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 milliliters, seconds, centimeters/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 – or the 'normal' product or procedure.

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
- Tell WHAT data to measure and WHERE to record it (first trial etc)
- Tell what to do with the data if appropriate – for example – do you subtract to find the difference? Do you need to find an average for the data?

Project Elements

- **Data**
  - Data should be shown in a table as well as a graph form (see next 2 slides)
  - Must show ALL DATA on the Data Table – only the AVERAGES/RESULTS on the Graph
  - Whenever possible the control goes first to make comparisons easier.

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

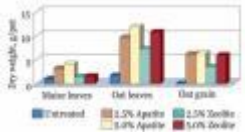
IV	Results (units)
Trial 1	
Trial 2	
Trial 3	
Trial 4	
Trial 5	
Trial 6	
Trial 7	
AVERAGE	

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 supported/not supported)
- **REFLECTION**:
  - Here is where you tell about what you think happened, what surprised you , why you think it happened.
  - Tell what you would do differently next time.

Sample Project

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

- Hypothesis: I think that if I increase insulation thickness then there will be a decrease the heat loss from the box because the outside air will have a harder time reaching the box

Sample Project: Materials

- 60 liter Glass Aquarium
- Lamp with 100 watt light bulb (heater)
- Fiberglass insulation of thickness 2.5 cm, 5 cm, 10 cm, 15 cm, 25 cm (be specific about the type)

  Be sure to tell the size of the piece of insulation needed to work with the dimensions of your aquarium
- 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 the temperature results of a test with the box with NO insulation on it.

Procedure

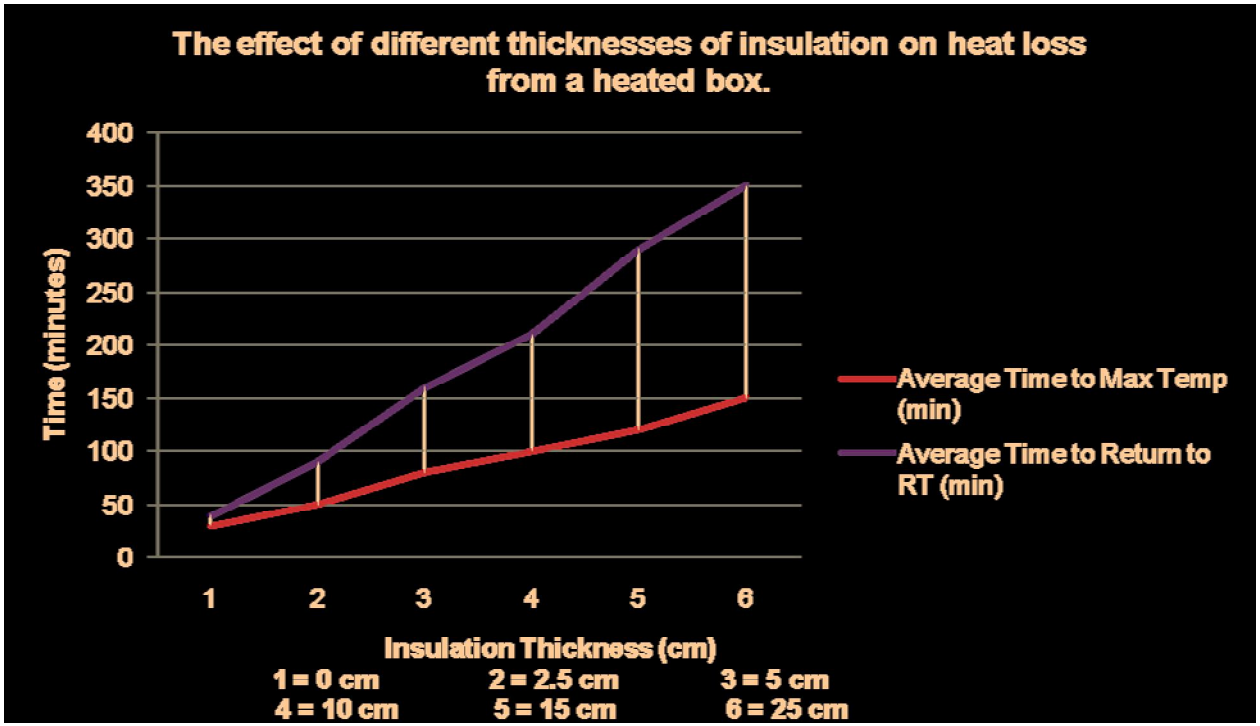
1. Place lamp and thermometer in box – spaced evenly in the interior space. Place glass cover on box.
2. Carefully cover entire box with insulation. All surfaces (including bottom) are covered. Tape is used to secure insulation.
3. Measure temperature inside and outside box.
4. Turn on lamp.
5. Every 10 min, measure and record temperature inside and outside the box.
6. Repeat step 5 until temperature stops rising. Record on table as time to maximum temperature.
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. Record on table as time to return to starting temperature.
10. Repeat steps 2 – 9 for different insulation thicknesses.
11. Perform steps 3 – 9 for with no insulation on the box (control).
12. Repeat each experiment to have 2 results for each insulation thickness to average.
13. Graph the average values.
14. Draw conclusions and reflect on your findings and experiment.

Data Table – the title would be:
The effect of different thicknesses of insulation on heat loss from a heated box.

On another Data Table you would have ALL of your results - this is a Data Table of the averages of your two trials of each insulation thickness.

Insulation Thickness (cm)	Average Maximum Temp (deg C)	Average Time to Max Temp (min)	Average Time back to RT (min)
0 (control)	29.7	30	40
2.5	35.8	50	90
5	41.6	80	160
10	48.4	100	210
15	55.7	120	290
25	61.2	150	350

Data Graph – the title would be: The effect of different thicknesses of insulation on heat loss from a heated box.



Conclusion

- My hypothesis was supported.
- 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.

Reflection

- Although the results were what I expected, I was surprised at how long it took for some of my temperatures to fall back to room temperature. With no insulation the rise and return times were relatively the same – with more insulation the return time sometimes was over twice as long as the rise time. The insulation also allowed the maximum temperature to be over twice what the control maximum temperature was.
- The next time I do this experiment I could use different TYPES of insulation to see if one is more effective than others.