

Lesson Plan

NEUROHEADWAY

Neuroscience Into Education

Space Flight – Parts of a space shuttle

Learning Objectives

- What is a space shuttle?
- What are the different parts of a space shuttle?
- What are the functions of these parts?
- How does the propulsion system work?

Lesson Plan

Slide	Topic	Description	Time
1	Introduction to space flight	Introduction to space flight	2
2	Recap	Recap of module 5.	5
3	Introduction to space shuttle	What is a space shuttle?	3
4-5	Components of space shuttle	Description of different parts and systems that comprise a space shuttle.	10
6	Activity 1	Activity to classify parts of a space shuttle	10
7 - 8	Propulsion System	How does propulsion work?	10
9	Activity 2	Design your rocket.	10
10	Home Assignment	Make your own rocket	4
11	Summary		5
12	Next module	Introduction to the next module	1

Slide 1

Exploration of space has long fascinated us! All those countless stars, planets and vast empty space. It was only in 1961 that Yuri Gagarin, a Russian cosmonaut entered outer space for the first time.

The cosmonaut went in space shuttle. A special vehicle designed to take us into outer space. The figure shown is a NASA Space shuttle launching into outer space.

We will look at space flights and learn about their components in this module.

Slide 2

Same as in slide

Slide 3

So, what is a space shuttle? *Teacher may encourage students to give answers.*

It is a rocket-launched spacecraft able to land like an unpowered aircraft, used to make repeated journeys between the earth and space.

What is their purpose?

....as written in slide

Some agencies that manage space flight and space exploration missions are NASA, ESA and ISRO.

Slide 4 – 5

What all parts and systems are there on a space shuttle.

A space shuttle comprises of several principal systems. They are,

As written in the slide.

Physically, the space shuttle is made up of three primary parts.

1. Orbiter – The actual shuttle that carries astronauts and equipment. *Teacher may show on the figure*

2. External Tank – A super large fuel tank.

3. Rocket Booster – A rocket that launches the space shuttle into space.

All of them together comprise a space shuttle. Perhaps you can design a space shuttle of your own one day!

Slide 6 - Activity 1: Identify Parts

Use the picture to classify different parts under respective system categories that we learnt about in the previous slide.

Slide 6 –

We saw that stiffened plate had a much higher bending strength as compared to a simple plate. Next question is which material should we choose? We saw a lot of options that fit our criteria. Two most prominent material groups are composites and metals.

Let us see how they compare against each other.

We can see that composites like high strain graphite clearly outperform metals. They have a specific strength of 1.48 and a specific modulus (Stiffness) of 0.19. Titanium on the other hand was the best performer for metals with 0.21 as specific strength and 0.025 as specific modulus (Stiffness).

From the table, composites can be seen as a clear winner. However, cost of composites can be quite high. Also, not compared here are metal alloys, which have much better properties than metals alone.

Slide 7 – 8

How does a rocket go into space?

It does so with the help of a propulsion system.

If you recall your activity in module 2 where you tried to throw a crumpled paper high up. We observed that the paper eventually came back down. This happened because of the paper's weight being pulled by gravity. We will learn about gravity a bit more in the next module.

But the point to take from the experiment is, if you can keep applying the throwing force on the paper ball, it will keep going up. We call this force thrust.

The rocket will go up as long as Thrust is greater than the weight of the rocket.

Rockets generate thrust by burning fuel.

Teacher can explain text in the slide in addition to this.

Slide 9 – Demonstration and Activity 2

Materials

- A two litre bottle of a diet aerated drink. Make sure it is warm.
- One packet of Mint Mentos.
- One roll of masking tape
- Protective Goggles
- Open environment

Procedure

- Make a stack of mentos between masking tape as shown below,



- Open the coke bottle and stick the mentos stack to the cap on the inside.
- Put the screw back on the coke bottle.



- Shake the bottle
- Launch the bottle by throwing the bottle high in the air and letting it drop.



<https://www.wikihow.com/Make-a-Diet-Coke-and-Mentos-Rocket>

The activity demonstrates how propulsion system generate thrust for the space shuttle to be launched in space.

Slide 10

Home assignment

Slide 11

Summary

Slide 12

Intro to next module - Space Flight – Parts of a space shuttle

Power point Example

NEUROHEADWAY

Neuroscience Into Education



Space Flight – Parts of a Space Shuttle

Aerospace Engineering

Recap

In the previous modules, we learnt about aircrafts, their structure, the materials that are used in making them, their design and flight dynamics.

The following modules introduce space ships, their components, effect of gravity, means to escape gravity and spaceship structures.

In this module we will look at different parts of a spaceshuttle and their respective functions.

What is a space shuttle?



It is a rocket-launched spacecraft able to land like an unpowered aircraft, used to make repeated journeys between the earth and space.

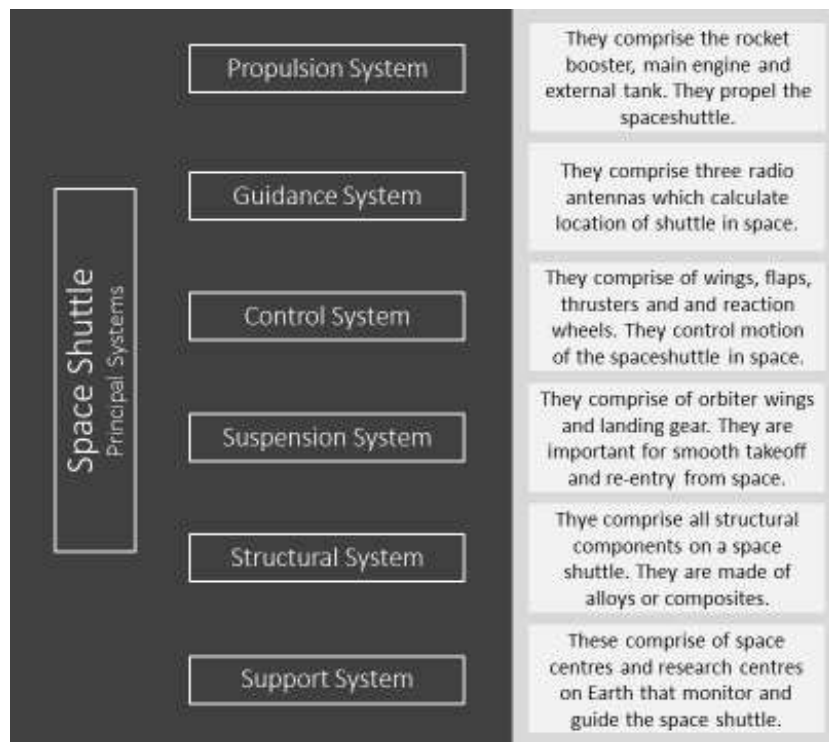
Space shuttles can carry people into space, carry satellites that orbit around the earth and carry building parts which can be assembled in space to form large structures like the International Space Station.



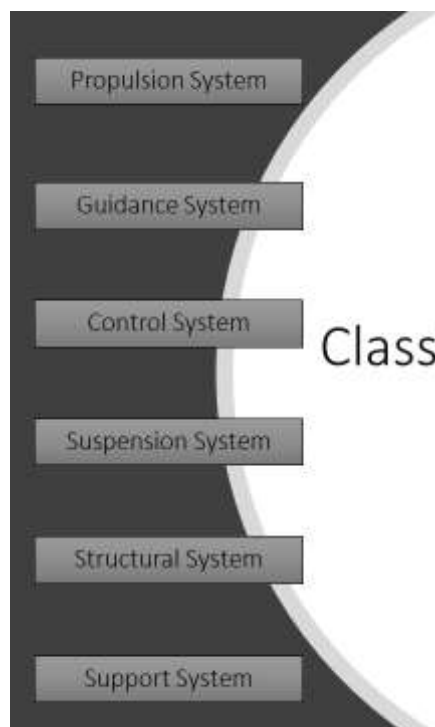
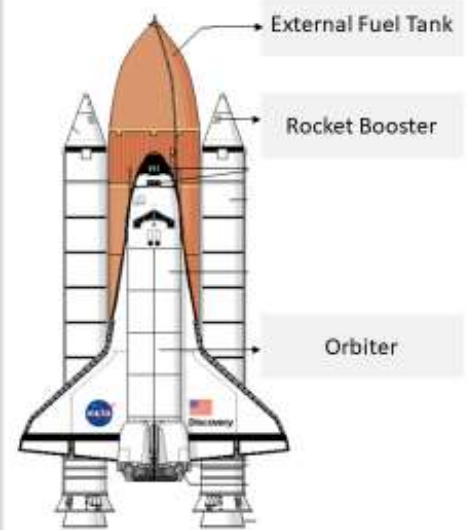
The space shuttle is also like a laboratory. Astronauts do experiments here in zero gravity.

Space shuttles are constructed and managed by space agencies. E.g., NASA, ESA, ISRO

What is a space shuttle
made of?

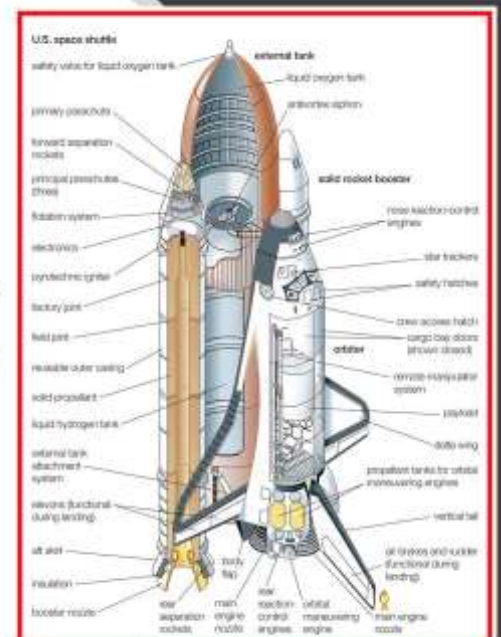


Space Shuttle Primary Parts



Activity 1

Classify parts under one of the six systems



Propulsion System

How does it work?



The rocket boosters have a substance known as the propellant (fuel). This substance burns and releases hot gases from the bottom.

The thrust generated by burning of propellant causes the rocket to go up.

Rocket acceleration depends on,

- Thrust from rockets
- Weight of space shuttle.

Hence, for a rocket to fly we need,

Thrust > Weight

Once the propellant is depleted, the rocket booster tanks and external fuel tank detach from the rocket to decrease weight.