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 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. **Experiments will not require any other safety equipment.**
   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 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 **Part I** of the report packet. Participants will focus on designing and conducting their experiment.
   c. After the first 20 minutes, participants will receive **Part II** of the report packet and will focus on analyzing their experiment and reporting findings. Participants may continue experimenting throughout the entire event.
   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 including both parts of the report packet.
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 **of the checklist** in the following order:
      i. **J. Analysis of Claim/Evidence/Reasoning**
      ii. **E. Procedure and Set-Up Diagrams**
      iii. **C. Variables**
      iv. **G. Data Table**
      v. **H. Graph**
   d. Any participant not following proper safety procedures will be asked to leave the room and will be disqualified from the event.
   e. Any team not following clean-up procedures will have their final score multiplied by 0.95.
   f. Any team not addressing the assigned question/topic area will have their final score multiplied by 0.75.
   g. **Any team not collecting data by conducting an experiment on-site will have their final score multiplied by 0.25.**

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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2020 Experimental Design Division B Checklist

(Note: The maximum points available for each task are shown.)

Part I – Design and Construction of the Experiment **(58 pts)**

A. **Statement of the Problem (2 pts)**

② ① ⓪ **Statement addresses the experiment including variables (Not a yes/no question)**

B. Hypothesis (6 pts)

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

C. Variables (**16** pts)

a. Independent Variable (IV) (6 pts)
② ① ⓪ **Correctly identified and defined**
④ ③ ② ① ⓪ Levels of IV given

b. Dependent Variable (DV) (4 pts)
④ ③ ② ① ⓪ **Correctly identified and defined**

c. **Controlled Variables & Constant** (CV) (**6 pts**)
② ① ⓪ **First** CV correctly identified
② ① ⓪ **Second** CV correctly identified
② ① ⓪ **Constant correctly identified**

D. Materials (4 pts)

② ① ⓪ **All materials are listed and quantified**
② ① ⓪ No extra materials are **listed**

E. Procedure **and Set-up** Diagrams (**14 pts**)

② ① ⓪ Procedure **is presented in list form**
② ① ⓪ Procedure is in a logical sequence
② ① ⓪ Steps for repeated trials are included
② ① ⓪ **Multiple diagrams** of setup are provided
② ① ⓪ **All diagrams are appropriately labeled**
④ ③ ② ① ⓪ Enough information is given so another could repeat procedure

F. Qualitative Observations (**6 pts**)

② ① ⓪ Observations about procedure provided
② ① ⓪ Observations about the results provided
② ① ⓪ Observations given throughout the course of the experiment

G. Quantitative Data - Data Table (1**0 pts**)

② ① ⓪ All raw data is **provided**
② ① ⓪ **A condensed data table showing only the data to be graphed provided**
② ① ⓪ Tables **and columns** labeled properly
② ① ⓪ All data has units
② ① ⓪ **Example calculations for derived variables are given**

Part II – Data, Analysis and Conclusions (**66 pts**)

H. Graph (1**2 pts**)

④ ③ ② ① ⓪ Appropriate **Graph is provided**
④ ③ ② ① ⓪ Graph properly titled and labeled
④ ③ ② ① ⓪ Appropriate scale and units included

I. Statistics (**14 pts**)

④ ③ ② ① ⓪ Statistics of Central Tendency (i.e., best fit, median, mode, mean)
④ ③ ② ① ⓪ **One example calculation is given for each statistic including units**
④ ③ ② ① ⓪ **Statistics of Variation (i.e., min, max, range)**
② ① ⓪ Calculations are accurate

J. Analysis **of Claim/Evidence/Reason (CER)** (**18 pts**)

② ① ⓪ **Statistics Claim completed logically**
② ① ⓪ **Statistics Evidence completed logically**
② ① ⓪ **Statistics Reasoning completed logically**
② ① ⓪ **Outliers Claim completed logically**
② ① ⓪ **Outliers Evidence completed logically**
② ① ⓪ **Outliers Reasoning completed logically**
② ① ⓪ **Data Trend Claim completed logically**
② ① ⓪ **Data Trend Evidence completed logically**
② ① ⓪ **Data Trend Reasoning completed logically**

K. Possible Experimental Errors (8 pts)

④ ③ ② ① ⓪ **One specific error is identified and effect on results discussed.**
④ ③ ② ① ⓪ **Second specific error is identified and effect on results discussed.**

L. Conclusion (8 pts)

② ① ⓪ Hypothesis is re-stated
② ① ⓪ **Hypothesis Claim completed logically**
② ① ⓪ **Hypothesis Evidence completed logically**
② ① ⓪ **Hypothesis Reasoning completed logically**

M. Recommendations for Future Experimentation (**6** pts)

② ① ⓪ Suggestions to improve the experiment are given
② ① ⓪ Suggestions for practical applications of experiment are given
② ① ⓪ Suggestions for future experiments are given

School: _____**Team#**_____

Point Total: _____**/124**

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

Final Score: _____

(revised 8/23/2019)