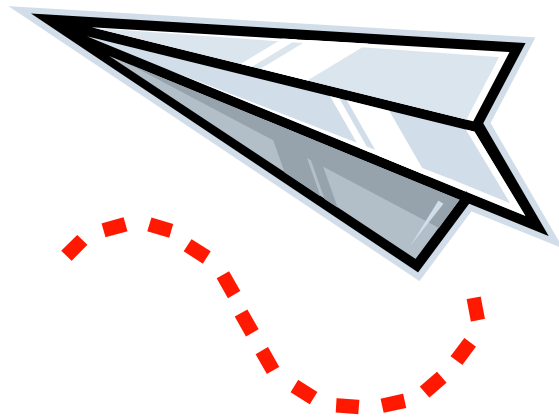


# Experimental Design Test



**Names:** \_\_\_\_\_

**Team Name:** \_\_\_\_\_

**Team Number:** \_\_\_\_\_

**Background:** You have been commissioned by NASA/Toys-R-Us to develop a better paper airplane. This technology will likely be used to better develop high altitude evacuation options for pilots and astronauts in the future.

**Task:** You are to design and conduct an experiment which explores different ways of constructing paper airplanes, to find the best way to make a paper airplane flight last the longest and fly the smoothest. You have 50 minutes to conduct, write up and clean up your experiment station.

**Materials:**

- Paper Clips
- Scissors
- Calculators
- Triple Beam Balance
- Extra Paper
- Graph Paper
- Meter Stick
- Glue Sticks
- Tape
- 3 sheets white printer paper
- 3 sheets construction paper
- 3 sheets cardstock
- 3 sheets notebook paper
- Stopwatch **(IF YOU BROUGHT ONE)**

**Directions:** Write your experiment on the notebook paper provided with this test. Please do not use this extra notebook paper in your experiment. Doing so will result in a point deduction. Grading will be according to the rubric on the following page.

**Special Instructions:** Teams are encouraged to be safe and to avoid interference with other teams as much as possible. Any team that is deemed as intentionally interfered with another team shall receive a warning. A second warning against that team will result in a penalty of up to 4 points. A third may result in that team being ranked below all other teams.

# Good Luck!

## Experimental Design Rubric for B/C

### a. Statement of problem (2 Points)

- Not a yes/no question and includes independent and dependent variables
- Problem is clearly testable and is written in a clear and concise manner

### b. Hypothesis (4 points)

- Statement predicts a relationship or trend
- Statement gives specific direction to the prediction(s): A stand is taken.
- Prediction includes both independent and dependent variables
- A rationale is given for the hypothesis.

### c. Variables

#### Independent Variable (IV) (3 Points)

- IV correctly identified
- IV operationally defined
- At least three levels of IV given

#### Dependent Variable (DV) (3 points)

- (2pts) DV correctly identified
- DV operationally defined

#### Controlled Variables (CV) (4 points)

- One CV correctly identified
- Two CVs correctly identified
- Three CVs correctly identified
- Four CVs correctly identified

### d. Experimental Control (Standard of Comparison-SOC) (2 points)

- SOC correctly identified and makes logical sense for the experiment
- Reason given for selection of SOC

### e. Materials (3 points)

- All materials used are listed
- All materials used are listed properly (no extras)
- Materials listed separately from procedure

### f. Procedure: Including Diagrams (6 points)

- Procedure well organized
- Procedure is in a logical sequence
- (2pts) Enough information is given so another could repeat procedure
- Diagrams used
- Repeated trials

### g. Qualitative Observations (4 points)

- Observations about results given
- Observations about procedure/deviations
- Observations about results not directly relating to DV
- Observations given throughout the course of the experiment.

### h. Quantitative Data - Data Table (6 points)

- All raw data is given
- All data has units
- Condensed table with most important data included
- Table(s) labeled properly
- Example calculations are given
- All data reported using correct figures (significant figures C Division only)

### i. Graph(s) (6 points)

- Appropriate type of graph used
- Graph has title
- (2pts) Graph labeled properly (axes/series)
- Units included
- Appropriate scale used

### j. Statistics **Division B&C-** (2 points)

- Average (mean), median, mode, range, or drawn in line best of-fit

### **Division C only** (4 more points)

- Measure of central tendency
- Measure of variation
- Regression analysis
- Other appropriate statistic used

### k. Analysis and interpretation of data (4 points)

- All data discussed and interpreted
- Unusual data points commented on
- Trends in data explained and interpreted
- Enough detail is given to understand data and all statements must be supported by the data.

### l. Possible Experimental Errors (3 points)

- Possible reasons for errors are given
- Important info about data collection given
- Effect errors had on data discussed

### m. Conclusion (4 points)

- Hypothesis is evaluated according to data
- Hypothesis is re-stated
- Reasons to accept/reject hypothesis given
- All statements are supported by the data

### n. Applications and Recommendations for

- Further Use (4 points)
- Suggestions for improvement of specific experiment are given
- Suggestion for other ways to look at hypothesis given
- Suggestions for future experiments given
- Practical application(s) of experiment given