canopy in the clouds
dosel en las nubes

Name: _____

Section: _____

Date: _____

SCIENCE AND HYPOTHESIS TESTING

Imagine you are trying to decide which pair of sneakers has the best traction. You come up with an experiment to measure the traction of a shoe by attaching a rubber band to the laces, then pulling the shoe across the ground using the rubber band. You measure the amount that the rubber band stretches before the shoe begins to slide across the floor, and decide that the more the rubber band has to stretch before it moves, the better the traction of the shoe. You measure three different sneakers using this technique, then call up a friend and ask her to measure a few of her sneakers this way. She sends you a text message later that day to share her data.

Your friend has a sneaker that did not move until the rubber band stretched 5 cm. You have a sneaker that did not move until the rubber band stretched 9 cm. Therefore, your sneaker has the most traction, right? Not so fast! Consider the following scenarios:

(1) Your friend used a rubber band that is 2 mm wide and you used a rubber band that is 6 mm wide. How might that affect the results?

_____

_____

(2) Your friend tested the sneakers on her sidewalk and you tested yours on the tiles of your kitchen floor. How might that affect the results?

_____

_____

This goes to show that there are many ways to collect information about the world, but sometimes we need more information before we can make appropriate comparisons. In order to get information about your question that you can trust, you need to take a much more careful approach.

Scientists need to be able to trust their data, so they use an approach to research called the inquiry method. The inquiry method includes several important components: asking a question, making a plan, gathering information (data) related to the question, examining the data, and drawing conclusions. Scientists may go through the steps in this order, or may go back and forth between the steps many times as they refine their ideas.

In this activity, you are going to create your own research question related to the cloud forests of Monteverde, Costa Rica. Once you have a suitable question, you will design a study that you could perform to help you gather information about it.

Step 1: Explore

Before you do anything else, you need to think about the cloud forests of Monteverde. What do you already know about them, if anything? Even cloud forest experts don't know everything about them. Let's explore the *Canopy in the Clouds* panoramas (www.canopyintheclouds.com) to get some inspiration!

Begin by clicking on the "Learn" link towards the top of the page. Read the "Cloud Forest Introduction" and the "Canopy Introduction." There is also a glossary you may use if you need to look up a word.

Next, return to the homepage and select a numbered panorama to explore. Once you have selected a panorama, look up, down, and turn around in a circle. Look for interesting details and zoom in to observe them more closely. Don't forget to jump up to the canopy view to explore the other world that exists up there.

You may also want to view other panoramas, or to visit the "Additional Media" page for additional information and inspiration.

Step 2: Ask a question

Now, as you think about the cloud forest, you need to ask yourself: What am I curious about?

Use the sentence starters below to record your thoughts.

I wonder

_____

I wonder

_____

I wonder

_____

In order to design a scientific study, you will have to start with a question that is testable. Testable questions usually follow this basic formula:
How does _____ *affect* _____ *?*

For example:
(1) How does age affect the rate at which people grow?
(2) How does calcium intake affect the cavity-resistance of teeth?
(3) How does computer use affect people's eyesight?

The two fill-in-the-blank parts of the formula have specific names. The first blank is the independent variable and the second one is the dependent variable.

For example, in the question "How does age affect the rate at which people grow?":
Independent variable = age
Dependent variable = the rate at which people grow

Knowing what your variables are will help you write a hypothesis and design a reliable study.

Now look back at your "I wonder" statements and rewrite one as a testable question on the line below, using the formula provided.

My research question:

How does _____ affect _____ ?

My variables:

Independent variable = _____
Dependent variable = _____

Your next step is to develop a hypothesis. A hypothesis is a predicted possible answer to your research question. Hypotheses are useful because they help you think about the results of your study and the types of data you will need to collect. A hypothesis needs to be carefully worded, just like your research question, and just like your research question, it often follows a formula:

IF the independent variable changes in *this* way, THEN the dependent variable will change in *this* way BECAUSE of *this* reason. It can also be stated as: I predict…..because….

Let's use this research question as an example: How does calcium intake affect the cavity-resistance of teeth?

Independent variable = calcium intake
Dependent variable = cavity-resistance of teeth

Your hypothesis might be:
IF calcium intake *increases*, THEN the cavity-resistance of teeth will *increase* BECAUSE *calcium is known to strengthen bones and teeth are a type of bone*.

Here is another example: How does computer use affect people's eyesight?

Independent variable = computer use
Dependent variable = people's eyesight

Your hypothesis might be:
IF computer use *increases*, THEN people's eyesight will *become worse* BECAUSE *spending a lot of time focused on a close object can weaken the eye muscles used for focusing*.

OR

IF computer use *increases*, THEN people's eyesight will *not be affected* BECAUSE *people's eye muscles are getting a lot of exercise when they use a computer, which would not make eyesight weaker*.

Use the prompts below to write your hypothesis for your own research question.

IF _____

THEN _____

BECAUSE _____
_____

Step 2: Make a plan

Now that you have your research question and a hypothesis, you need to figure out how to collect information about it. Your plan needs to be very specific. Answering these questions will help you organize your thoughts.

1. What types of data will you need to collect?

_____
_____

2. How much data will you need? (When will you know you have enough data?)

_____
_____

3. What pieces of equipment will you need for data collection?

_____
_____

4. Do you need to collect data at certain times of the day, or in specific locations? If so, when/where?

_____
_____

Once you have answered those questions, write out your detailed research plan on a separate sheet of paper.