

## ***PHYSICS PHYNAL EXAM***

### ***2L BOTTLE ROCKET PROJECT***

Each student will design and build a 2L bottle rocket which will be propelled by air pressure and water propellant. Students will provide their own material, except that the following materials will be made available: hot glue, masking tape, poster board, string, cutting utensils and hole punches. Other materials may be available at school, such as cardboard, bubble wrap, and plastic bags.

A full lab report will be completed on final exam day, worth 40 points. The launch will have been held on an earlier day and data collected.

Lab report requirements (on unlined paper):

- a. (2 pts) Cover page
- b. (2 pts) Purpose & Procedure
- c. (4 pts) Design: A design drawing showing top and side view of the rocket with labels, dimensions (centimeters), and color scheme.
- d. (8 pts) Appearance: Description of color scheme and other detailing done to rocket. This grade is determined by the objective artistic eye of your beloved teacher.
- e. (4 pts) Data (everything in metric):
  1. Length of rocket: \_\_\_\_\_ m
  2. Mass of rocket with egg loaded but without "fuel": \_\_\_\_\_ kg
  3. Time of flight to maximum height: \_\_\_\_\_ sec
  4. Total time in air for egg capsule: \_\_\_\_\_ sec
  5. Rocket acceleration (done in class): \_\_\_\_\_  $\text{m/s}^2$
- f. (12 pts) Performance.
  1. (6 pts) Egg survival (all or nothing)
  2. (6 pts) Score from performance table on next page
- g. (4 pts) Required calculations. Calculate maximum height (m) and velocity (m/s) of rocket, and force (N) acting on rocket.
- h. (4 pts) Conclusion/summary. Include:
  - ▶ Discussion of results, how your rocket performed compared to what you expected, and what you might have done differently to improve performance.
  - ▶ Did mass or length affect performance?
  - ▶ Do your calculations for height, speed, and force seem reasonable?

## *TABLE OF PERFORMANCE VALUES*

$\Delta t_{up}$	Points	$\Delta t_{Total}$	Points	Egg survived
1.5	0	4.5	0	
2.0	1	5.0	1	
2.5	2	5.5	2	
Standard: 3.0	3	6.0	3	+1
3.5	4	6.5	4	+2
4.0	5	7.0	5	+3
4.5	6	7.5	6	+4

NOTE: The idea is to maximize performance by launching the rocket aerodynamically into the air followed by a long descent which allows the egg to survive the landing.