EXPERIMENTAL DESIGN

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** This event will determine the participant's ability to design, conduct, and report the findings of an experiment conducted **entirely** on site.

   A TEAM OF UP TO: 3 **EYE PROTECTION:** C **APPROXIMATE TIME:** 50 minutes

2. **EVENT PARAMETERS:**
   a. Participants must bring goggles and writing utensils. Chemicals that require other safety clothing will not be used.
   b. Division B teams may bring one timepiece, one linear measuring device, and one **stand-alone** non-programmable non-graphing calculator.
   c. Division C teams may bring one timepiece, one linear measuring device, and one **stand-alone** calculator of any type.
   d. The event supervisor will provide each team with identical sets of materials either at a distribution center or in an individual container.
   e. The event supervisor will supply a report packet, based on the Experimental Design Checklist posted on the event page at soinc.org, for recording their experimental information and data.

3. **THE COMPETITION:**
   a. The teams must design, conduct, and report the findings of an experiment actually conducted on site that addresses the assigned question/topic area provided by the event supervisor. The assigned question/topic area should be the same for all teams and allow the participants to conduct experiments involving relationships between independent and dependent variables (i.e., height vs. distance).
   b. **During the first 20 minutes of the event, participants will receive the assigned question/topic area, materials, and the first half of the report packet so they can focus on designing and conducting their experiment**.
   c. **After the first 20 minutes, participants will receive the last half of the report packet and while they may continue experimenting, participants will also begin to analyze their data and report findings**.
   d. Each team must use at least two of the provided materials to design and conduct an experiment. The materials will be listed on the board or placed on a card for each team. If provided, both the card and the container will be considered part of the materials. The identity of the materials will be unknown until the start of the event.
   e. When a team finishes, all materials must be returned to the event supervisor along with all written materials and reports.

4. **SCORING:**
   a. High score wins. Scoring will be done using the Experimental Design Checklist found on the Science Olympiad website (soinc.org).
   b. Points will be awarded depending upon the completeness of the response. Zero points will be given for no responses as well as illegible or inappropriate responses.
   c. Ties will be broken by comparing the point totals in the scoring areas in the following order:
      i. Variables
      ii. Procedure
      iii. Analysis of Results (Claim, Evidence, & Reason)
      iv. Graph
      v. **Raw** Data Table
   d. Any participant not following proper safety procedures will be asked to leave the room and will be disqualified from the event.
   e. **The final score of a team will be multiplied by 0.95 if they do not follow cleanup procedures.**
   f. **The final score of a team will be multiplied by 0.75 if their experiment does not address the assigned question/topic area.**
   g. **The final score of a team will be multiplied by 0.25 if they do not conduct an experiment (i.e., performing a dry lab, making up data or trials).**

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Experimental Design CD and Problem Solving/Technology CD; other resources are on the event page at soinc.org

EXPERIMENTAL DESIGN CHECKLIST

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Part I - Design and Construct Experiment

A. Hypothesis (6 pts)

② ① ⓪ Statement predicts a relationship or trend **between the independent and dependent variables**
② ① ⓪ Statement gives specific direction to the predictions(s) (e.g., a stand is taken)
② ① ⓪ A rationale is given for the hypothesis.

B. Variables (**16 pts**)

a. Independent Variable (IV) (6 pts)
② ① ⓪ IV correctly identified
② ① ⓪ IV operationally defined
② ① ⓪ At least three levels of IV given

b. Dependent Variable (DV) (**4** pts)
② ① ⓪ DV correctly identified
② ① ⓪ DV operationally defined

c. Controlled Variables (CV) (**6** pts)
② ① ⓪ One CV correctly identified
② ① ⓪ Two CVs correctly identified
② ① ⓪ Three CVs correctly identified

C. Experimental Control (Standard of Comparison) (4 pts)

② ① ⓪ SOC correctly identified and makes logical sense for the experiment
② ① ⓪ Reason given for selection of SOC

D. Materials (6 pts)

② ① ⓪ Materials listed separately from procedure
② ① ⓪ All materials used are listed
② ① ⓪ **No extra materials are used**

E. Procedure with Diagrams (12 pts)

② ① ⓪ Procedure well organized
② ① ⓪ Procedure is in a logical sequence
② ① ⓪ Repeated trials
② ① ⓪ Diagram of the experimental setup provided
④ ③ ② ① ⓪ Enough information is given so another could repeat procedure

F. Qualitative Observations (8 pts)

② ① ⓪ Observations about results given
② ① ⓪ Observations about procedure/deviations
② ① ⓪ Observations about results not directly relating to Dependent Variable or other data
② ① ⓪ Observations given throughout the course of the experiment

G. Quantitative Data - Data Table (10 pts)

② ① ⓪ All raw data is given
② ① ⓪ All data has units
② ① ⓪ Table(s) labeled properly
② ① ⓪ **Reports most relevant data**
② ① ⓪ All data reported using correct figures (significant figures C Division only)

(revised 08/22/18)

Part II – Data, Analysis and Conclusions

H. Graphs (10 pts)

② ① ⓪ Appropriate type of graph used
② ① ⓪ Graph has title
② ① ⓪ Graph labeled properly (axes/series)
② ① ⓪ Units included
② ① ⓪ Appropriate scale used

I. Statistics (6 pts)

② ① ⓪ **Age-appropriate statistics (i.e., best fit, average/mean, median, mode) are used**
② ① ⓪ Example calculations are given with appropriate units
② ① ⓪ **Calculations are accurate**

J. Analysis and interpretation of data (10 pts)

② ① ⓪ All data discussed and interpreted
② ① ⓪ Unusual data points commented on
② ① ⓪ Trends in data explained and interpreted
② ① ⓪ **Interpretations based on statistics used are accurate**
② ① ⓪ Enough detail is given to understand data and all statements must be supported by the data.

K. Possible Experimental Errors (6 pts)

② ① ⓪ Possible reasons for errors are given
② ① ⓪ Important info about data collection given
② ① ⓪ Effect errors had on data discussed

L. Conclusion (8 pts)

② ① ⓪ Hypothesis is evaluated according to data
② ① ⓪ Hypothesis is re-stated
② ① ⓪ Reasons to accept/reject hypothesis given
② ① ⓪ All statements are supported by the data

M. Applications & Recommendations for Further Use (8 pts)

② ① ⓪ Specific suggestions to improve the experiment are given
② ① ⓪ Suggestions for other ways to look at hypothesis are given
② ① ⓪ Suggestions for future experiments are given
② ① ⓪ Practical application(s) of experiment are given

Team #: _____

School Name: _____

Point Total: _____**/106**

Deduction multiplier(s): _____
Non clean up (0.95), Off topic (0.75), or Non lab (0.25)

Final Score: _____