

A Appendices

A.1 Formulas

Summary of the kinematic equations for constant acceleration. The bar over the v means average. The initial values of time, position, and velocity to be 0, 0, and v_0 , respectively.

$$d = \bar{v}t$$

$$d = \frac{1}{2}(v_0 + v)t$$

$$d = v_0t + \frac{1}{2}at^2$$

$$v = v_0 + at$$

$$v^2 = v_0^2 + 2ad$$

$$a_c = \frac{v^2}{r} = \frac{\left(\frac{2\pi r}{T}\right)^2}{r} = \frac{4\pi^2 r}{T^2}$$

$$f = \frac{1}{T}.$$

Formulas from dynamics and energy. (Use 9.81 m/s² for g .)

$$F = ma \qquad F = \frac{mv^2}{r} = \frac{m\left(\frac{2\pi r}{T}\right)^2}{r} = \frac{4\pi^2 mr}{T^2}$$

$$PE = mgh \qquad KE = \frac{1}{2}mv^2 \qquad W = Fd$$

Conversion Factors

$$1 \text{ inch} = 2.54 \text{ cm (exact)}$$

$$1 \text{ h} = 3600 \text{ s}$$

$$1 \text{ ft} = 30.48 \text{ cm (exact)}$$

$$1 \text{ d} = 86,400 \text{ s}$$

$$1 \text{ m} = 39.37 \text{ in.}$$

$$1 \text{ kg} = 1000 \text{ g}$$

$$1 \text{ lb} = 4.45 \text{ N}$$

$$1 \text{ kg has a weight of } 2.21 \text{ lbs}$$

A.2 Suppliers and Books

Accelerometers Accelerometers can be made or bought as kits. In addition to the instructions found in this booklet the following may be useful.

Amusement Park Physics, A Teachers Guide, Nathan A. Uterman, (J. Weston Walch, Portland, 1990) pages 19-47. Making horizontal and vertical accelerometers, practice problems; using accelerometers in cars, elevators, swings, etc. The author has a web page at http://newton.dep.anl.gov/hwp/unterman_n.html

Amusement Park Physics, Carole Escobar, Editor, (American Association of Physics Teachers, College Park, 1994) Thorough discussion of the physics and the measurements. Contains reprints of papers on amusement park rides. This can be ordered from Pasco and from AAPT (www.aapt.org).

Carole Escobar, "Amusement Park Physics," *The Physics Teacher*, Vol. 28, # 7, pp. 446-453, (October 1990).

Roller Coaster Science, Jim Wiese (Wiley, New York, 1994) pages 25-26. Making a simple *g* meter, testing on a merry-go-round and in a car, pages 25- 26.

Local Sources: Both rigid and flexible tubing can be found at home builders suppliers, hardware stores, fish stores, and hobby shops. Flexible tubing is cheapest at larger stores. A good type of rigid tube is the shields sold to cover fluorescent lamps. Both can usually be bought in longer lengths and cut to size.

Kits for making about fifteen horizontal and vertical accelerometers may be bought for about \$63 (mid 1998). The kits may be ordered from, among others:

Science Kit and Boreal Laboratories
777 East Park Drive
Tonawanda, NY 14160 -6781
716 - 874 - 6020 and 213 - 994 - 6317

Sargent-Welch
P.O. Box 5229
Buffalo Grove, IL 60089-5229
800 - 727 - 4368 Phone
<http://www.sargentwelch.com>

Pasco
P.O. Box 619011
10101 Foothills Blvd.
Roseville, CA 95678 - 9011
916 - 786 -3800 Phone 916 - 786 - 8905 Fax
sales@pasco.com Sales Information
<http://www.pasco.com>

For those who may want to use graphing calculators and the associated probes and sensors.

Vernier Software
8565 SW Beaverton - Hillsdale Highway
(503) 297 - 5317
<http://www.vernier.com>

A.3 Web Sites

<http://homepage.mac.com/cbakken/pga/>

Clarence Bakken's work with Physics Day at Great America Park.

<http://solomon.physics.sc.edu/~tedeschi/midway/bigtop.html>.

The web site for the University of South Carolina Midway Physics Day.

<http://www.glenbrook.k12.il.us/gbssci/phys/Class/circles/u612b.html>

Excellent background. Detailed look at looping coasters.

<http://newton.dep.anl.gov/>

Ask a scientist service.

<http://www.joyrides.com/links.htm>

Usergroups, directories, databases, etc.

<http://141.104.22.210/Anthology/Pav/Science/Physics/book/home.html>

Explanations of rides with numerical examples.

http://rollercoaster.com/web_links/

Photos, park locations.

<http://www.gunn.palo-alto.ca.us/physlab/plab99/labs/nmorley/rollercoaster.htm>

Good classroom activity, explanations of lab, photos.

<http://curie.uncg.edu/~mturner/title.html>

Questions and activities for 6 rides, and two playground rides.

<http://www.learner.org/exhibits/parkphysics/>

General overview of rides with conceptual examples.

<http://www.linfield.edu/~twsobey/Coaster/>

Some equations. Assumes some background.

<http://www.esc2.bet/TIELevel2/projects/roller/default.htm>

Activities and guide. Many resources.

<http://www.cinternet.net/~bowersda/history.htm>

History of roller coasters.

<http://library.thinkquest.org/2745/data/openpark.htm>

Mostly accurate discussion of rides. Some vector diagrams hard to decipher.

<http://www.phy.nau.edu/~danmac/AAPTDB/>

AAPT articles.

<http://dalton.gamstc.org/get-it/lessons/by-district/flint/aguthrie>

Science of park rides background for elementary teachers.

A.4 Requests for suggestions

We will continue Midway Physics Day at the South Carolina State Fair. Help us prepare for the next one by sending suggestions and comments for improving the guide to:

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