LABORATORY LEARNING ACTIVITY

Bungee Barbie

Introduction

Barbie and her friend, Ken, are enthusiastic adventurers, who would like to go bungee jumping.

In bungee jumping, a very strong and elastic rope is attached to both a support and to the bungee jumper. The bungee rope is often attached to the jumper's lower legs using a leg harness, but a chest harness can also be used.

The jumper initially stands on a platform near the support where the other end of the rope is attached. Often the adventurer jumper will ask for the rope to be adjusted so that the jumper will get as close as possible to the ground without actually hitting the ground. If the jump is made over water, the jumper might ask for the rope to be adjusted so that only the hair (or the head or the chest) gets wet.

The elasticity (stretchiness) of the rope will ensure that the jumper will keep moving up and down several times before finally stopping.

In this activity, you will investigate some of the factors that affect the bungee jump, so that Barbie and Ken can have an exciting, but safe, experience.

Key ideas

Force – a push or a pull

Tension force – a pull stretches an object to try to make it bigger or longer.

Newton's First Law – Objects at rest stay at rest. Objects in motion stay in a straight line motion unless subjected to an unbalanced force.

Newton's Second Law – The net force acting on an object is equal to the mass of the object multiplied by its acceleration:
F=ma

Newton's Third Law – When one object exerts a force on a second object, the second object exerts an equal and opposite force back on the first object.

Kinetic energy – Energy that an object has by virtue of its motion.

Potential energy – Energy that is stored in an object has by virtue of its position.

Elasticity – The ability of an object or material to resume its normal shape after being stretched or compressed; stretchiness.

Energy loss – When energy is transformed from one form to another, there is some energy loss.

Equipment and materials

- Retort stand, and clamps,
- Tape measure,
- 7 rubber bands
- string
- Weighing balance
- Barbie/Ken doll

Part 1: Bungee Barbie

1. Use two rubber bands to create a double-loop around Barbie's feet. A double loop is made by securing one rubber band to another.

Tying two rubber bands together. Diagram © "Baller14".

www.instructables.com/id/How-to-Make-a-Rubber-Band-Ball/

2. Wrap the open end of the double-loop tightly around Barbie's feet.

Photo: Kieran Lim

3. If desired, you can attach more rubber bands.

4. Attach the end of the last rubber band to the retort stand & clamp.

Photo: Lam Pham

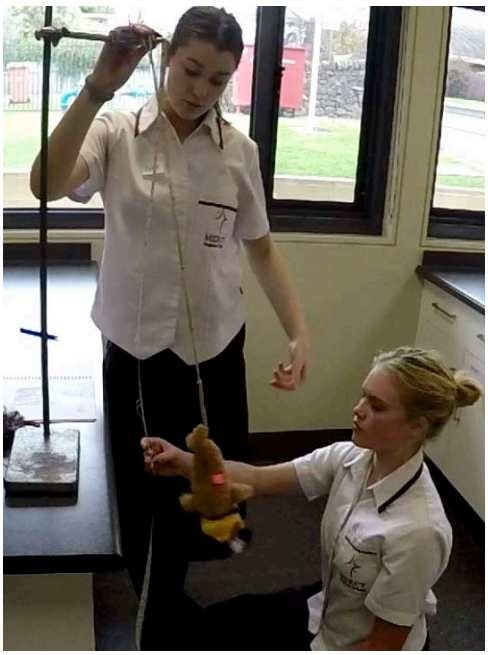

Photo: John Long

5. Hold Barbie standing upright with her feet at the end of the clamp. When your group is ready, release Barbie. She must fall head first.

Part 1: Observations

What happened? Make some notes of what you observed (saw) in the box below:

Suggest two details, about how the bungee jump is made, could you change?

Make one of those changes, repeat the bungee jump and make some observations:

Part 2: Scientific questions

When scientists and engineers ask a scientific question, they make a prediction: ***if this thing is changed, then that is expect to happen***. In testing that prediction, they try to keep all other factors unchanged.

Suggest a couple of scientific questions that you could ask using your experimental equipment and materials:

Some scientific questions will be more suitable for investigation in a classroom setting. Your teacher will lead a discussion to decide which scientific questions will be investigated. Your group will then decide how to investigate that question.

The scientific question that my group will investigate is:

Our hypothesis is:

Our **independent variable** is:

Our **dependent variable** is:

Our **controlled variables** are:

We will make the following changes to the **experimental procedure** of Part 1. If appropriate, make a drawing of your proposal:

Are there any **safety** issues to consider?

Part 3: Testing our scientific question

Get approval from your teacher of your plans (Part 2) before starting Part 3.

Remember to take photos throughout your experiment to add to your scientific poster.

What happened? Record your observations or measurements:

Did your observations or measurements agree with your expectations and prediction? Can you explain why?

Did you encounter any problems?

What changes could you have made to this experiment?

What did you discover for this experiment?

Part 4: Newton's Laws of Motion

Draw a diagram to illustrate the **forces** (Newton's 1st Law) acting on Barbie when she is:

a) standing on the ledge at the top of the bungee

b) Free falling on the downwards motion of the bungee.

c) At the lowest point of the bungee jump.

d) On the upward journey of the bungee.

Remember to indicate the directions and sizes of forces.

Using Newton's 2nd Law of Motion, calculate the force at which Barbie would hit the ground if the bungee failed. (Remember gravity causes an object to accelerate to Earth at a rate of 9.8 m/s^2):

What is one area in this experiment when you observed Newton's 3rd Law of Motion?

Part 5: Scientific poster

1. Complete introduction:
    - One to two paragraph overview of the reason for completing the investigation, the scientific context and an explanation of the relevant scientific theory.
    - All sources need to be acknowledged.
2. Complete the discussion section:
    - Discuss your scientific question in this section. **POE** is often a useful guide is to help what you put in this section:
        a. Predict. Your scientific question, hypothesis and prediction of what will happen.
        b. Observe. What you observed or measured.
        c. Explain. Did your observations or measurements agree with your expectations and prediction? Can you explain why?
    - Discuss the implications of your results.
    - Were there any limitations to your investigation?
3. Complete the conclusion section:
    - State your main result from your investigation.
    - State whether this supports or refutes your hypothesis.
4. Complete References and Acknowledgements.

Acknowledgement:

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