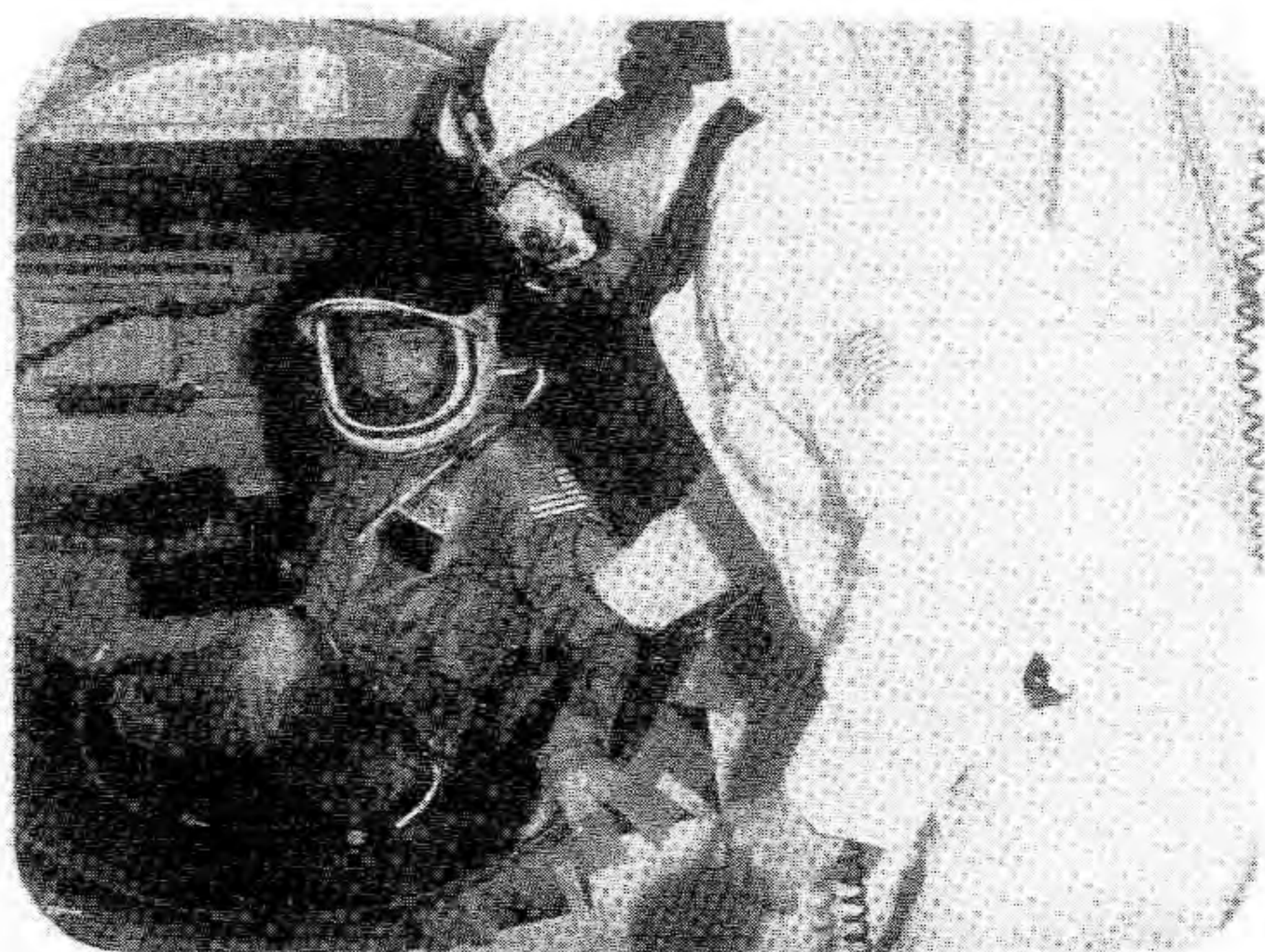


H O U S I N G

BOOK 1

LIVING IN SPACE



BACKGROUND INFORMATION

Concepts

The Space Shuttle is an astronaut's home in space. The spacecraft cabin

- consists of three levels: an upper flight deck; a lower life-support, housekeeping, and storage deck; and mid-deck living quarters
- provides astronauts with private places to sleep
- allows astronauts entry to other parts of the Shuttle through hatches and air locks

Space Shuttle Deck Areas

The cabin of the Shuttle has three levels. The top level is the flight deck, where the commander and pilot handle the spacecraft. The lowest level contains life-support and housekeeping equipment. The mid-deck living area is a room measuring about 4 meters long and ranging from a 3.7-meter width at the back to a 2.7-meter width at the front. This level is filled with equipment, such as a private toilet, a washbasin with a mirror, a galley with an oven, drawer-size lockers, bunk beds, and the air lock that leads into the cargo bay. Although much roomier than early spacecraft, the cabin is small compared to Skylab, which was about the size of a small three-bedroom house. The cabin area is used for exercising, and sometimes various experiments are performed here.

Sleeping Accommodations

Sleeping arrangements aboard the Shuttle have been designed with a weightless environment in mind. Because there is no up or down in such an environment, a two-level bunk bed actually provides sleeping space for four people. The first person sleeps on the top bunk, the second on the lower bunk. A third person sleeps on the underside of the lower bunk, actually facing the floor. A fourth person sleeps vertically in another bunk set against one end of the two-level bed. Bunks are more than 1.8 meters (6 feet) long and about .75 meters (30 inches) wide. Each bed is a padded board with a fireproof sleeping bag attached to it. The bag has perforations for ventilation. In Earth's gravity, your body sinks into the mattress. In the Space Shuttle, your body hardly feels the bed board. Weightlessness gives the illusion of a mattress and pillow beneath you.

Astronauts zip themselves inside the sleeping bags, leaving their arms outside. They snap together straps that circle the waist. Each sleeping compartment has a light for reading and side panels that can be shut for privacy. Eyeshades and earmuffs are available to reduce cabin light and noise. If all seven members of the Shuttle crew decide to sleep at one time, three more sleeping bags will be attached vertically to the bulkhead storage lockers. Two of the crew members must wear communications headgear so that they can receive calls from Mission Control or hear alarms.

Hatches and Air Locks

Crew members move about the Shuttle through hatches and air locks. Initial entry into the Shuttle is through a circular hatch (one meter in diameter) located on the left side of the Shuttle. This hatch, which opens outward, leads directly into the mid-deck cabin. Three crew members sit here for liftoff. Other astronauts pass through an open hatch into the flight deck for launch and reentry.

Astronauts wear space suits (extravehicular mobility units) when Space Shuttle activities involve extravehicular activity (EVA). An air lock, a small cylindrical chamber usually located in the back of the mid-deck cabin, is used by the astronauts to move from the controlled environment of the cabin to the environment of space. The astronaut enters the air lock hatch and changes into EVA gear. After depressurizing the air lock, the astronaut opens the outer hatch and works in the cargo bay or in space.

TEACHER PRINTOUT

Objectives

Students will understand the following:

- Proper sleeping quarters are provided for each astronaut.
- Astronauts sleep in fireproof sleeping bags attached to padded boards.
- Because of weightlessness, astronauts can sleep facing up, facing down, or even standing.

Vocabulary

Have the students use these words as part of your motivating discussion and in the follow-up *Space Lab* and *Space Countdown* activities.

- weightless (having little or no weight because the force of gravity has been balanced by the force of forward speed)
- sleeping bag
- fireproof
- eyeshades
- earmuffs
- astronauts

Motivation

1. **Have you ever slept in a sleeping bag? What was it like?**

(Accept any answers that make sense. It was cozy. It felt too hard.)

2. **Astronauts sleep in sleeping bags on the Space Shuttle. Why do you think this is so?**

(There isn't enough room for regular beds. They can be rolled up and put away during the day. Sleeping bags help keep them warm.)

3. **Explain that gravity is a force that holds us down to Earth. On board the Shuttle there is not enough gravity to hold astronauts down. How could a sleeping bag help an astronaut to sleep aboard the Shuttle?**

(It stops the astronaut from floating around.)

Activity Description

The *Student Liftoff* page for this lesson contains two activities: *Space Lab* and *Space Countdown*.

The *Space Lab* is a hands-on activity that simulates what it is like to sleep in a sleeping bag the way an astronaut does. The students are asked: What is it like for an astronaut to sleep in a sleeping bag? Using an actual sleeping bag, students can zip themselves inside, have their arms strapped down, and add earmuffs and eyeshades to eliminate noise and light. It is important to help students understand that because of weightlessness, astronauts must be strapped down, or they would simply float about the cabin. This activity may be done at school or at home.

The *Space Countdown*, a math activity, has the student record the results of six tosses, and compare larger and smaller.

Additional Activities for School or Home

- As a follow-up activity to the *Space Lab*, students might be helped to brainstorm words that describe how an astronaut would feel sleeping facing up, facing down, standing up. Discuss other unusual sleeping arrangements that students have been exposed to — cots, couches, chairs, hammocks, car seats. Create a class poem incorporating some of the brainstormed words.
- Have students draw pictures showing themselves sleeping in unusual settings or situations, perhaps on board the Shuttle.

STUDENT LIFTOFF



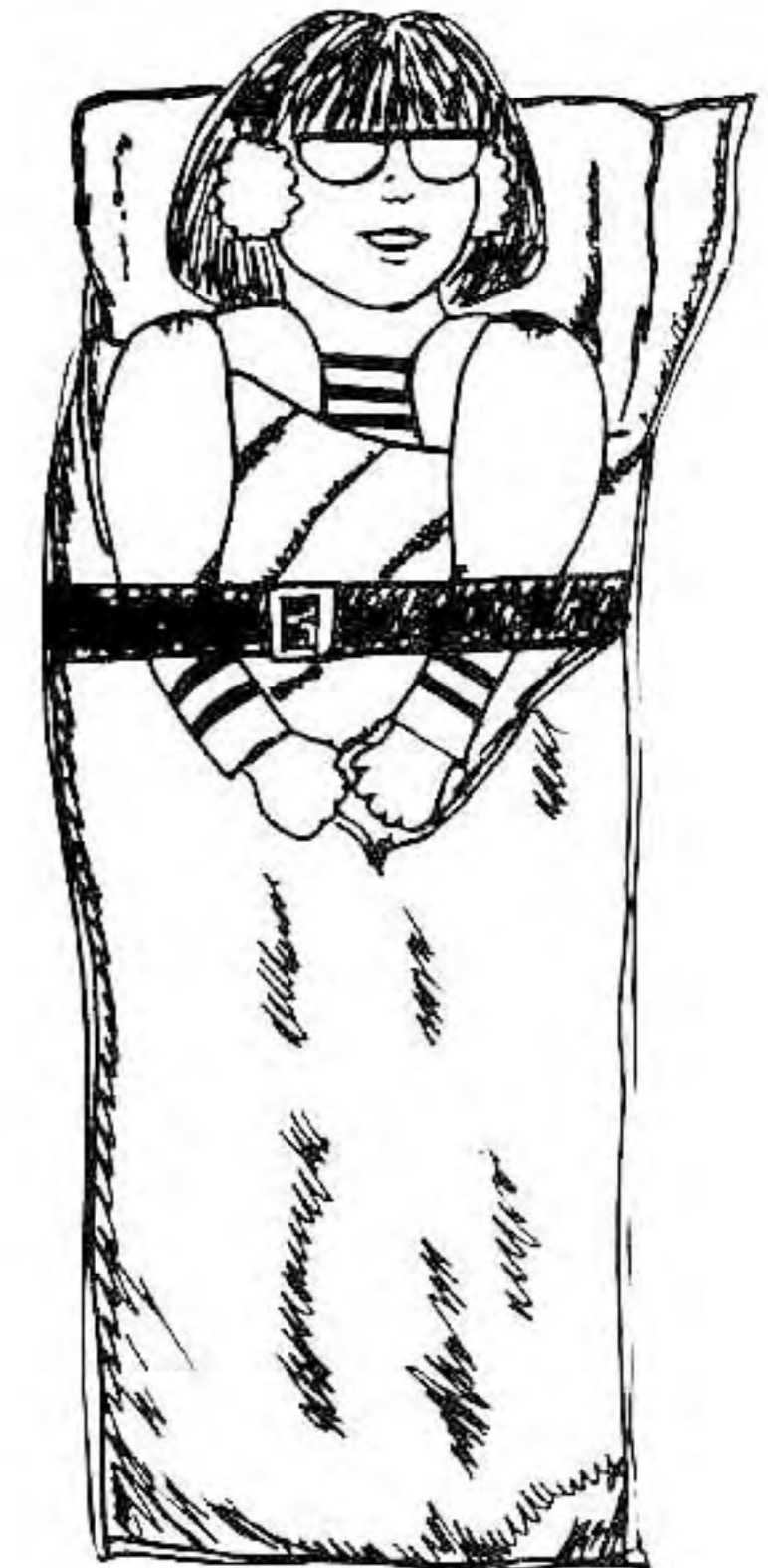
Have you ever slept in a sleeping bag? On the Space Shuttle, each bed is a fireproof sleeping bag. The bag rests on a padded board. At bedtime you zip into the bag and strap yourself in. Two astronauts sleep facing up. One astronaut sleeps facing the floor. Another astronaut sleeps standing up. Which way would you choose to sleep?

Space Lab

What is it like for an astronaut to sleep in a sleeping bag?

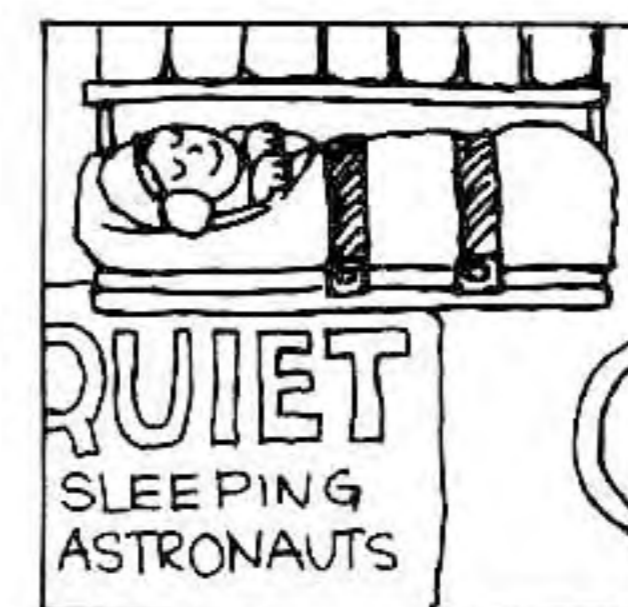
You need: a sleeping bag, a belt, earmuffs, eyeshades, a friend.

- Step 1.** Take off your shoes. Zip yourself inside the sleeping bag. Leave your arms outside. How do you feel?
- Step 2.** Put on the earmuffs and eyeshades. Wait two minutes. How do you feel now? Why do astronauts cover their eyes and ears when they sleep?
- Step 3.** Have a friend strap the belt around the sleeping bag so your arms are held down. Wait two minutes. How do you feel now? Why do you think astronauts must be strapped down?



Space Countdown

Cut out the pictures of the sleeping astronauts. Paste them together with a piece of cardboard in between. Toss the card six times. Put a check in the correct box on the chart after each toss.



TOSSES	1	2	3	4	5	6
Up						
Down						

1. How many times did the astronaut sleep facing up?
2. How many times did the astronaut sleep facing down?
3. Which way to sleep had the higher score? How much higher was it?

TEACHER PRINTOUT

Objectives

Students will understand the following:

- Astronauts move about the Shuttle's decks and work areas through hatches and air locks.
- Hatches lead from one deck to another.
- Air locks are special kinds of openings made up of two hatches and a connecting space.

Vocabulary

Have students use these words as part of your motivating discussion and in the follow-up *Space Lab* and *Space Countdown* activities.

- hatch (an opening or doorway that leads from one place to another)
- air lock (two hatches with space in between)
- cargo bay (the large main body of the Shuttle where the payload or cargo is stored)
- mid-deck • flight deck

Motivation

1. Does your house or apartment have different rooms? Why?

(Different rooms are used for different activities.)

2. What different kinds of rooms might we expect to find on the Space Shuttle? Why?

(Astronauts need different rooms for different activities too. Explain how the Shuttle is much larger than older spacecraft such as **Apollo** and **Gemini**.)

3. How do you get from one room to another room at home?

(You walk through doors or other openings.)

Activity Description

The *Student Liftoff* page for this lesson contains two activities: *Space Lab* and *Space Countdown*.

The *Space Lab* is a hands-on simulation helping the student understand how an air lock is set up. The students are asked: How does an astronaut move through an air lock? A large cardboard box is used to create the illusion of the air lock drum aboard the Shuttle. If no board compass is available, substitute a string and pencil. This activity may be done at school or at home.

The *Space Countdown*, a math activity, has the student counting by twos from 2 through 46. Students can then color the resulting picture of an air lock.

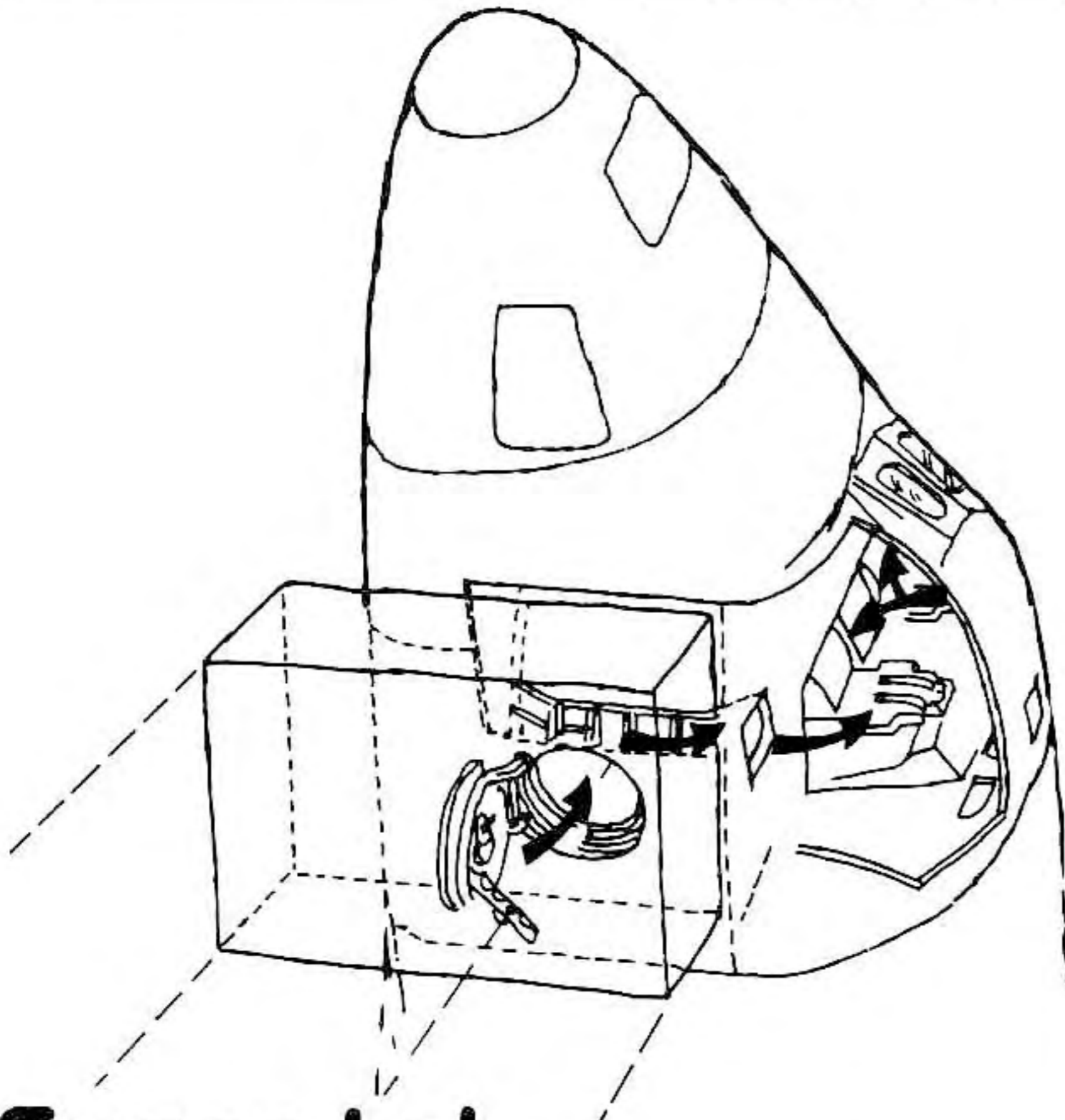
Additional Activities for School or Home

- As an extension of the *Space Countdown* activity, students could be helped to create their own connect-a-dot picture illustrating other parts of the Space Shuttle cabin.
- Students could write stories entitled "The Day I Visited the Space Shuttle." Such stories should include information about how they moved from one deck area to another using hatches and air locks. Use the words below as a starter word bank. Have the children work in pairs, brainstorming other words to add to their personal word banks before they start writing.

Word Bank

hatch	flight	crawl	ladder	air lock	shuttle
crew	up	doorway	floating	job	down

STUDENT LIFTOFF



Astronauts go through hatches and air locks when they move from one part of the Space Shuttle to another.

A hatch is an opening from one deck to another deck.

An air lock is two hatches with space in between.

Before liftoff, crew members crawl through a hatch into the mid-deck cabin.

The commander and pilot continue up a ladder through an open hatch to the flight deck.

During the flight, astronauts pass through an air lock to work in the cargo bay.

Space Lab

You will need an adult to help you with this experiment.

How does an astronaut move through an air lock?

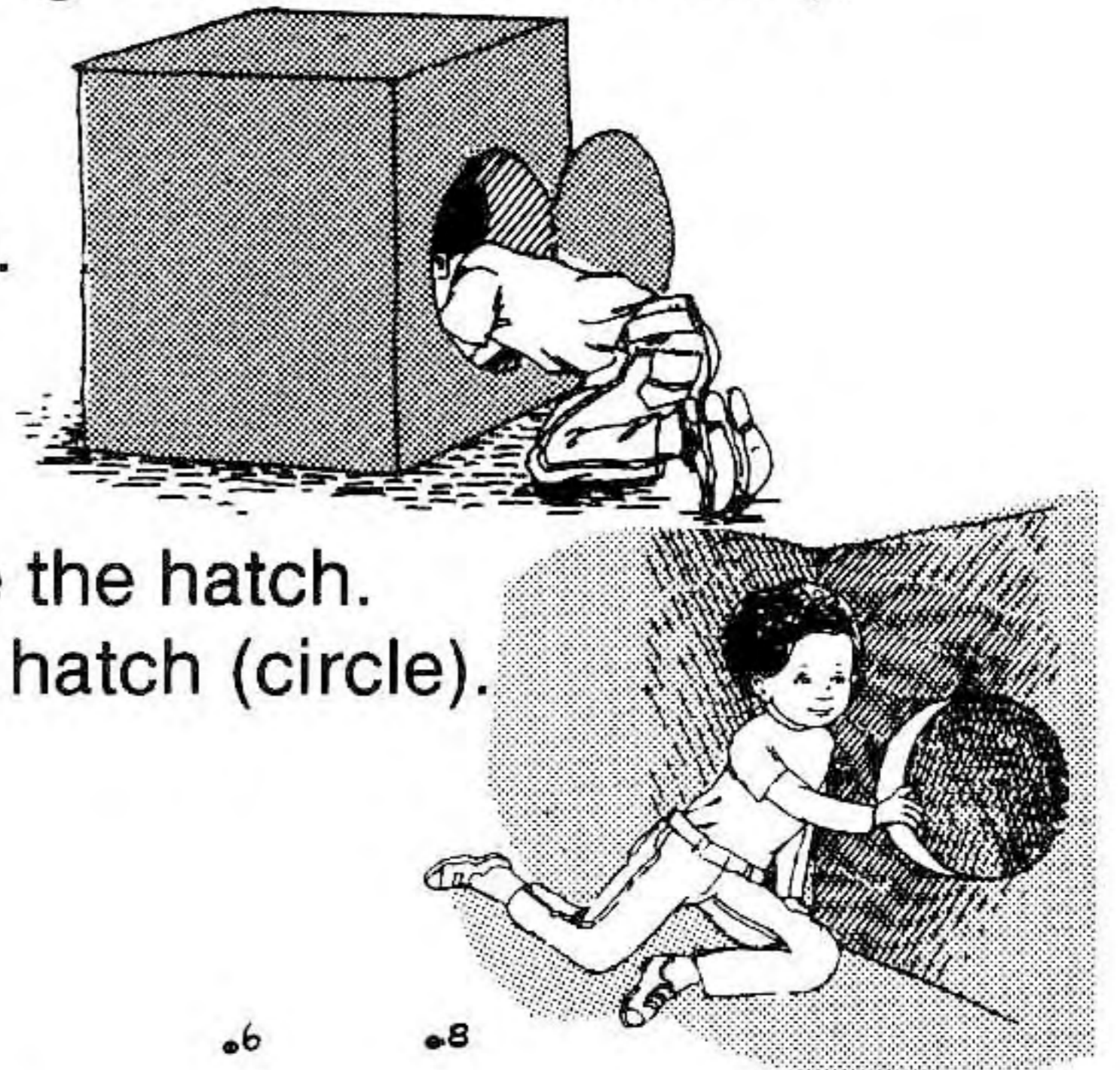
You need: one large cardboard box (from a new refrigerator or dishwasher), an Exacto knife, a teacher's board compass.

Step 1. Use your teacher's board compass to draw large circles on opposite sides of the carton.

Step 2. Have an adult cut open the circles, leaving one side of each circle attached to the box.

Step 3. Open one hatch (circle). Crawl inside. Close the hatch. Move to the other side of the box. Open the hatch (circle). Crawl out. Close the hatch.

How is the cardboard box like an air lock?
Why does an astronaut use an air lock?



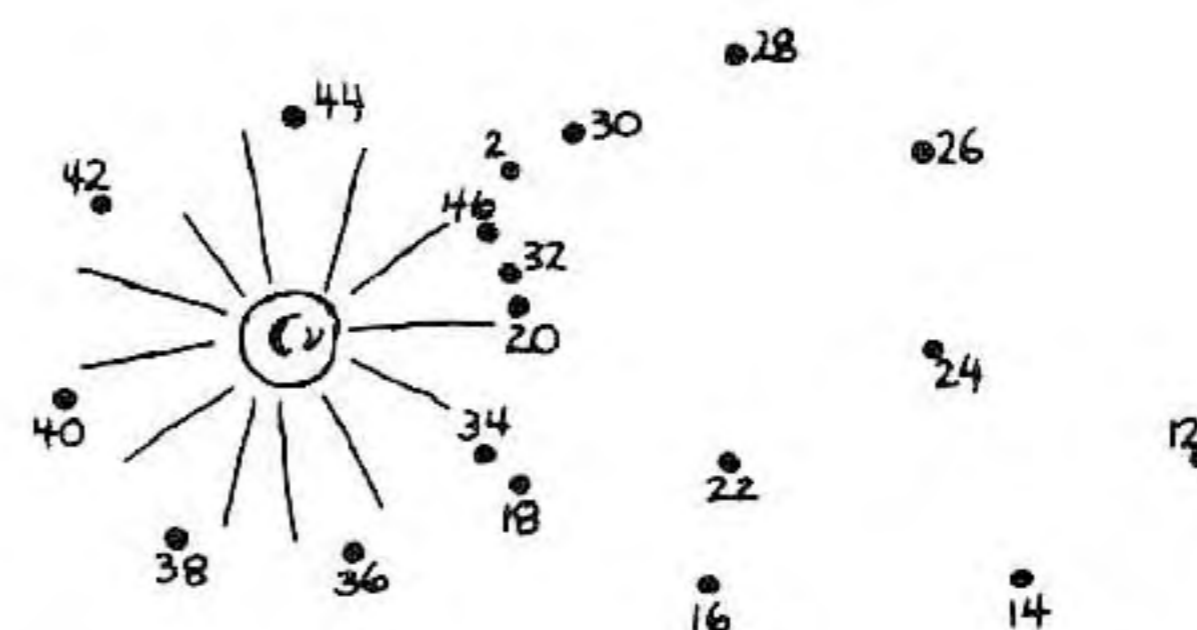
Space Countdown

Can you count by twos?

Connect the dots starting at 2 and going to 46.

What picture did you make?

Color the picture.



TEACHER PRINTOUT

Objectives

Students will understand the following:

- The Shuttle is an astronaut's home in space.
- The Shuttle has three decks: the flight deck, an equipment storage deck, and the mid-deck living area.
- Cabin areas are comfortable places to live.

Vocabulary

Have the students use these words as part of your motivating discussion and in the follow-up *Space Lab* and *Space Countdown* activities.

- flight deck
- equipment deck
- mid-deck living area
- experiments • hatch
- commander • pilot

Motivation

1. What are some of the different parts of your house or apartment?

(Accept any logical answers — bedrooms, kitchen, living room, etc.)

2. Are there any rooms in your home that are used for different activities? Which room and for what kind of activities?

(Family rooms, dens, and sometimes kitchens are multipurpose rooms.)

3. What kinds of things do both you and astronauts need in order to live?

(Air, food, water, others as applicable).

Activity Description

The *Student Liftoff* page for this lesson contains two activities: *Space Lab* and *Space Countdown*.

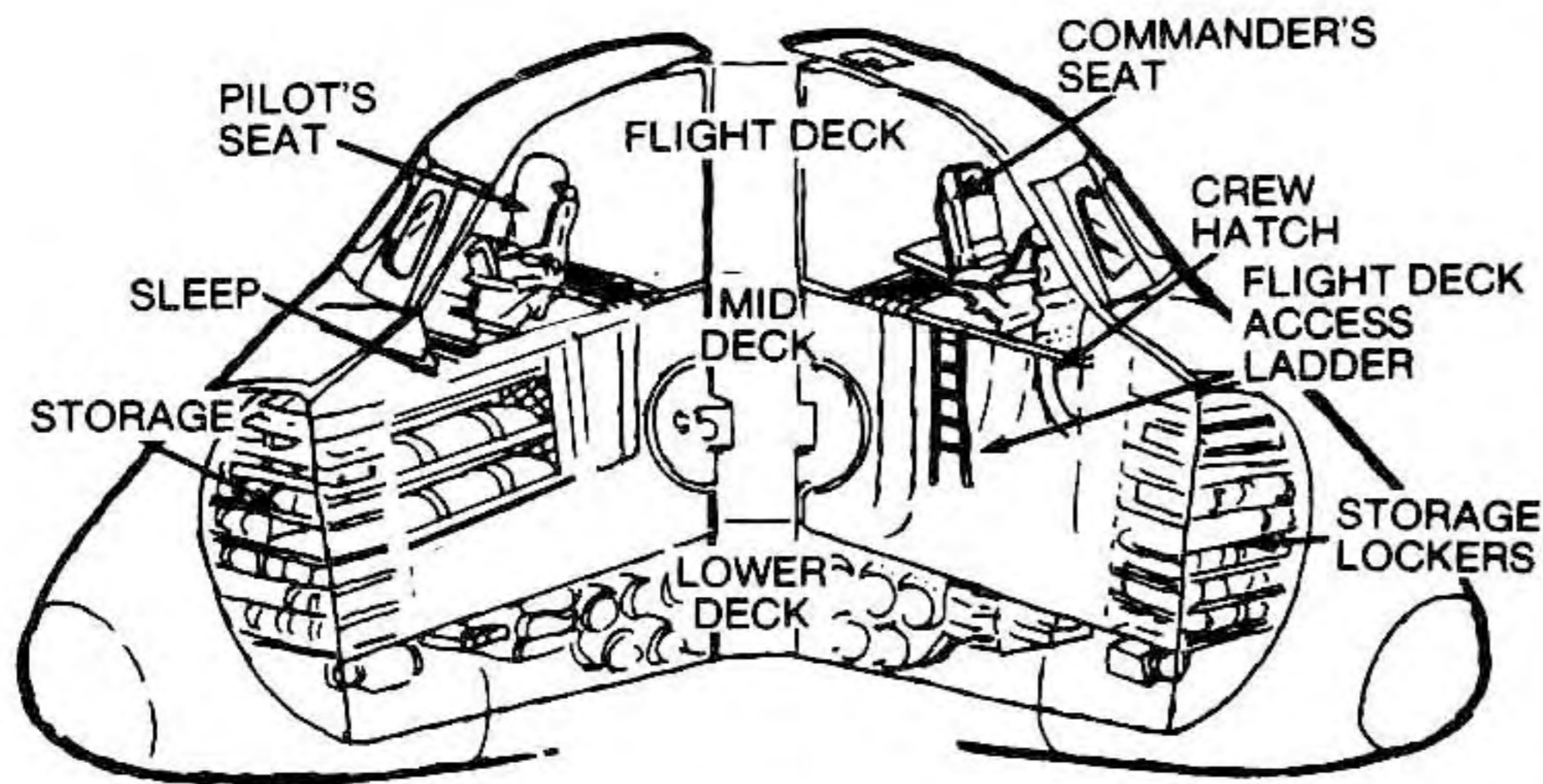
The *Space Lab* is a hands-on activity that has the students create a facsimile of the Space Shuttle cabin. The students are asked: What does an astronaut's home in space look like? Students use a plastic jug and cardboard to create their version of the Shuttle cabin. You may prefer to have adults handle all cutting. This activity may be done at school or at home.

The *Space Countdown*, a math activity, has the students find their way through a maze by following movement directions. Before doing this activity, ask students to pace a defined floor area using forward, right, and left commands. These commands will reinforce computer skills. With each square representing ten units, students must also equate number values.

Additional Activities for School or Home

- Draw or paint pictures of Shuttle crew members relaxing in their mid-deck living quarters. Pretend you are a member of the crew. Write a letter to your family back on Earth explaining how you spend your free time.
- Try this imagery activity. Have students sit comfortably in their seats and relax. Have them close their eyes, clear their minds, and allow their brains to fill up with lovely, interesting "imaged" pictures. Slowly read through the following: "Relax. Feet comfortable on the floor. Let your mind go blank. Now fill your mind with a warm, glowing sun. You feel comfortable, relaxed, happy. See yourself entering the Shuttle, strapping yourself in, and getting ready for launch. Feel the power of the launch. Watch Earth streaking by. You're in orbit. Undo your belt, get up, and walk around the cabin. See yourself doing your work. See yourself relaxing" After imaging, have the students share what they saw and what they felt.

STUDENT LIFTOFF



The Space Shuttle is an astronaut's home in space. Its cabin has three different sections. On the upper flight deck are the controls for the commander and pilot. The bottom deck holds different kinds of equipment.

The mid-deck of the cabin is where the crew lives. Here food is stored, heated, and eaten. There are bunks for sleeping. The bathroom is also on this deck. Crew members exercise in the mid-deck and may also perform experiments.

The cabin areas provide air, water, and comfortable temperatures.

Space Lab

You will need an adult to help you with this experiment.

What does an astronaut's home in space look like?

You need: 1 large empty plastic jug, cardboard, scissors, glue.

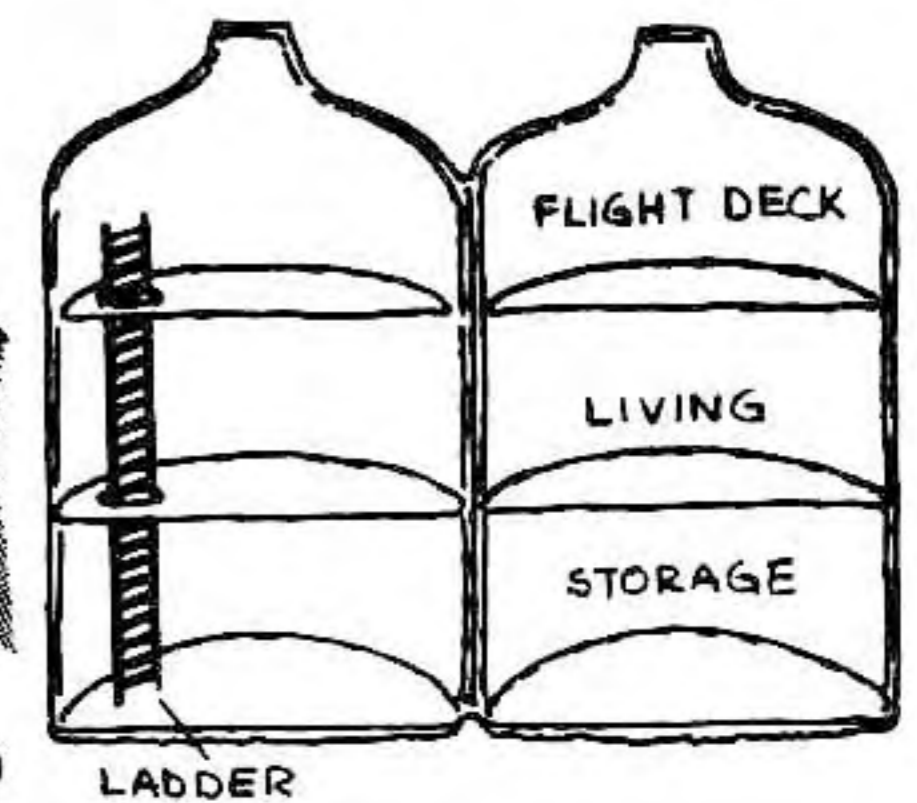
Step 1. Have an adult split open a large plastic jug.

Step 2. Cut cardboard semicircles to fit in the jug. Glue the circles in place to make three decks. Cut out the hatch.

How are the different decks like the different parts of your home?

Why do astronauts work and sleep on different decks?

How do the astronauts move from one deck to another?



Space Countdown

Help the Shuttle commander go from the sleeping quarters to the commander's seat.

Follow the directions.

Each square stands for ten moves.

- | | |
|---------------|-------------|
| a. forward 20 | e. right 20 |
| b. right 20 | f. left 40 |
| c. forward 50 | g. right 30 |
| d. left 10 | h. left 10 |

