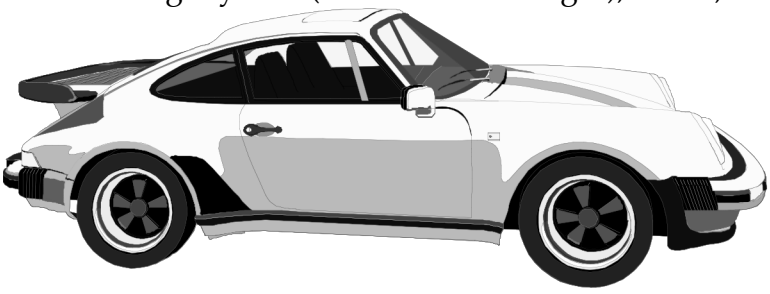
"MOVING ON DOWN" Prologue

WHAT FACTORS MIGHT AFFECT THE SPEED OF TOY CARS GOING DOWN RAMPS?
(lubrication, mass, angle of incline, length of ramp, shape of car, mass distribution, composition, wheel size, friction, force of push, air resistance, etc....)
Each team must use numerical data, graphs and measurements to support their conclusions and results.

Technology Resource 1: Science Sleuths Videodisc
Chapter A13 "A Day at the Races"
Was there cheating in the Pine Block Derby?
Groups of 2-3 take turns selecting clues from list. Teacher/Hired Investigator plays clues to class, each group must write down ideas and conclusions. At each point, the group should check to see how all the information fits the conclusions. At the end, each group hands in their ideas....

CLUES:
INTERVIEWS:
Loser's Father, Loser, Winner's Father, Winner, Referee, Engineer
DERBY VIDEO:
DOCUMENTS:
Derby Results, Derby Flyer, Referee's Notes
LITERATURE SEARCH on words:
Races, Race Cars, Weight and Speed, Kirby, Lubrication
LAB RESULTS: Lubrication, Weight, X-Rays, Photos

"MOVING ON DOWN" LAB TO FOLLOW..... Purpose: To introduce physics students to a simple experiment with the forces of motion, introduce basic measurements, introduce scientific experimental processes.
Using toy cars (borrowed or bought), CBL's, CAPT format....



NAME_____ DATE_____

MOVING ON DOWN

You will be investigating a problem related to motion. During this activity, you will work with a partner (or possibly two partners). However, you must keep your own individual lab notes because after you finish you will work independently to write a report about your investigation.(pg 3)

THE PROBLEM

The president of a toy company has written to you, asking you to to do research, and to recommend some design changes for their toy car division. Most of their customers let cars roll down ramps, and the company wishes to build toy cars that will fit the customer's performance needs.

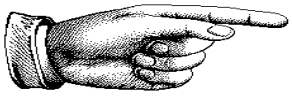
Objects move down a ramp because the force of gravity overcomes the force of friction and air resistance.

To understand how these factors work together on a moving object, it is necessary to examine specific variables in detail.

YOUR TASKS

You and your partner(s) will design and conduct 2 experiments to determine how a factor such as distance, mass, shape, incline, friction, composition changes the speed of a car. You may use a variety of safe moving toy cars, and a variety of methods for measuring the speed and acceleration with clocks, stopwatches, ramps, other cars, protractors, rulers, computer and CBL calculator motion detectors. Equipment from home is welcome. You may even choose to use results from a simulation to help you. You will then use these results to write a letter to a toy company. (pg 3)

MAJOR TASK Pick two factors, based on your preliminary tests, or other knowledge, that you think may affect the speed of a toy car rolling down a ramp, and design at least two experiments, with a control group and several experimental groups, that have quality data to show how the factors you have picked affect the speed. Factors to choose from include: lubrication, mass, angle of incline, length of ramp, shape of car, mass distribution, composition, wheel size, friction, force of push, air resistance, wheel mass distribution, color, etc....



MOVING ON DOWN

MOVING ON DOWN: THE MATERIALS:

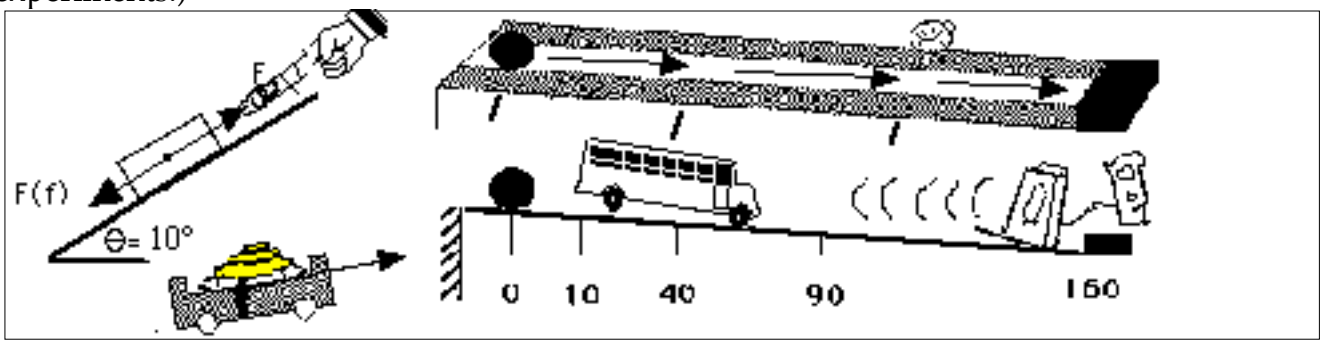
You have been provided with the following materials and equipment that you may use. If you have other materials or test equipment that you wish to bring in from home, please let the instructor know!:

Toy cars, plastic, metal, wood Spheres, metal, wood, plastic, rubber
Carts Weights Clay Tape Plastic, paper, sandpaper, foil, cloth surfaces
wood ramps meter sticks together (grooved) ring stands blocks
Motion probe with Apple II (2) String Rubber Bands Paper Clips
Ti-82 graphing calculator with CBL and motion probe
Clock stopwatches Calculators Science Sleuths:Day At The Races,
Apple II simulation program: Wood Car Rally
rulers Meter sticks spring scales ? balances?

STEPS to FOLLOW

1. In your own words, on the next page, state the problem(s) you are going to investigate and write your statement of the problems.

2) Design experiments to solve the problems. Describe your experimental designs on the next page, showing a design with appropriate variables, data collection table or graph, as well as a rough sketch. Show your design to your teacher before you begin your experiments. (Hint: There are several ways to investigate this problem. The illustration(s) below may give you ideas for designing your experiments.)



3. After receiving written approval from your teacher, work with your partner to carry out your experiments. Your teacher's approval does not necessarily mean that your teacher thinks your experiments are well designed. It simply means that in your teacher's judgment that your experiments as stated are not dangerous, or likely to be wasteful.

4. While conducting your experiment, take notes (separate paper). Make sure you leave space for charts, table, or graphs. You should use your notes later as you work independently to write about your experiments and the results. You **must** keep your own notes because you will not work with your partner when you write your report.

5. Later, you will work independently with your individual lab notes to write about your investigation in the form of a lab report.

MOVING ON DOWN

LAB REPORT:

Your lab report is in the form of a letter to the president of a toy company.

You wish to advise the executive on how to build the most satisfying, fast-moving toy cars. Your report should include:

- A clear statement of the problems you investigated, detailing the independent and dependent variables;

- a description of the experiments you carried out;

- the results of your experiments (including data presented in the form of charts, tables, or graphs);

- your conclusions from the experiments and

- comments about how valid you think your conclusions are. (In other words, how much confidence do you have that your results are accurate? What errors may have affected your results?)

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NAME_____ **MOVING ON DOWN LAB**

MAJOR TASK PROBLEM To investigate with accurate measurements how _____ affects speed.

EXPERIMENTAL DESIGN(S)
(includes very specific procedures, predictions, safety, illustrations, and data collection):

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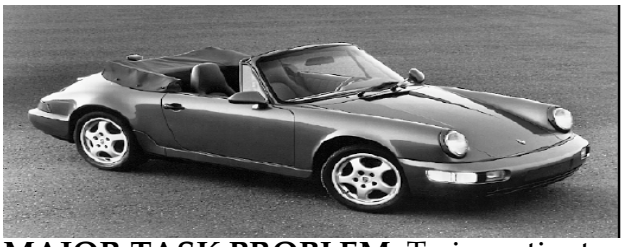
TEACHER'S APPROVAL:
__ Design ___ Procedure ____ Safety ____ Data

NAME_____ **MOVING ON DOWN LAB**



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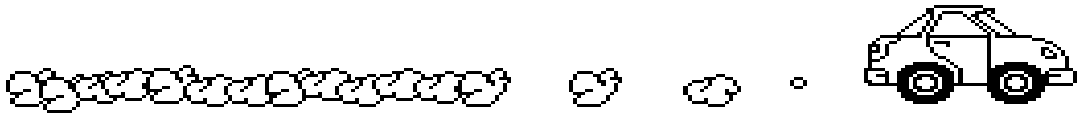
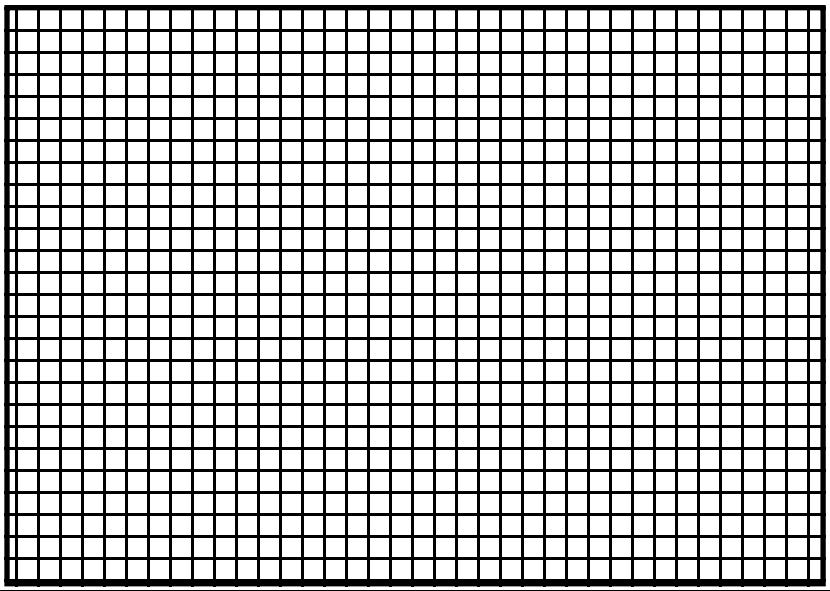
MOVING ON DOWN



SPACE FOR TABLES, CHARTS, GRAPHS



ANALYTIC SCORING RUBRIC CAPT Science Performance Tasks

(EXAMPLE: "MOVING ON DOWN" Letter to Toy Company President)

DIMENSION **SCORE**

PROBLEM DEFINITION

- The problem is stated clearly. Clear identification of independent and dependent variables. 3
- The problem is stated adequately. Adequate identification of independent and dependent variables. 2
- The problem is poorly stated. Poor identification of independent and dependent variables. 1
- The statement of the problem is very limited or missing altogether. No identification of independent and dependent variables. 0

EXPERIMENTAL DESIGN

- The experiment matches the stated problem. Variables are controlled. The procedures are clear, complete and replicable. A control is included when appropriate. 3
- The experimental design generally matches the stated problem. Attempt at controlling variables is made. Procedures are generally complete. Minor modifications or clarifications may be needed. 2
- The experimental design matches the stated problem to some extent. Little attempt to control variables. Procedures are incomplete. Major modifications or clarifications may be needed. 1
- The experimental design does not match the stated problem, is very incomplete or missing. No attempt to control variables. 0

DATA PRESENTATION

- Data are accurate, complete, well-organized and presented in an appropriate manner. 3
- Data are generally accurate, complete, organized and presented in an appropriate manner. Minor errors or omissions may be present. 2
- Data are somewhat inaccurate, incomplete, poorly organized and presented in an inappropriate manner. Major errors or omissions may be present. 1
- Data are highly inaccurate, incomplete, poorly organized or presented in an inappropriate manner or missing altogether. 0

CONCLUSIONS

- Conclusions are related to the stated problem and fully supported by the data. Validity of conclusions is thoroughly discussed. 3
- Conclusions are generally related to the stated problem and fully supported by the data. Minor errors in the interpretation of the results may be present. Discussion of validity of conclusions is limited. 2
- Conclusions are related to the stated problem and supported by the data to a limited extent. Major errors in interpretation of results may be present. Little discussion of validity of conclusions. 1
- Conclusions are not related to the stated problem, not supported by data or are missing. No discussion of validity of conclusions. 0