Nature of Science

Name_____

Experimental Design

! SAFETY !
Be aware of other students when releasing helicopters.

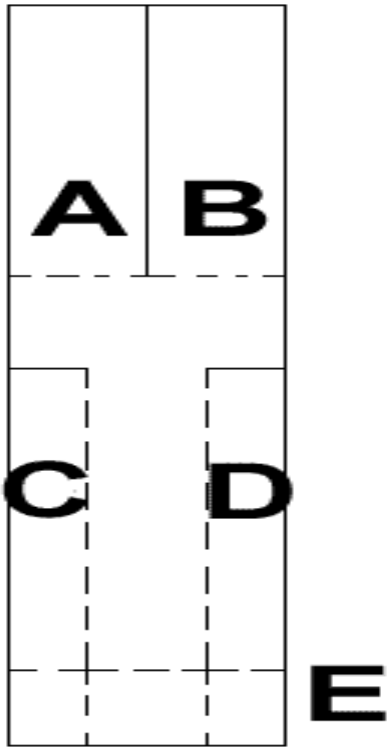
Purpose:

1. to practice the skills used by professional scientists in designing experimental investigations

What to do:

Day 1 –

1. Answer the "Before You Begin" questions.
2. Build your prototype (first) helicopter
    a. Work with your partner
    b. Use **ONE** 3 x 5 index card
    c. Use the diagram at the right as a guide.
    d. Cut along all the solid lines.
    e. Fold flap A forward and flap B to the back.
    f. Fold flaps C and D both forward along the dotted lines.
    g. Fold along the line E upward to increase mass at the bottom.
3. Practice with the helicopter.
    a. Use only the materials provided
    b. Helicopter must be "released", not thrown.



Day 2 –

1. Build and modify several helicopters.
    a. Only one index card may be used.
    b. All helicopters must have
        i. Propellers (A & B)
        ii. Yoke (C & D)
        iii. Base (E)
    c. You may add TWO paper clips.
2. Make observations about the flight of the helicopters.
3. Record your designs, modifications, and observations in the data table.

Day 3 –

1. Each team will be given a Problem Scenario.
2. Each will:
    a. Design, build, and test a helicopter that solves the problem.
    b. Draw and label a diagram of the helicopter.
    c. Design a data table to record observations.
        i. Remember titles & labels (see *Science Handbook*)
        ii. Allow for repeated trials (3 – 5)
        iii. Allow for a mean (average)

Day 4 –

1. Each team will be give ONE index card and 2 paper clips.
2. Using your diagram, build your helicopter in class.
3. Teams with the same Problem Scenario will test their helicopters together.
4. Means from each team will be recorded, combined and graphed.

Day 5 –

1. Answer “Processing the Lab” questions.

Day 1 ~ Before You Begin:

1. Describe the following in your own words:
    a. Qualitative observation –

    b. Quantitative observation –

    c. Descriptive research –

    d. Experimental research –

    e. Variable –

    f. Independent / manipulated variable –

    g. Dependent / responding variable –

    h. Controlled variable / constant –

Day 2 ~ Data:

Helicopter Design	Observation of flight
1. No modifications	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

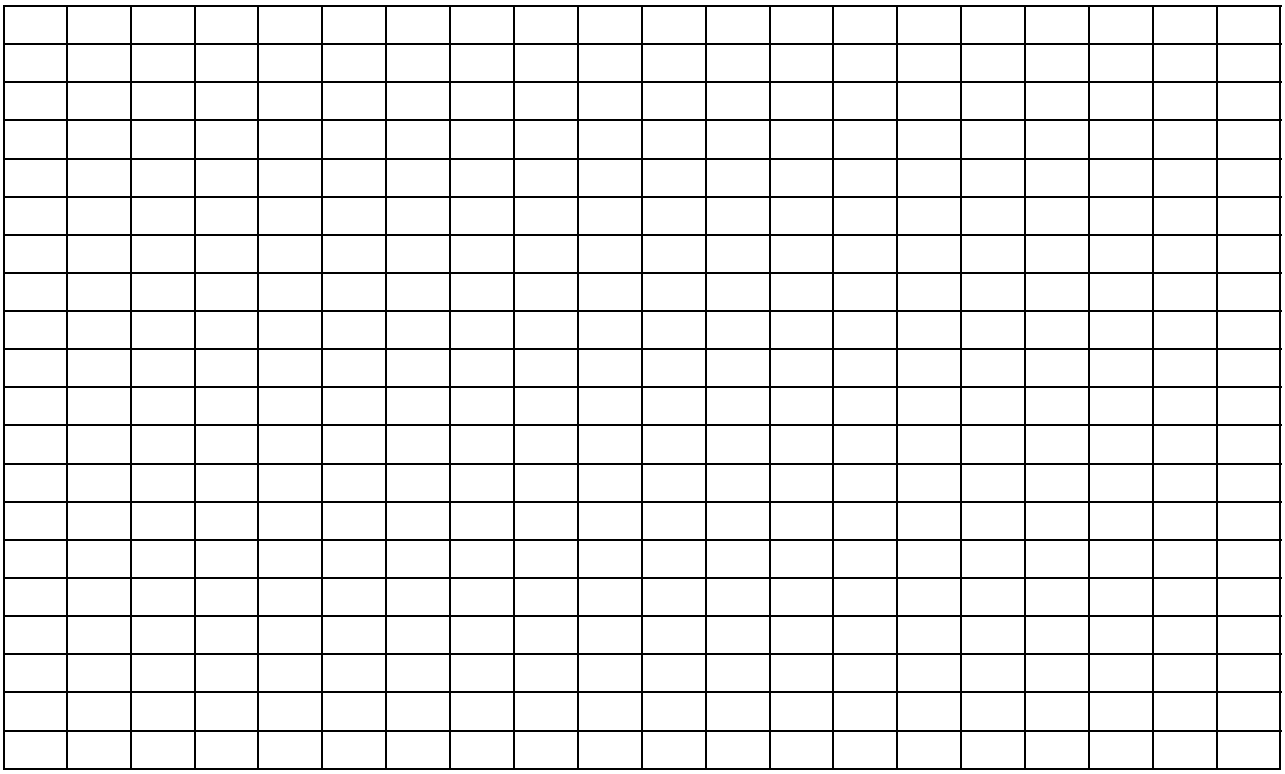
Day 3 ~ Problem Scenarios:

Problem Scenario 1 **Accuracy** Design a helicopter that will land on a target when dropped directly above the target.	**Problem Scenario 2** **Most lateral motion** Design a helicopter that will drift and land the furthest away from a target when dropped directly above the target.
Problem Scenario 3 **Staying aloft** Design a helicopter that will stay in the air longer than any other helicopter.	**Problem Scenario 4** **Speed of descent** Design a helicopter that will descend faster than any other helicopter.

Day 3 ~ Design a Data Table:

Day 4 ~ Graph of Combined Data:

(Remember to check your Science Handbook to make sure you are making a quality graph)



Day 5 ~ Processing & Conclusions:

1. Give an example of qualitative observation in this investigation:

2. Give an example of quantitative observations in this investigation:

3. Give an example of independent / manipulated variables in then investigation?

4. Give an example of dependent / responding variables in this investigation:

5. Give an example of controlled variables / constants in this investigation:

6. Even though you were not asked to write a hypothesis during this investigation, you made some. Write a hypothesis you made using an IF, THEN statement.

7. What type of graph was best to display the data from this investigation? Why?