DESIGNING A CREW EXPLORATION VEHICLE

Student Section Student Name _____

In this lesson, you will design and build a model of a Crew Exploration Vehicle (CEV).

During this lesson, you will

- design a model CEV for future space exploration.
- construct a model CEV from the created design.
- develop a conclusion based upon the results of this design.
- compare your results to class results looking for patterns.

Problem

Can I design and build a Crew Exploration Vehicle (CEV) that will be a model for future space exploration?

Observation

The space shuttle is the world's first reusable spacecraft and the first spacecraft in history that can carry large satellites both to and from orbit. The space shuttle is designed for low-Earth orbit and cannot voyage to the moon or to Mars. Since we hope to send people to these places soon, we are in the process of designing a new space vehicle.

Currently, NASA scientists and engineers are working on a space vehicle that can take astronauts to the moon, Mars, and beyond. The spacecraft in current design is called the Orion. It will be the new Crew Exploration Vehicle (CEV). The CEV is a vehicle that will be used to transport human crews beyond low-Earth orbit and back to Earth again. The Orion's shape is similar to the Apollo only larger. It is schedule to fly its first mission to the science research lab in space called the International Space Station by 2014 and to the moon by 2020.

Development of the CEV will take place in stages and will require numerous multifunctional support systems. Support systems will include launch vehicles, in-space transportation, navigation and communication, life support, extravehicular activity (the ability to leave the spacecraft), power sources, control system and mission operations support.

In this lesson, you will design and build a model CEV using recyclable materials.

Use the first column of this KWL chart to organize your observations about spacecraft design. Brainstorm with your group what you want to know about spacecraft design, then list in the second column of this KWL chart.

Materials

Per group

- an assortment of household recyclables such as paper plates, plastic containers, milk jugs or cartons, craft sticks, etc.
- assorted fasteners such as tapes, brads, staples, rubber bands
- graph paper
- scissors
- permanent markers

Safety

- Review classroom rules.
- Review lab safety rules.
  - Watch for problems and report unsafe situations immediately.
  - Handle equipment with care.
  - Clean up work area.
  - Dispose of waste properly.

KNOW	WANT TO KNOW	LEARNED

Hypothesis

Based on your observations, answer the "problem question" with your best guess about what will happen. (Can I design and build a Crew Exploration Vehicle (CEV) that will be a model for future space exploration?) Your hypothesis should be written as a statement.

My hypothesis: _____

Test

1. Design your CEV on graph paper. Be sure you include these items:
   - a place for the crew
   - fuel tank
   - rocket boosters
   - storage space for life support (air, water, food and waste)
   - storage place for cargo
   - power source (fuel cells) ex. solar arrays
   - antenna
   - landing system
   - other items if you can explain why

   Make sure your drawing is complete:
   - label all parts
   - create a materials list
   - name the spacecraft
   - list all group members names
2. As a group, present and explain your drawing to your teacher and classmates. You may make changes based upon their suggestions.
3. Gather building materials. You may want to use paper towel rolls, yogurt cups, empty 2-liter bottles, jar lids, wire, empty cereal boxes, etc.
4. **Collect and record data** by making notes on your design paper as you build. Indicate changes in your plans.
5. When your CEV is complete, write a short statement to convince NASA that your CEV is worthy of future space exploration.

Study Data

When you have completed your CEV, study your design paper and notes. Make improvements to your CEV. After all improvements are made, study the data and answer the following questions.

1. Did your CEV design change as you built your model? How? Why?

2. Why was your drawing helpful? How would your drawings and notes help other CEV builders?

3. Does this data support your hypothesis? Why or why not?

4. Compare all of the CEV models in your class to look for similarities and differences.

5. Based on what you did in this CEV design activity, what would your recommendations be to NASA on designing a new CEV? Why?

Conclusion

- Update the LEARNED column in your KWL chart.
- Restate your hypothesis and explain how the results do, or do not, support your hypothesis.

Scientific Investigation Rubric

Activity: DESIGNING A CREW EXPLORATION VEHICLE

Student Name _____ Date _____

Performance Indicator	0	1	2	3	4
The student developed a clear and complete hypothesis.					
The student followed all lab safety rules and directions.					
The student followed the scientific method and the design process.					
The student recorded all data on the data sheet and drew a conclusion based on the data.					
The student asked engaging questions related to the study.					
The student understood some engineering problems associated with CEV design.					
Point Total					

Point total from above: _____ / (24 possible)

Grade for this investigation _____

Grading Scale:

A = 22 - 24 points

B = 19 - 21 points

C = 16 - 18 points

D = 13 - 15 points

F = 0 - 12 points