# Chester Science Fair Workshop

The making of a good Science Fair Project

# Project Elements

- **RESEARCH QUESTION**:

  What is the effect of the Independent Variable on the Dependent Variable ?

  **HYPOTHESIS**:

  I think IF . . . . THEN . . . .. . because . . .. . . . . .

  Educated guess because of some preliminary research

- **MATERIALS**:

  Must be specific about what you used including the AMOUNTS (with units). Put materials in a list

- **INDEPENDENT VARIABLE**:

  What you are testing – what are YOU changing as part of the experiment?

# Project Elements

## DEPENDENT VARIABLE:

What are you MEASURING? You must be able to record what you measure in numbers with units (ex feet, seconds, miles/hour, etc)

- **CONSTANTS:**

  What you keep the same to make a fair test. If it is not the independent variable or what you are trying to measure then you want to keep it constant through the test. This way you know that what you are changing is the cause of the change in what you are measuring

- **CONTROL**:

  What you COMPARE your measurements to. Tells you what happened

  Often a set of samples that you have that you don't change the independent variable for.

# Project Elements

**PROCEDURE:**

- Must be numbered in list form
- Must be specific enough for someone else to repeat EXACTLY what you did.
- Include some repeats or else a large # of tests to be trials

# Project Elements

- **Data**
  - Data should be shown in tabular as well as graphical form (see next 2 slides)
  - Must show all data in **AT LEAST** either the table data or the graphs, preferably both

# Project Elements

**DATA TABLE**:

- Must have title that tells you WHAT the numbers are all about
- Have trials – difference – results – before/after
- CONTROL placed to help in comparing the results
- Use METRIC units, indicate what the units of measure are (meters, kilograms)
- Use the type of table that your procedure's results can be shown on

**The effect of Independent Variable on Dependent Variable**

| Indep Var (units) | Depend Var (units) | | Ave(units) |
|---|---|---|---|
| | Trial 1 | Trial 2 | |
| Control | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# Project Elements

**DATA TABLE**: More Examples

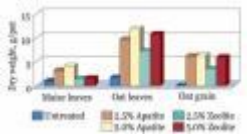
| IV | Results (units) |
|---|---|
| Trial 1 | |
| Trial 2 | |
| Trial 3 | |
| Trial 4 | |
| Trial 5 | |
| Trial 6 | |
| Trial 7 | |
| AVERAGE | |

| Indep Var (units) | Depend Var (units) | | CHANGE Can be + or – (units) |
|---|---|---|---|
| | Before | After | |
| Control | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# Project Elements

## GRAPH

– SHOW your numeric data in visual form. Make sure that you label the axes on the graph, complete with units. Ex: time(sec) or distance (feet)

| | | |
|---|---|---|
|  |  |  |
| Line Graph for change over time | Bar graph for comparison of results | Pie Chart for % of whole |

Usually Independent Variable = X axis
Dependent Variable = Y axis

# Project Elements

- **CONCLUSION**:
  - State what you learned from the experiment, not why but what
  - Should be a summary of what is shown in the data portion
  - Compare your results to your hypothesis (my hypothesis was right/wrong)

# Sample Project

- Research Question: What is the effect of different thicknesses of insulation on heat loss from a heated box?

- Hypothesis: I think that increasing insulation thickness will decrease the heat loss from the box because the outside air will have a harder time reaching the box

# Sample Project: Materials

- 20 Gallon Glass Aquarium
- Lamp with 100 watt light bulb (heater)
- Fiberglass insulation of thickness 1 inch, 2 inch, 4 inch, 6 inch, 10 inch (be specific about the type)
- Duct tape (to secure the insulation)
- Remote Digital thermometer, resolution 0.1 Celsius

# Variables and Constants

- **Independent Variable**: insulation thickness. This is changed by you.
- **Dependent Variable**: temperature in the box. This is measured by you.
- **Constants**: things you will keep the same for ALL the tests:
  - Source of heat (100 watt bulb)
  - Starting temperature in the box
  - Temperature of the air outside the box
  - Location of lamp and thermometer in box

# Control

- You want to know what happens if you do nothing. In this case, the control is a test with the box with NO insulation on it.

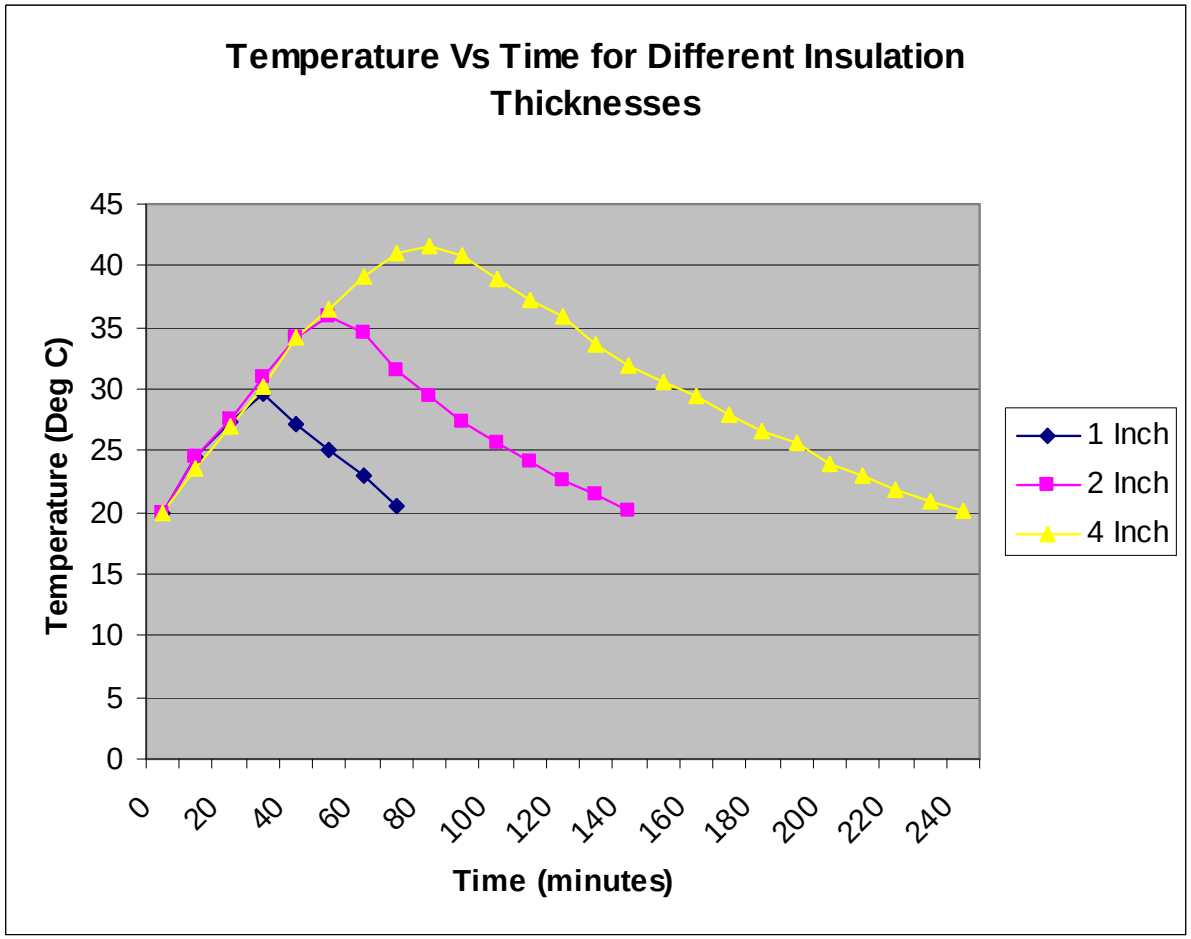
# Procedure

1. Place lamp and thermometer in box. Place glass cover on box.
2. Carefully cover entire box with insulation. All surfaces (including bottom) are covered. Tape is used to secure insulation.
3. Measure temperature inside and outside box
4. Turn on lamp.
5. Every 10 min, measure and record temperature inside and outside the box.
6. Repeat step 5 until temperature stops rising.
7. Turn off lamp.
8. Every 10 min measure and record temperature inside and outside the box
9. Repeat step 8 until temperature inside box is the same as the temperature outside the box
10. Repeat steps 2 – 9 for different insulation thicknesses.
11. Perform steps 3 – 9 for with no insulation on the box (control).

# Data Table

| Insulation thick (inches) | max temp (deg C) | time to max temp (minutes) | time back to RT (minutes) |
|---|---|---|---|
| 0 | 29.7 | 30 | 40 |
| 1 | 35.8 | 50 | 90 |
| 2 | 41.6 | 80 | 160 |
| 4 | 48.4 | 100 | 210 |
| 6 | 55.7 | 120 | 290 |
| 10 | 61.2 | 150 | 350 |

# Data Graph


Temperature Vs Time for Different Insulation Thicknesses
Temperature (Deg C)
45
40
35
30
25
20
15
10
5
0
0
20
40
60
80
100
120
140
160
180
200
220
240
Time (minutes)
1 Inch
2 Inch
4 Inch

# Conclusion

- The thicker insulation caused the temperature in the box to reach a higher maximum temperature. The time to cool down was much longer for the thicker insulation.
- My hypothesis was correct