

# Mission Design – Shuttle

**Grade Level:** 8  
**Time Required:** 4 - 5 class periods

<b>Suggested TEKS:</b>	
Science -	8.3
<b>Suggested SCANS</b>	
Interpersonal. Teaches others.	
<b>National Science and Math Standards</b>	
Science and Technology, Computation, Measurement, Communicating	

## Countdown:

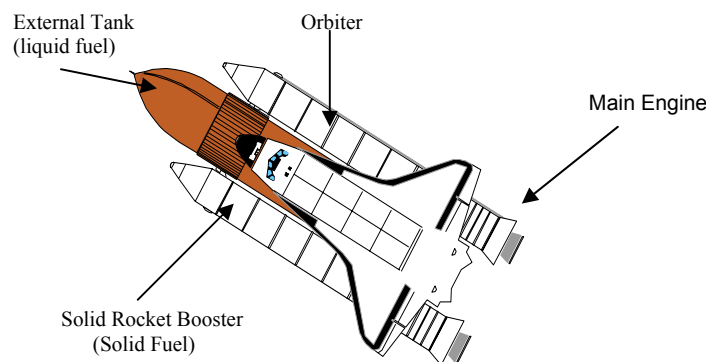
Inexpensive materials to build a model shuttle -- student choice  
Suggestions: Pringles cans, Oatmeal cartons, plastic soda bottles in various sizes  
1 Venn Diagram per student

## Ignition:

The space shuttle is a spacecraft that can be used for many flights into space. It has four major parts:

- 1) orbiter
- 2) 3 main engines - burn a mix of supercooled liquid oxygen and hydrogen
- 3) external tank
- 4) 2 solid rocket boosters - each carry about 500 tons of fuel which create 6.6 million pounds of thrust.

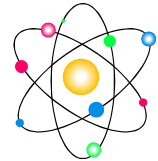
Only the orbiter and the main engines go into orbit around the Earth. The other two parts, the rocket boosters, and the external fuel tank, are only for liftoff and powered flight. See diagram below.



The space shuttle has three distinct modes of flight. Following is a brief flight description.

1. At liftoff, weighing about 2,200 tons, the shuttle soars **vertically** into the sky. About two minutes later, the reusable boosters burn out, are jettisoned, and fall to the ocean below. Nine minutes into the flight, the external fuel tank runs dry and is released. It burns up as it falls back through the atmosphere.

2. In orbit 175 miles above the Earth, the craft flies **upside down**, with its cargo doors opened toward Earth, unless it is launching a satellite. This also allows the heat inside the crew's living quarters to radiate away.
3. To prepare for landing, the shuttle -- now weighing about 94 tons -- is turned so that its engines face **in the direction of its flight**. The engines are fired in short bursts, slowing the craft from 17,000 to 8,000 miles per hour. The craft is then turned again so that **its bottom is toward the ground**, and it enters the atmosphere. Cruising earthward as a glider, it touches down at about 200 miles per hour.



### Liftoff:

#### A. Shuttle Construction

Explain to the students that they will plan, design, and build a model of a shuttle. Their shuttle will consist of three areas:

1. cockpit - on the top level, with built-in storage underneath
2. shuttle bay - contains the experimental stations and the living areas
3. cargo area - houses the bathrooms and storage

Approximate measurements should be 8 feet by 16 inches for the cargo and cockpit area, 8 feet by 11 inches for the shuttle bay.

#### B. Written plans

Ask a recorder to write down the following, as the initial part of the procedure. Students should brainstorm their ideas together, and provide the writer with the necessary information.

1. Detailed sketch or blueprint of the model (a 3D small model could be made).
2. List of materials (inexpensive) to be used.
3. Step-by-step instructions for construction of the model.
4. Descriptions of equipment, i.e., cameras and velcro (attached to the walls) to be added to the basic model.

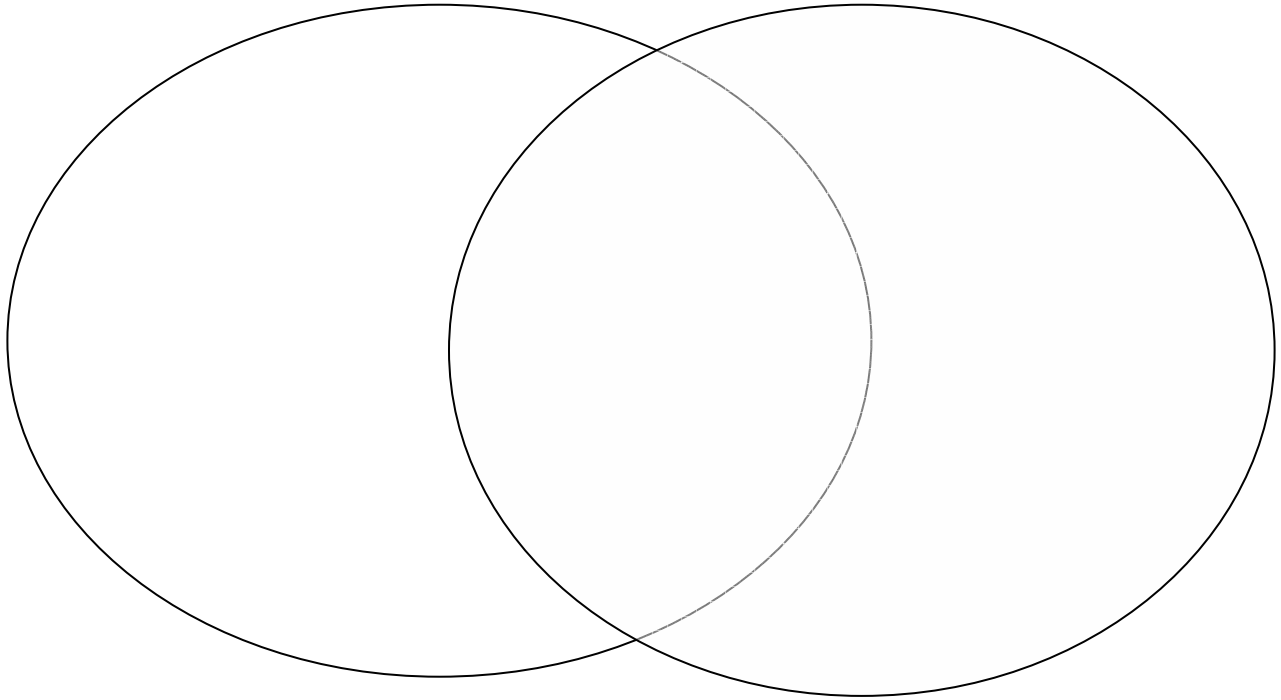
#### C. Analysis

Ask students to make a Venn diagram to compare and contrast the inside of a real space shuttle with the student shuttle model. Ask students to analyze their model, and determine how they might change it to make it more efficient and more realistic.

## Venn Diagram

**Space  
Shuttle**

**Student  
Shuttle**



### More Ideas ...

- Make a display for the school or public library.
- Donate a space shuttle to a pre-school class.
- Develop an information sheet from notes on how to build a Space Shuttle.
- Make a shuttle with NASA:  
<http://spacelink.nasa.gov/Instructional.Materials/NASA.Educational.Products/Space.Shuttle.Glider/Space.Shuttle.Glider.pdf>