

# The Need for Spacesuits

## A Canadian Space Agency Mini-Package

This mini-package is intended to complement your existing space studies' unit, particularly on the topic of **spacesuits** and **the hazardous conditions in space**, which requires them. It includes a *Student Fact Sheet*, describing the adverse environment found in space, along with 3 creative activities and 1 scientific demonstration for students who wish to further explore this fascinating topic.

### **INCLUDES:**

Spacesuit Fact Sheet  
Activities

- ☆ Build a Wearable Spacesuit
- ☆ Build a Wearable Space Helmet
- ☆ The Paper Spacesuit
- ☆ The Atmospheric Pressure Demonstrator
- ☆ Space Suit Colouring Activity



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Information provided courtesy of NASA.



# The Need for Spacesuits

Although inside the space shuttle temperature and atmosphere are controlled, outside is a completely different story. Outer space is a very hostile environment, requiring special equipment and clothing if one is to venture out into it. Let's take a look at some of the qualities of space.

The principal characteristic of space is the vacuum. The gravitational attraction of large bodies in space such as planets and stars pulls gas molecules close to their surfaces leaving the space between quite empty. Some stray gas molecules are found between these bodies, but their density is so low that they can be thought of as practically non-existent.

On Earth, the atmosphere exerts pressure in all directions. In the vacuum of space, where there is no pressure from the outside, the air inside our lungs would immediately rush out; dissolved gases in body fluids would expand, pushing solids and liquids apart. The skin would expand like an inflating balloon. Bubbles would form in the bloodstream and render blood ineffective as a transporter of oxygen and nutrients to the body's cells. Furthermore, the sudden absence of external pressure balancing the internal pressure of body fluids and gases would rupture fragile tissues such as eardrums and capillaries.

As you can see, the effect of being in space without protection would be devastating. And there are other problems too, such as the temperature range. If you are facing the Sun the temperature can be as high as 120 degrees Celsius, while if you are on the shaded side it can drop to about -100 degrees Celsius!

Other environmental factors encountered include radiation of electrically charged particles from the Sun, ultraviolet radiation and micrometeoroids (very small bits of rock travelling at high velocities). Though usually small in mass, these particles





travel at such high velocities that they could easily penetrate human skin and thin metal.

The Extravehicular Mobility Unit, worn by Canadian Space Agency Astronaut Chris Hadfield represents more than 50 years of development and testing. It consists of 12 layers to protect astronauts during EVA's. The two inner layers comprise the liquid-cooling and ventilation garment. Next comes the pressure bladder layer followed by a seven-layer thermal micrometeoroid garment.



## Activity 1: Build a Spacesuit

### You will need:

- ☆ A wearable paper suit from a paint store
- ☆ Photos of astronauts in their EVA suits
- ☆ Variety of duct tapes/hockey tapes (all colours)
- ☆ Dryer hose tubing
- ☆ Cereal or other flat boxes
- ☆ Odds and ends
- ☆ Glue/tape/scissors/felts

In this creative activity, your students will design and build their own, wearable space spacesuits.

### Instructions

- 1 Obtain some kind of wearable “paper suit” from a local paint store or hardware store;
- 2 Obtain photos of astronauts wearing their *Extra Vehicular Activity* (EVA) Suits and note all the details;
- 3 Have students decorate their suits using various coloured tapes, dryer hose tubing, and other kinds of tubes and felts;
- 4 Using the cereal box, have students create a control box for their suit;
- 5 Add lots of pockets and tethers for your suit, so your space tools won’t float away!
- 6 Through the Canadian Space Agency, you can obtain stickers of the various Canadian mission patches and logos for students to add to their spacesuits;
- 7 Divide students into “crews”, and have them create their own mission patches to add to their suits;
- 8 Your spacesuits are now ready to wear; good luck on your mission!



# Activity 2: Build a Space Helmet

## You will need:

- ☆ A 16 inch balloon
- ☆ Paper maché
- ☆ Newspaper
- ☆ White paint
- ☆ White duct tape
- ☆ A knife
- ☆ A few pots

In this creative activity, students will build an accompanying space helmet, to go with their Spacesuits.

**NOTE:** allow at least 5 days for this activity.

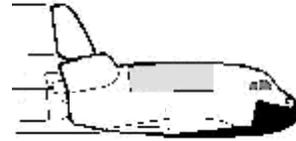
## Instructions

- 1 Have each student blow up one 16-inch balloon and tie it off;
- 2 The balloon needs to “sit” in something hard and stable in order for you to work on it. A bowl or pot works great for this.
- 3 Tear the newspaper into dozens of long, narrow strips.
- 4 Mix the papier maché and have it near you in another bowl.
- 5 Papier maché the entire balloon twice over. Let it stay in its bowl or pot to dry overnight.
- 6 Repeat step 2 to 5, and again, let the balloon dry overnight (the balloon has now been covered four times).
- 7 Using a sharp knife carefully cut out a generous hole at the bottom, big enough to be able to fit your head through comfortably. You may want to do this for your students.
- 8 Cut out an area for your face (called a visor) so you can see through. Put the cut-out piece aside;
- 9 Using white duct tape (easily obtainable at a hardware store) tape over all the edges to keep the papier maché from wearing away.
- 10 Paint the entire helmet white, and allow overnight drying.



# Activity 3: The Paper Spacesuit

## Group Activity!



### You will need:

- ☆ 1 long sheet of paper/group
- ☆ Pencils/felts
- ☆ Scissors

This is a great activity where students will work in-groups and create spacesuits, which you can hang up in the classroom.

### ***Instructions***

- 1 Place students into groups of 5 or 6
- 2 Have one student lie down on the sheet of paper; have the other students in the group trace her/him.
- 3 Onto the traced outline, students will begin drawing the rest of the spacesuit. This includes parts such as the helmet, gloves, boots, logos, lights, gadgets and dials, etc.
- 4 Cut out the drawn spacesuit and have students continue 'decorating it' on the backside.
- 5 Your spacesuits are now ready to be hung up and displayed!

# Activity 4: The Atmospheric Pressure Demonstrator

## You will need:

1 wine bottle  
1 wine pump  
A small balloon

Atmospheric pressure is the weight of the atmosphere pushing down on us. Without it human beings cannot survive, and for this reason, astronauts' spacesuits are pressurized. This activity demonstrates the importance of the pressurized spacesuit by demonstrating what happens to a balloon when the atmospheric pressure is removed from a bottle.

## Instructions

- 1 Obtain an empty wine bottle and a wine pump (such as EpiVac; approx. \$10.00) purchasable from most liquor or kitchen supply stores.
- 2 Put a tiny amount of air into a small balloon, and insert the balloon into the bottle.
- 3 Explain to the students what atmospheric pressure is, and that there are equal amounts of atmospheric pressure inside the bottle, as there is in the room.
- 4 Field the question 'what would happen to the balloon if we removed the atmospheric pressure from the bottle?'
- 5 Place the wine pump on the bottle, and begin pumping. Tell the students to keep their eyes on the balloon.
- 6 After 2-3 minutes, students will observe a noticeable difference in the size of the balloon (it got bigger!).
- 7 Discuss the importance of the pressurized suit to the human body. What other kinds of suits are there that need to be pressurized?



# Finish the Space Suit!

You can colour this space suit as well as add buttons, dials and stripes!

