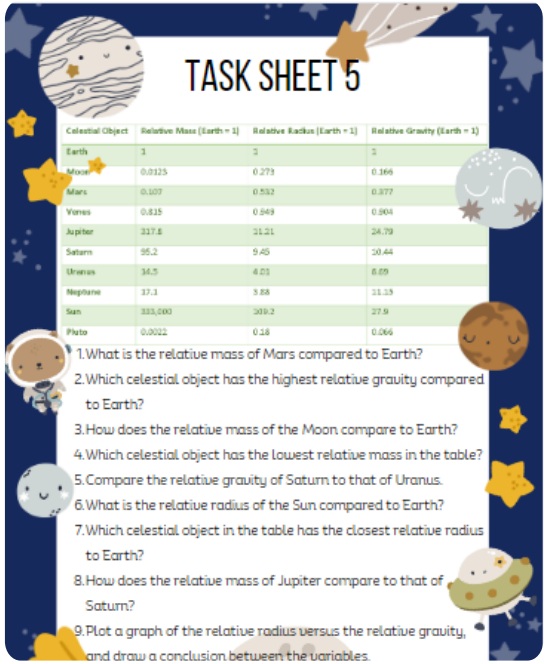
3. Studying Other Worlds: Spacecraft like the Hubble Space Telescope have allowed us to peer deep into the universe, capturing stunning images of galaxies, nebulae, and other celestial objects. Telescopes like these teach us about the universe's history and expansion.

4. The Moon and Mars: The Moon has been a target for both human and robotic missions. NASA's Artemis program aims to return humans to the Moon, while Mars missions aim to learn about the Red Planet's history and potential for future colonization.

5. Space Agencies: Many countries have space agencies, like NASA (United States), ESA (European Space Agency), Roscosmos (Russia), and CNSA (China National Space Administration). These agencies collaborate on international missions.

6. Challenges and Discoveries: Space exploration faces challenges like the harsh conditions of space and the enormous distances involved. However, it has also led to incredible discoveries, such as the confirmation of water on Mars and the search for signs of extraterrestrial life.

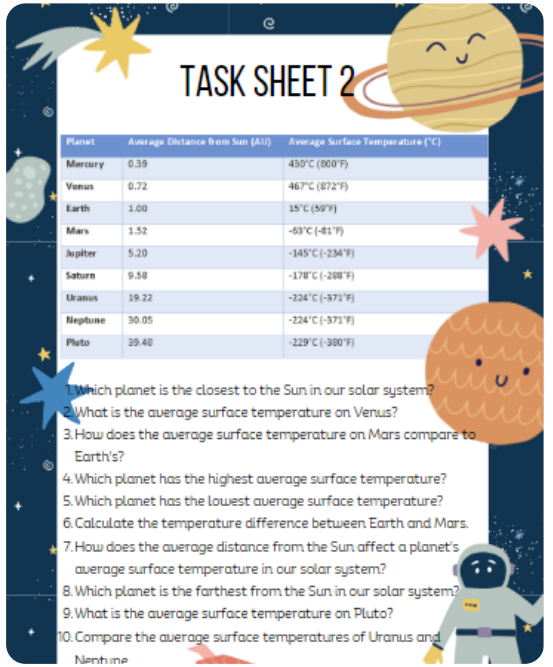
1. What is space exploration, and why is it important?
2. What are some examples of unmanned space exploration missions?
3. How does human spaceflight differ from robotic missions?
4. What is the International Space Station (ISS), and what is its purpose?
5. How do telescopes like the Hubble Space Telescope contribute to our understanding of the universe?
6. What is the Artemis program, and what are its goals?
7. Which countries have space agencies, and what is their role in space exploration?
8. What are some of the challenges faced by space exploration missions?



TASK SHEET 5

Celestial Object	Relative Mass (Earth = 1)	Relative Radius (Earth = 1)	Relative Gravity (Earth = 1)
Earth	1	1	1
Moon	0.0125	0.273	0.166
Mars	0.107	0.532	0.377
Venus	0.815	0.949	0.904
Jupiter	317.8	11.21	24.79
Saturn	95.2	9.45	10.44
Uranus	14.5	4.01	8.69
Neptune	17.1	3.88	11.15
Sun	333,000	109.2	27.9
Pluto	0.0022	0.18	0.066

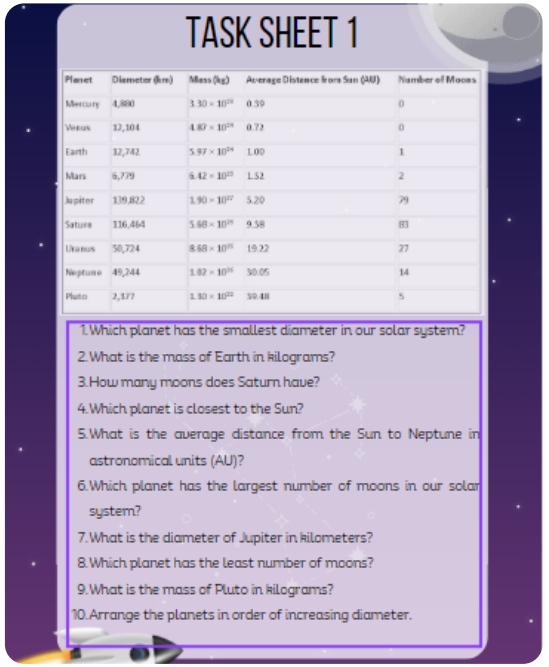
1. What is the relative mass of Mars compared to Earth?
2. Which celestial object has the highest relative gravity compared to Earth?
3. How does the relative mass of the Moon compare to Earth?
4. Which celestial object has the lowest relative mass in the table?
5. Compare the relative gravity of Saturn to that of Uranus.
6. What is the relative radius of the Sun compared to Earth?
7. Which celestial object in the table has the closest relative radius to Earth?
8. How does the relative mass of Jupiter compare to that of Saturn?
9. Plot a graph of the relative radius versus the relative gravity, and draw a conclusion between the variables.



TASK SHEET 2

Planet	Average Distance from Sun (AU)	Average Surface Temperature (°C)
Mercury	0.39	430°C (800°F)
Venus	0.72	467°C (872°F)
Earth	1.00	15°C (59°F)
Mars	1.52	-63°C (-81°F)
Jupiter	5.20	-145°C (-234°F)
Saturn	9.58	-178°C (-288°F)
Uranus	19.22	-224°C (-371°F)
Neptune	30.05	-224°C (-371°F)
Pluto	39.48	-229°C (-380°F)

1. Which planet is the closest to the Sun in our solar system?
2. What is the average surface temperature on Venus?
3. How does the average surface temperature on Mars compare to Earth's?
4. Which planet has the highest average surface temperature?
5. Which planet has the lowest average surface temperature?
6. Calculate the temperature difference between Earth and Mars.
7. How does the average distance from the Sun affect a planet's average surface temperature in our solar system?
8. Which planet is the farthest from the Sun in our solar system?
9. What is the average surface temperature on Pluto?
10. Compare the average surface temperatures of Uranus and Neptune.



TASK SHEET 1

Planet	Diameter (km)	Mass (kg)	Average Distance from Sun (AU)	Number of Moons
Mercury	4,880	3.30×10^{23}	0.39	0
Venus	12,104	4.87×10^{24}	0.72	0
Earth	12,742	5.97×10^{24}	1.00	1
Mars	6,779	6.42×10^{23}	1.52	2
Jupiter	139,822	1.90×10^{27}	5.20	79
Saturn	116,464	5.68×10^{26}	9.58	83
Uranus	50,724	8.68×10^{25}	19.22	27
Neptune	49,244	1.02×10^{26}	30.05	14
Pluto	2,377	1.30×10^{22}	39.48	5

1. Which planet has the smallest diameter in our solar system?
2. What is the mass of Earth in kilograms?
3. How many moons does Saturn have?
4. Which planet is closest to the Sun?
5. What is the average distance from the Sun to Neptune in astronomical units (AU)?
6. Which planet has the largest number of moons in our solar system?
7. What is the diameter of Jupiter in kilometers?
8. Which planet has the least number of moons?
9. What is the mass of Pluto in kilograms?
10. Arrange the planets in order of increasing diameter.

ES4 – Earth-Sun-Moon Relationship

Moon Phases

My Moon Diary

Look at the Moon each day for one month. Write down the date and time, and draw what the moon looks like. Shade the circle so that the section of the Moon that is illuminated remains. If you cannot see the Moon at all on a day, record this and also write down or draw why you could not see the Moon.

Date:________ Time:________	Date:________ Time:________	Date:________ Time:________	Date:________ Time:________	Date:________ Time:________	Date:________ Time:________
Date:________ Time:________	Date:________ Time:________	Date:________ Time:________	Date:________ Time:________	Date:________ Time:________	Date:________ Time:________
Date:________ Time:________	Date:________ Time:________	Date:________ Time:________	Date:________ Time:________	Date:________ Time:________	Date:________ Time:________
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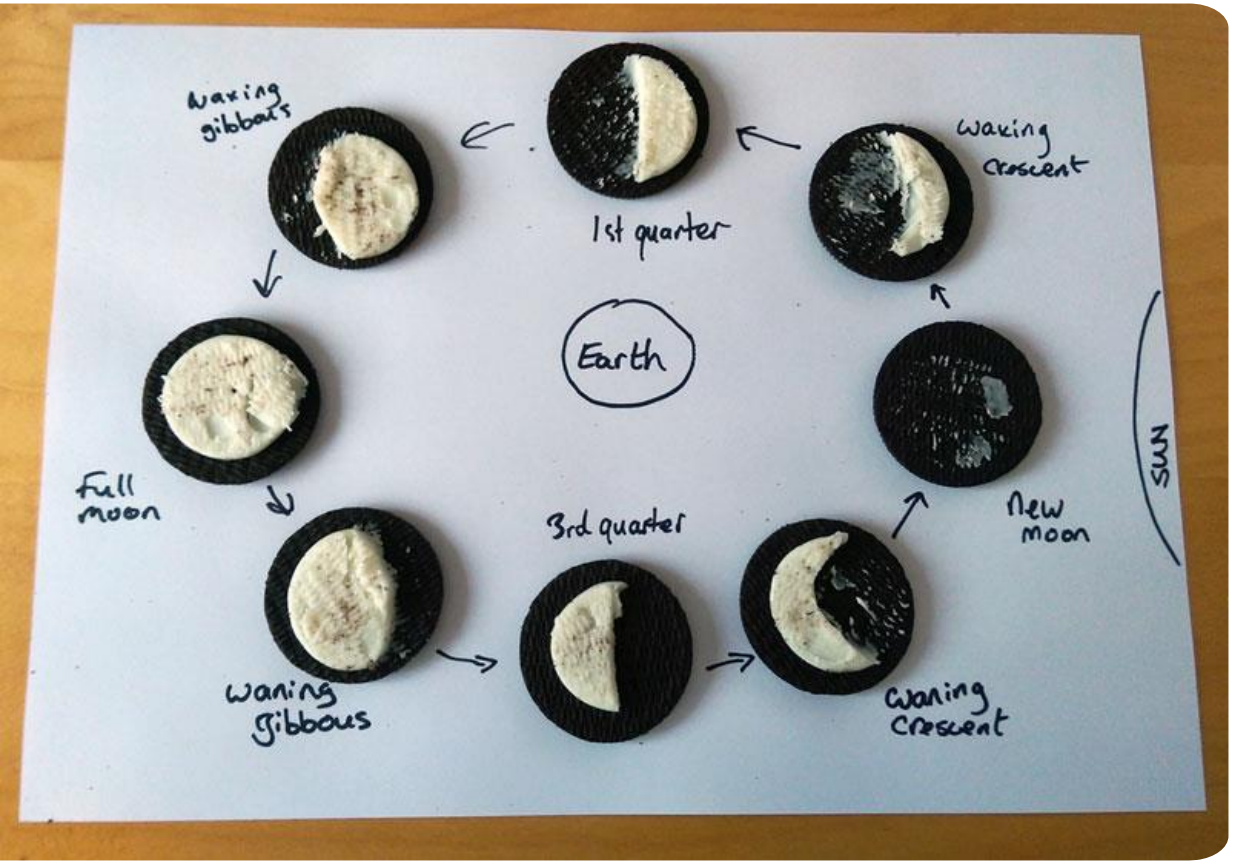
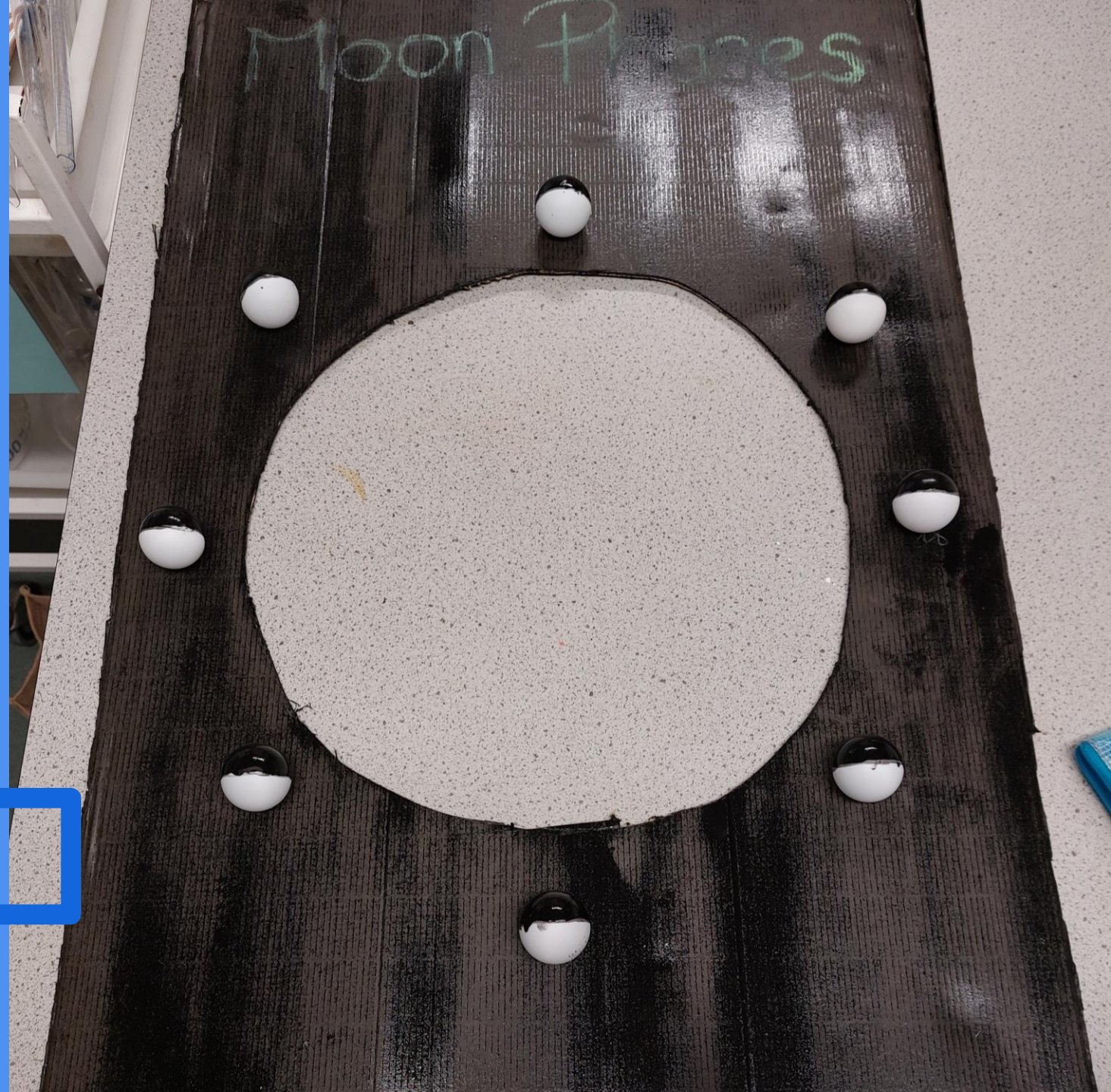


Modelling Moon Phases

Visualizing the Moon Phases



Model Making

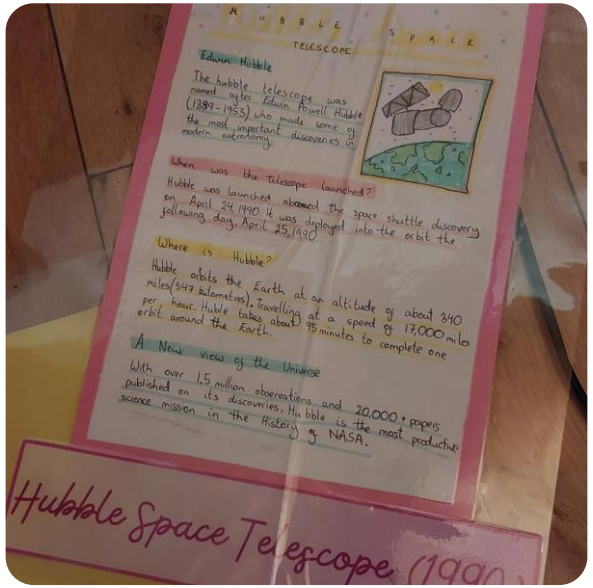
- Solar eclipse
- Lunar eclipse
- Day and Night
- Seasons
- Earth, sun and moon relationship

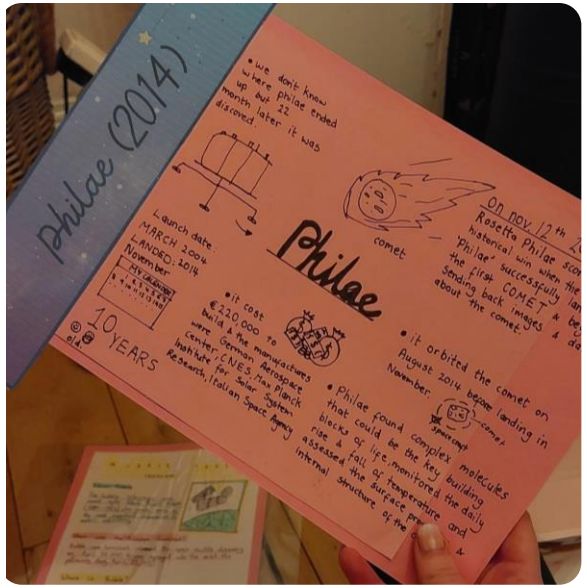
- Students must model one or more of the natural phenomena and record their explanations.

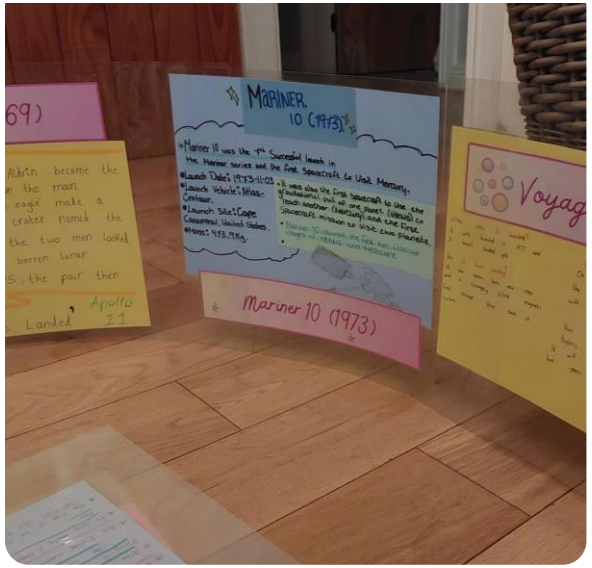
Show-me-boards

Brilliant for assessing student learning
Students given a diagram to draw at the start/end of each class.

ES8 – Space Exploration







Space Exploration – Timeline

- Assign each student a mission
- Research and make a poster outlining the mission
- Option to present
- Put all mission together to create a timeline for display

Space Mission Report

Title of Mission:

Submitted by:

Aim of the Mission

Background information about the mission

Benefits of Technology in Space Exploration

Discuss the future of space travel

Space Mission Report

Cost Involved

Time frame of Mission

Space Mission Report

Benefits of Space Travel

Hazards of Space Travel

Results of the Mission

Moon Landing Challenge

- JCT website
- https://drive.google.com/file/d/178rrnhZixLwoh0GphaVjqrgvUxaOiyUT/view?fbclid=PAAabrTnk0XvbiqKIBUYYZnLmifWX6SH0jVzDZwfd0LKeYYiph3nkKjQriHtc

Moon Landing Ranking Chart

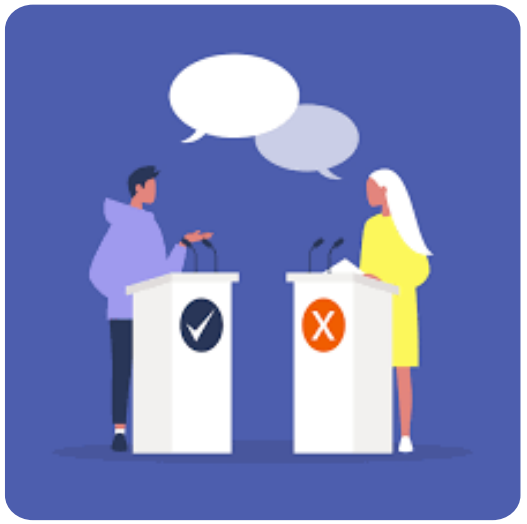
My ranking	Salvaged items	Team ranki
	Box of matches	
	Food concentrate	
	16 metres of nylon rope	
	Parachute silk	
	Two 0.45 calibre pistols	
	One case of dehydrated milk	
	Two 50 kg tanks of oxygen	
	Stellar map	
	Self-inflating life raft	
	Magnetic compass	
	20 litres of water	
	Signal flares	
	First aid kit containing injection needles	
	Solar powered FM receiver	
	Portable heating unit	
SCORE		**SCORE**

NASA Expert Analysis

Item	NASA Ranking	NASA Reasoning
Box of matches	15	Virtually worthless -- there's no oxygen on the moon to sustain combustion.
Food concentrate	4	Efficient means of supplying energy requirements.
16 metres of nylon rope	6	Useful in scaling cliffs and tying injured together.
Parachute silk	8	Protection from the sun's rays
Two 0.45 calibre pistols	11	Possible means of self-propulsion
One case of dehydrated milk	12	Bulkier duplication of food concentrate
Two 50 kg tanks of oxygen	1	Most pressing survival need (weight is not a factor since gravity is one-sixth of the Earth's - each tank would weigh only about 490 Newtons on the moon.)
Stellar map	3	Primary means of navigation - star patterns appear essentially identical on the moon as on Earth.
Self-inflating life raft	9	CO_2 bottle in military raft may be used for propulsion.
Magnetic compass	14	The magnetic field on the moon is not polarised, so it's worthless for navigation.
20 litres of water	2	Needed for replacement of tremendous liquid loss on the light side.
Signal flares	10	Use as distress signal when the mother ship is sighted.
First aid kit containing injection needles	7	Needles connected to vials of vitamins, medicines, etc. will fit special aperture in NASA space suit.
Solar powered FM receiver	5	For communication with mother ship (but FM requires line-of-sight transmission and can only be used over short ranges.)
Portable heating unit	13	Not needed unless on the dark side.
SCORE		**SCORE**

Debate

- Ethics surrounding space exploration
- Assign a for and against team
- Give student 15 minutes to research and document their main points



MarsBase – Video

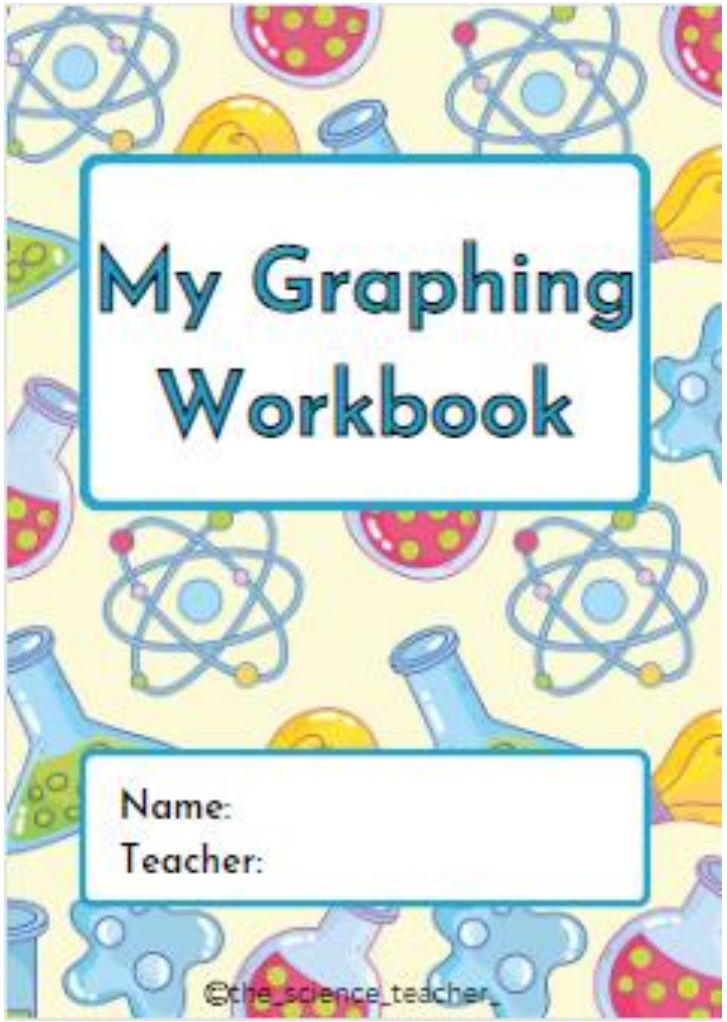
- Name one thing this video assumes will have already happened before we build a Marsbase.
- How efficient is solar power on Mars compared to Earth?
- Why wont geothermal power work on mars?
- How dense is the Martian atmosphere compared to Earth's?
- What is the main component of the Martian atmosphere?
- How much of the radiation from space reaches the Martian surface?
- What materials could be used to cover the habitats to protect from radiation?
- Where on the planet should the base be for easy access to water?
- What is the pH of the Martian soil?
- What element is missing from the Martian soil that plants nee
- Name two health impacts from living in Martian gravity.
- How can this process be slowed down?
- Name two things the base will need from Earth.
- How often do the orbits of Earth and Mars link up?

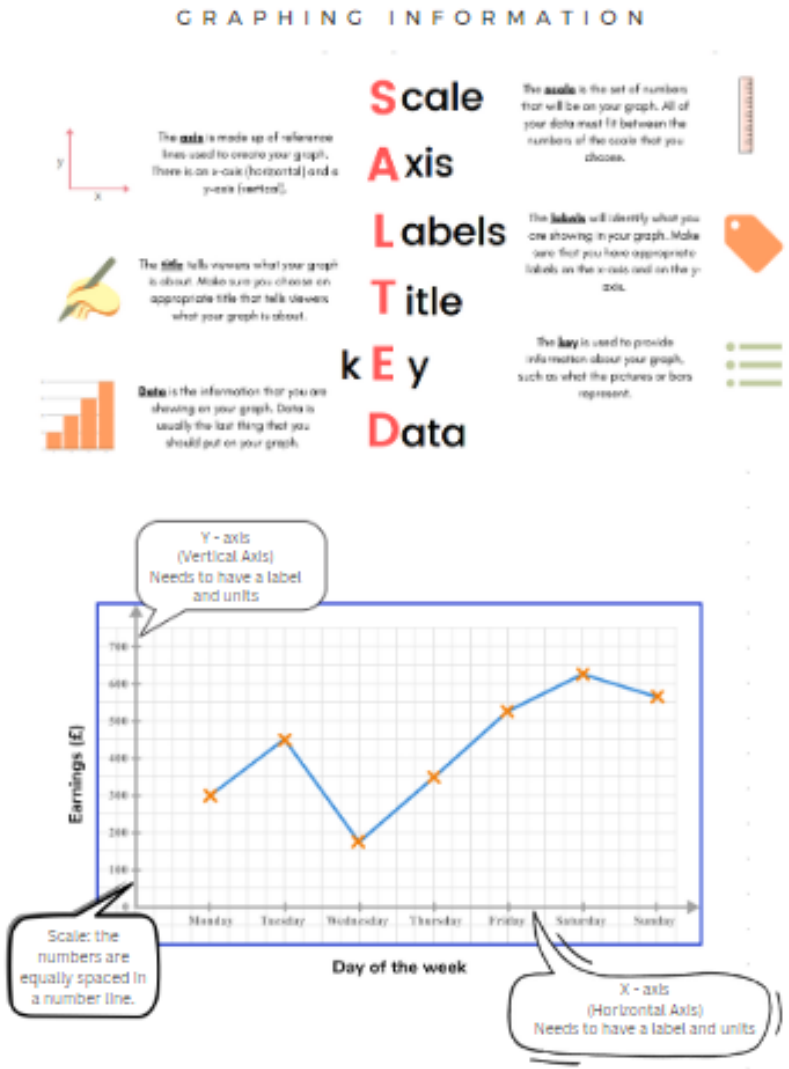
https://www.youtube.com/watch?v=uqKGREZs6-w

Heads Up Activity – key words

- Revision for units of learning
- In pairs students complete tasks
- Level of difficulty increases through tasks

Graphing


My Graphing Workbook
Name:
Teacher:
@the_science_teacher_


GRAPHING INFORMATION
Scale
Axis
Labels
Title
kEy
Data
Y - axis (Vertical Axis) Needs to have a label and units
Earnings (£)
Day of the week
Scale: the numbers are equally spaced in a number line.
X - axis (Horizontal Axis) Needs to have a label and units


Graph Number 3
To the right is a table of data representing the average surface temperature of the planets and their approximate distance from the sun.
Construct a graph to show the relationship between the distance from the sun and the average surface temperature of each planet.
Describe the relationship between the two variables in the graph above:

Thank you

Any questions....