Contents

Introduction

The Real-Life Science series is designed to engage students with topics of high interest that involve places, phenomena, technology and concepts that they may encounter in their everyday lives. The topics were chosen by professionals in science education, and the activities have been developed to address a number of science concepts. Each book in the series has a correlations chart that shows core science concepts that are addressed by each lesson, as well as other standards that are addressed, but are not the main focus of the lesson.

Using "real-life" examples is a technique that supports the theory that quality instruction can and should include material that does more than just require students to memorise and repeat basic facts.

This series supports the following teaching approaches:

Teachers of science plan an inquiry-based science program for their students.

- Select science content and adapt and design curricula to meet the interests, knowledge, understanding, abilities and experiences of students.

Teachers of science guide and facilitate learning.

- Focus and support inquiries while interacting with students.
- Orchestrate discourse among students about scientific ideas.

Teachers of science develop communities of science learners that reflect the intellectual rigour of scientific inquiry and the attitudes and social values conducive to science learning.

- Structure and facilitate ongoing formal and informal discussion based on a shared understanding of rules of scientific discourse.
- Model and emphasise the skills, attitudes and values of scientific inquiry.

Each book in the Real-Life Science series features lessons you can use in your classroom today. Use these engaging lessons to help your students explore the intriguing ways that science is at work all around them.

1. What If You Fell Out of an Aeroplane Without a Parachute?

Topics

gravity, terminal velocity, air resistance

Goal

To help students understand the various forces and circumstances that affect the behaviour of a falling body, in particular a human body, as it falls from an aeroplane

Context

Students have continually increasing access to a wide variety of extreme sports, either through actual participation, print media, video or video games. As a consequence, they are interested in unusual events in physics and some of the extreme conditions that the human body can withstand.

Teaching Notes

- Demonstrate the effect air resistance has on a falling body by comparing the fall rate of two objects, perhaps a crumpled piece of paper and a flat piece of paper of the same mass.
- Clarify the nature of terminal velocity. Students need to understand that the object is still falling; it is simply no longer accelerating.
- Ask students to share examples of falls they have taken or have heard about that were survived with little or no injury. Ask for examples they have heard of that resulted in serious injury, particularly falls that happened from low heights.

Extension Activity

Ask students to find examples of people surviving a fall out of an aeroplane. Have them be sure to include the circumstances that allowed the falling person to survive. Make a list with the class of the various circumstances that might protect them should they ever find themselves falling without a parachute.

Answer Key

1. a
2. d
3. b
4. c
5. c
6. d
7. b
8. a
9. d
10. d

1. What If You Fell Out of an Aeroplane Without a Parachute?

Explanation

Of course, little experimentation has been done on humans to determine the answer to this question. With that in mind, we are left with what we have learned from people who have fallen from planes by accident, or were left falling without the benefit of a parachute during a skydiving mishap.

The short answer is: It would be very bad. An object accelerates at around 9.8 m/s^2 due to the pull of gravity near Earth's surface. Even with air resistance factored in, a person will reach terminal velocity in 10 to 20 seconds, depending on the altitude from which he or she starts falling. In this case, terminal velocity is the highest speed a person will reach before the effects of air resistance keep the person from accelerating any more. For most people, this speed is somewhere around 193 km/h. Speed does depend on the angle of the falling body, weight and the aerodynamics of the clothing the person is wearing.

The end result of the fall depends on the material landed on. The result can be anything from cuts, scrapes and bruises, to severe injury or death. Falls from as low as simply standing on the ground have been fatal under the right conditions. Most falls in excess of 15 metres have a high chance of being lethal. People have survived falling from aeroplanes from a variety of altitudes, including as high as 6100 metres. They have survived by landing in or on things such as water, thick vegetation, trees, freshly plowed ground, sand, swamps, haystacks, power lines, car roofs, awnings, deep snow and slanted surfaces.

Some people who have survived falls from great heights have done so in the wreckage or part of a plane that was damaged or failed in flight. Some were entangled in a partially opened parachute or clung to a second person whose parachute deployed properly. Some were even in the remains of a crashing hot-air balloon.

Name _____ Date _____

STUDENT PAGE

1. What If You Fell Out of an Aeroplane Without a Parachute?

Circle the letter of the best choice to complete each sentence.

1. The acceleration due to gravity at Earth's surface is _____.

   a. 9.8 m/s^2
   b. 9.8 m^2/s
   c. 32 m/s^2
   d. 32 m^2/s

2. It generally takes a skydiver _____ to reach terminal velocity.

   a. 5 to 8 seconds
   b. 5 to 8 minutes
   c. 10 to 20 minutes
   d. 10 to 20 seconds

3. The highest speed a falling object reaches before it stops accelerating due to air resistance is called _____.

   a. maximum velocity
   b. terminal velocity
   c. maximum speed
   d. terminal speed

4. Terminal velocity for the average person is around _____.

   a. 193 mph
   b. 120 km/h
   c. 193 km/h
   d. 120 m/s

5. The terminal velocity of a falling object is not affected by _____.

   a. the weight of the object
   b. the shape of the object
   c. the colour of the object
   d. gravity