Exhibit-based Worksheet

SPACE- Black Holes & Gravity


It's not really a hole! Black holes are invisible masses.
We know they exist from the way they affect nearby dust, stars & galaxies.

Black holes are burned out or dead stars. When this happens, gravity becomes so strong that the core of the star crushes - its mass compressed into a very small area.

Check out the **Black Hole** exhibit:

1. Roll a coin from the top of the table. What do you see?
2. Observe the orbit/path taken by the coin.

What do you think is the shape of Earth's orbit around the Sun? Can you explain?

What do you think? [**√** your choice]

• What causes stuff to enter a black hole & not come out?	Suction? Gravity?
• We can detect a black hole by looking at the behaviour of objects around it.	True? False?
• According to Sir Isaac Newton, gravity is a force of attraction that exists between any two: masses, bodies or particles. E.g. apples that fall to the ground & planets that orbit the sun.	True? False?

Discussion :

Why doesn't the International Space Station (ISS), space shuttle or satellites fall into Earth?
[Hint: gravity, speed, mass, distance from Earth***]***

[Teachers/parents guidance may be required]

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DO YOU KNOW?

1. Black holes are made up of 3 parts:

Outer Event Horizon	Inner Event Horizon	Singularity
• Very outer layer • Gravity is not as strong • Can feel the gravity but will not become trapped	• Middle layer - region around the singularity • Much stronger gravity • Nothing can escape	• Center of a black hole • Means collapsed or squashed up star • Strongest gravity

2. The black hole continues to grow by absorbing mass from its surroundings (other stars & black holes) even after it is formed.
3. A black hole becomes a 'supermassive black hole' after it has absorbed enough materials - equivalent to over one million solar masses.
4. Scientists believe that supermassive black holes exist in the centres of most galaxies, including the Milky Way.

TO EXPLORE

How a Black Hole is Formed - the end state for a star

<u>What you need</u>

- A balloon
- Two sheets of aluminium foil (each about 30 cm square)
- A pin for popping the balloon

<u>What to do</u>

- Inflate the balloon & tie the opening.
- Cover the balloon with at least 2 layers of aluminum foil to represent a star.
- Lightly push on the surface of the covered balloon with your hands to stimulate the effect of gravity.
- Now pop the balloon with a pin to remove the air pressure inside. Ensure the foil retains its shape
- Finally, collapse the balloon star with your hands. The "gravity pull" represented by your hands collapses the star & creates a black hole.

<u>What is going on</u>

- Stars constantly battle the effects of fusion, pressure & gravity.
- Large amounts of mass enable a star to collapse a body into a point.
- Gravity will eventually overwhelm the star and the end state of a star's collapse is determined by the original mass of the star.

Watch these!

Travel Inside a Black Hole : https://www.youtube.com/watch?v=3pAnRKD4raY
Gravity - From Newton to Einstein - The Elegant Universe : https://www.youtube.com/watch?v=4yyb_RNJWUM
Gravity Ink. - Einstein's Gravity (Episode 1) : https://www.youtube.com/watch?v=a_zMKF66tzo

***[Keywords:** gravity, black holes]*

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