

Chapter 4

Striking at the heat in the night

(thermal processes)

Here are the references and web links for the stories in the book. **Recently added references are highlighted.** For updates to those stories and for all the new stories, go to

<http://www.flyingcircusofphysics.com/News/NewsDetail.aspx?NewsID=40>

November 2009

4.1 Dead rattlesnakes

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.youtube.com/watch?v=Bb1R6xGC8HI&feature=related> slow-motion snake strike. You can see the venom squirt out of the fangs.

<http://www.keepbusy.net/play.php?id=decapitated-snake-head-attacks>

<http://www.youtube.com/watch?v=GiqxyozkCos> same video

<http://www.break.com/index/snake-attacks-after-losing-body.html> same video

http://www.metacafe.com/watch/823553/decapitated_rattle_snake_still_moves/

news items about squirrels and snakes

<http://news.mongabay.com/2007/0813-squirrels.html>

<http://acp.eugraph.com/news/news07/rundus.html>

<http://notexactlyrocketscience.wordpress.com/2007/08/19/ground-squirrels-use-infrared-signals-to-fool-heat-seeking-rattlesnakes/>

http://scienceblogs.com/grrlscientist/2007/08/squirrels_wave_hot_tails_to_co.php including videos

news item about decapitated snake biting someone

http://seattletimes.nwsourc.com/html/localnews/2003829929_dige10m.html

<http://www.scientificamerican.com/article.cfm?id=news-bytes-of-the-week-headless-snake-bites-hapless-man>

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4.2 Fire-detecting beetles

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://spectre.nmsu.edu/dept/docs/armu/arthropods/beetles/photo4.jpg> Photo of the beetle

<http://insects.tamu.edu/images/insects/common/images/b-txt/bimg150.html>

Photo of the beetle in bark

<http://www.forestpests.org/subject.html?SUB=354> Photos of larvae in bark

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4.3 Bees kill hornet

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Bees kill via heating

<http://www.youtube.com/watch?v=K6m40W1s0Wc&feature=related>

<http://www.youtube.com/watch?v=JtFVQe4JRmA>

<http://www.sciencenews.org/articles/20050924/fob5.asp> News story plus photo

<http://www.boingboing.net/images/beefu.jpg> The same photo

Bees kill via suffocation

<http://www.youtube.com/watch?v=EuAfbt8-7VE>

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4.4 Huddling animals

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<http://www.youtube.com/watch?v=6AiCIZ9wM1o> Video

<http://www.youtube.com/watch?v=cgGL6SbMfKc&mode=related&search=>

BBC video, David Attenborough

<http://video.google.com/videoplay?docid=1194255384237631189&q=huddling+penguins&hl=en> Video

http://notblogging.notwriting.com/2005/08/i_am_haunted_by_penguins.html

News story plus photo

<http://www.youtube.com/watch?v=cgGL6SbMfKc&feature=related> penguin huddling, slow march from windward side

<http://www.aad.gov.au/default.asp?casid=3524> Scroll down to the huddling of the penguins

<http://www.kailo.org/about/images/penguins.jpg> Photo of huddling penguins

<http://www.aad.gov.au/default.asp?casid=2880> stories and photos, Australian Antarctic Division

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4.5 Space walking without a spacesuit

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Comments

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4.6 Drops on a hot skillet, fingers in molten lead

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Dean Baird’s video:

<http://phyzblog.blogspot.com/2007/01/post-ptsos2-note-leidenball-video.html>

Me at UCLA:

<http://www.youtube.com/watch?v=TjEhMSADaHs>

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4.7 Short Story: A rather dreadful swallow

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

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4.8 Walking over hot coals

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http://www.sptimes.com/2003/10/05/images/xlarge/B_1_1bfire_169174_1005.jpg Photo

<http://mangalorean.com/images/feature/0314dance8.jpg> Photo

http://news.nationalgeographic.com/news/2005/09/0901_050901_firewalking.html Photo (at the bottom) plus news story

http://www.straightdope.com/classics/a3_036.html Cecil Adams in his “Straight Dope” column

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4.9 Short Story: Fire-walking accounts

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

http://www.straightdope.com/classics/a3_036.html Cecil Adams in his "Straight Dope" column

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4.10 Freezing and supercooling water

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.kentchemistry.com/KentsDemos2.htm> One of Kent's videos is about the sudden freezing of a very cold soda

http://www.youtube.com/watch?v=n_H5ZIoZSBo&mode=related&search=

Video showing how mechanical disturbance to a supercooled beer causes rapid freezing. Way cool!

<http://www.youtube.com/watch?v=4xTHSf1I2BY&NR=1> Similar

<http://www.youtube.com/watch?v=KqQu7wIOYwU&mode=related&search=>

Rapid freezing of beer

<http://www.youtube.com/watch?v=CC3DUwseZn8&mode=related&search=> At a temperature well below the freezing point, pouring out water at the boiling point produces instant ice crystals

http://www.youtube.com/watch?v=fSPzMva9_CE Video #2 in which a few ice crystals suddenly cause supercooled liquid water to freeze

http://www.youtube.com/watch?v=fSPzMva9_CE Video # 3

http://www.youtube.com/watch?v=fSPzMva9_CE Video # 4 in which supercooled liquid water is poured into a container where it immediately freezes

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4.11 Eating sea ice

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4.12 Cooling rates of initially hot and warm water

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http://www.straightdope.com/classics/a2_098b.html Cecil Adams in his “Straight Dope” column

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4.13 Water frozen by the sky

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4.14 Saving the stored vegetables with a tub of water

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

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4.15 Spraying an orchard to preventing freezing

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

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4.16 Throwing hot water into very cold air

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<http://www.youtube.com/watch?v=CC3DUwseZn8&NR=1> At a temperature well below the freezing point, pouring out water at the boiling point produces instant ice crystals

<http://www.youtube.com/watch?v=nUDuPyod1WU>

[http://www.youtube.com/watch?v=PQEVcCv_xkQ&mode=related&search=Video # 2, including infrared images](http://www.youtube.com/watch?v=PQEVcCv_xkQ&mode=related&search=Video%20#2,includinginfraredimages)

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4.17 Icicles

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Videos

[http://www.youtube.com/watch?v=WE4hZn1YgAY&mode=related&search=Icicles can kill you, and that is a really embarrassing way to die](http://www.youtube.com/watch?v=WE4hZn1YgAY&mode=related&search=Icicles%20can%20kill%20you, and%20that%20is%20a%20really%20embarrassing%20way%20to%20die)

<http://www.youtube.com/watch?v=CeSvYK2RvWw>

<http://www.youtube.com/watch?v=CeSvYK2RvWw>

Photos

http://curiouslee.typepad.com/photos/best_of_curiouslee/icicle_tip.html tip of icicle

<http://gallery.spacebar.org/f/a/photo/viewpic/1/91/1/>

http://www.raglanroad.org/weblog/archives/2005_12.html the ribs often seen on an icicle

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4.18 Ice dams at eaves

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.extension.umn.edu/distribution/housingandclothing/DK1068.html>

Discussion plus nice diagram

http://www.umass.edu/bmatwt/publications/articles/ice_dams.html

Discussion

plus good photos, near bottom

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4.19 Rime ice and glaze ice on cables

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.michelestapleton.com/MtWash/pages/Mt%20Wash%20Rime%20ice%20on%20ro00006.htm> Photo

<http://www.zakon.org/robert/album/washington-winter02/> Photo

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4.20 Ice spikes and other ice formations

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

Video

<http://www.youtube.com/watch?v=zAQ0OQUKDXA> Watch the spikes grow

Photos:

<http://www.its.caltech.edu/~atomic/snowcrystals/icespikes/icespikes.htm>

http://www.uweb.ucsb.edu/~cdelacerda/Ice_Spike2.jpg

<http://www.nbb.cornell.edu/neurobio/land/images/Crystal1.jpg>

http://upload.wikimedia.org/wikipedia/commons/thumb/d/d1/Ice_spike.jpg/800px-Ice_spike.jpg

http://upload.wikimedia.org/wikipedia/commons/thumb/d/d1/Ice_spike.jpg/800px-Ice_spike.jpg Photo plus news story

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4.21 Cloudy ice cubes

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

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4.22 Figures inside melting ice

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4.23 Freezing of ponds and lakes

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4.24 Freezing carbonated drinks

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

http://www.youtube.com/watch?v=n_H5ZIoZSBo&mode=related&search=

Video showing how mechanical disturbance to a supercooled beer causes rapid freezing. Way cool!

<http://www.youtube.com/watch?v=4xTHSf1I2BY&NR=1> Similar

<http://www.youtube.com/watch?v=KqQu7wIOYwU&mode=related&search=>

Rapid freezing of beer

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4.25 Bursting pipes

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4.26 Touching or licking a cold pipe

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

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4.27 Bumps in winter, pingos in permafrost

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.geo.uu.nl/fg/berendsen/pictures/photography/alaska/Pingo.jpg> Photo

<http://www.arctic.uoguelph.ca/cpe/environments/land/features/freeze-thaw/pingoes.htm> Photos plus short discussion

http://www.mbari.org/news/news_releases/2003/paull_pingos.html Photos plus discussion

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4.28 Arctic ice polygons

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

http://www.crrel.usace.army.mil/permafrosttunnel/1g3d_Wedges.htm

Discussion plus photos

<http://sis.agr.gc.ca/cansis/taxa/landscape/ground/nwt.html> Photos

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4.29 Growing stones in a garden, and patterned ground

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.hi.is/~oi/patterned%20ground%20Thule%201986.jpg> Photo of patterned ground

<http://carbon.hampshire.edu/~sroof/images/hol14.jpg> Photo

<http://www.yukoncollege.yk.ca/~agraham/svalbardpictures/pages/abe%20Zeipelodden%20patterned%20ground%203028.1.html> Photo

<http://www.uspermafrost.org/images/permafrost.jpg> Photo

http://www.uspermafrost.org/gallery/swalker/swalker_gallery.shtml Photos and discussion

<http://geoimages.berkeley.edu/GeoImages/Johnson/Landforms/GlacialPeriglacial/PatternedGround01.html>

<http://sis.agr.gc.ca/cansis/taxa/landscape/ground/nwt.html> Photos

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4.30 Ploughing boulders

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

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4.31 Short Story

Dead-cat bomb and a frozen disappearance

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.youtube.com/watch?v=QaprCLxG5Tg> Liquid nitrogen and flower

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4.32 Snowflake formation

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4.33 Skiing

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4.34 Ice skating and making a snowball

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.youtube.com/watch?v=66CVS6drH-M> Penn State snowball fight, an uncontrolled fascination with the physics of hard-packing snow with pressure

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4.35 Ice walking

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

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<http://www.youtube.com/watch?v=Pia4i5sr0o0> video: Building an igloo

<http://www.youtube.com/watch?v=dTB666s8wwY> Video: building an igloo

http://www.youtube.com/watch?v=83YIR_k542w&mode=related&search=

Building an igloo in a blizzard, part 1, TV news clips

<http://www.youtube.com/watch?v=j8KdTjf-zcw&mode=related&search=> More on the news clips

<http://www.phototour.ca/pop/igloo.htm> Photo

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4.37 Snowrollers

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Photos

<http://surfaquarium.com/eIDITAROD/2003/snowrollers.htm> More good photos

http://www.enquirer.com/editions/2003/02/13/tem_snowrollers13.html Photos

plus news story

<http://epod.usra.edu/archive/epodviewer.php3?oid=45408> Photo plus description

<http://www.usatoday.com/weather/resources/askjack/wasnow1.htm> Scroll down to the news item and photo

<http://www.atmos.uiuc.edu/~jgrim/photos/wx/photos/roller2.jpg> Photo

<http://www.crh.noaa.gov/ilx/events/roller/roller.php> NOAA'S National Weather Service, brief description plus several really good photos

<http://surfaquarium.com/eIDITAROD/2003/snowrollers.htm> More good photos

http://www.enquirer.com/editions/2003/02/13/tem_snowrollers13.html Photos plus new story

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<http://www.usatoday.com/weather/resources/askjack/wasnow1.htm> Scroll down to the news item and photo

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4.38 Snow avalanche

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.youtube.com/watch?v=6qVwIuznFW0> Video of skier who causes an avalanche, which then sweeps down the cameraman

http://www.youtube.com/watch?v=Z2L_3QIEgI&mode=related&search=

Video: snowboarder triggers an avalanche

<http://www.youtube.com/watch?v=B0RWLxOFGLY&mode=related&search=>

Video of avalanches

<http://www.youtube.com/watch?v=JhUhhbiNHIs&mode=related&search=>

Video of snowboarder; very, very dangerous: racing with an avalanche. Music by Wolfmother (one of my favorite groups)

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4.39 Patterns formed by melting snow

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4.41 Homemade ice cream

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<http://www.youtube.com/watch?v=l9c5rmDQ9DE&mode=related&search=>

Video

http://www.country-freezer.com/cf_20.JPG Photo

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4.42 Drinking hot coffee, eating hot pizza

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4.44 Boiling an egg

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4.45 Cooking in a stove or over flames

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4.46 Campfire cooking

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.kickassbbq.com/chimney.jpg> Photo

<http://www.campfiredude.com/campfire-cooking.shtml> Photos plus descriptions

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4.47 Cooking pizza

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

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4.48 Heating in a microwave oven

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.youtube.com/watch?v=nkM8XpY3ItA&feature=related> Adding powder to water that has been superheated in a microwave oven

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4.49 Popping popcorn

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

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4.50 Cooking scrambled eggs

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.youtube.com/watch?v=C1SM73Qi1BQ> Instruction video. Note the rule about not using salt before the eggs cook.

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4.51 Geysers and coffee percolators

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

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4.52 Toy putt-putt boat

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

To see me demonstrate a putt-putt boat in a bathtub on “The Daily Planet” on the Discovery Channel Canada, follow this link: Go to

<http://www.gumfrog.com/dailyplanet>

and use

Username: previewguest

Password: d1sc0very (note the two numbers)

I suggest that you click the box that allows the computer to remember this information (or you may have to enter it several times)

Choose Feb 2008. Scroll down to Feb 12 / 08. Click on "Fact of the Matter".

(Want to buy or make a putt-putt boat? Go to <http://www.puttputtboats.com/>)

<http://www.youtube.com/watch?v=boqUUPMT6Gc> Video

<http://www.youtube.com/watch?v=pHf2Uj13s0c> Video

<http://www.youtube.com/watch?v=K-BoCDiouMU> Video: boat takes a few second before it begins to move

<http://www.sciencetoymaker.org/boat/index.htm> descriptions plus a button to see boats built by lots of people, a button to see patents, and other buttons

<http://www.nmia.com/~vrass/pop-pop/> Web site devoted to putt-putt (pop-pop) boats

<http://www.glue-it.com/boats/general-information/glossary/p/putt-putt.html>

Sketch plus description

<http://www.puttputtboats.com/edu.html> Description plus photos

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4.53 Thermal effects on lengths

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.upscale.utoronto.ca/IYearLab/Intros/ThermalExpans/Images/Train1.gif> Old newspaper photo of railway tracks that have buckled by thermal expansion

<http://www.physics.brocku.ca/courses/1p23/Heat/rail.html> Similar photo, with a short discussion

http://tapseis.anl.gov/guide/photo/Above_Ground_Pipe_and_Dalton.html Photo of zig-zag pipe

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4.54 Collapse of railroad storage tank

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://video.aol.com/video-detail/railroad-tank-car-implosion/108399741> video, a railroad tanker car

http://www.youtube.com/watch?v=E_hci9vrvfw&feature=related same video

<http://blog.onlinemetals.com/?tag=rail-car-implosion> photos of accident

<http://mattson.creighton.edu/BarometricPressure/Tankerview1.jpg> Photo of the crushed tanker car

<http://www.delta.edu/slime/cancrush.html> Another photo

<http://www.youtube.com/watch?v=Uy-SN5j1ogk&feature=related> barrel heated, sealed, and then floated in water to cool

<http://www.youtube.com/watch?v=GgRjPDkPkzs&feature=related> high-speed video of can being crushed by air pressure

<http://www.youtube.com/watch?v=zl657tCCudw&feature=related> can crush in a classroom setting

<http://www.youtube.com/watch?v=0fy4TLMNb6s&feature=related> classic television with Julius Sumner Miller

<http://www.youtube.com/watch?v=XejHq8AQxQE> Barrel is first heated, then sealed, and then cooled with water.

<http://www.youtube.com/watch?v=r2yUcnnQX1Q&NR=1> University of Minnesota physics demonstration

http://www.youtube.com/watch?v=_yRBb8k1ScI&feature=related Rhodes College, barrel crush and a bit of football chanting

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4.55 Drying of hanging laundry

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4.56 Warm coats

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4.57 Warm plants

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.sciencenews.org/articles/20031213/bob9.asp> News item plus photos, including one of a plant that has melted snow

<http://www.darbycreeks.org/skunk%20cabbage%2072.jpg> Skunk cabbage has melted the snow around it.

<http://biolessondeblog.blogspot.com/2007/01/interesting-fact.html> The blog spot that contains that photo.

<http://www.uwgb.edu/biodiversity/phenology/2003/symfoe20030316uwgb.jpg>

Photo

http://www.deanswildflowers.com/Blog/Fe08_WL_SCabbage1.jpg Photo

<http://www.fosc.org/Images/SkunkCabbage.jpg> Photo

<http://www.pathcom.com/~wgbz/xv040tri.jpg> Photos

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4.58 Polar-bear hairs

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

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4.59 Black robes and black sheep in the desert

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.wonderquest.com/black-robes.htm> News item plus photo

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4.60 Cooling rate of a cup of coffee

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4.61 Cool water from porous pottery

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

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4.62 Dunking bird

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.youtube.com/watch?v=kjqqWv4eZiE> Video

http://scienceblogs.com/clock/2006/08/bird_magic.php History of the dunking bird

<http://science.howstuffworks.com/question608.htm> Photo plus description

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4.63 Short Story: Large dunking birds

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4.64 Heat pipes and potato stickers

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4.65 Foggy mirrors

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.youtube.com/watch?v=nL0KeVmDRBc> Writing on a foggy mirror, with a bit of music.

http://www.metacafe.com/watch/838882/fun_halloween_prank/

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4.66 Condensation on eyeglasses

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4.67 Water collection in arid regions

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.fes.uwaterloo.ca/faculty/newsletter/march2004/fog.html> News story plus photos

<http://www.sciam.com/article.cfm?articleID=000CECBE-91F8-1C75-9B81809EC588EF21&pageNumber=3&catID=4> News story plus photos

<http://www.technovelgy.com/ct/Science-Fiction-News.asp?NewsNum=655>

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4.68 Mud cracks

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

http://www.gps.caltech.edu/~rkopp/photos/Andros2005/images/pc120611_mudcracks.jpg Photo

<http://www.terrageria.com/america/nevada/black-rock-desert/picture.usnv9106.html> Photo

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4.71 Making cakes at high altitudes

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4.72 Champagne in a tunnel

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<http://www.tmk.com/books/eastriver/east.shtml> Report on the construction of the tunnel under the East River in New York City. Scroll down to the material on air pressure.

<http://www.tmk.com/books/tunnel/tunnel.shtml> Report on the construction of the tunnel under the Hudson River in New York City.

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4.73 Short story: Stuck in a bottle

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4.74 Wintertime thunder

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4.75 Stack plumes

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.colorado.edu/MCEN/flowvis/galleries/2003/assignment3.html> Photo of stack plume becoming unstable

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4.76 Smoke signals and mushroom clouds

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4.77 Fire in a fireplace

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4.78 A candle flame

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4.79 Spraying a fire

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

Videos:

http://www.youtube.com/watch?v=d96ywpu_-R4&mode=related&search=flashover

[http://www.youtube.com/watch?v=CMEg6x3HYFQ&mode=related&search=Flashover traps a firefighter on the roof](http://www.youtube.com/watch?v=CMEg6x3HYFQ&mode=related&search=Flashover+traps+a+firefighter+on+the+roof)

[http://www.youtube.com/watch?v=uYAdffzkYlw&mode=related&search=Video: look for the flashover near the end, almost gets the firefighter on the roof](http://www.youtube.com/watch?v=uYAdffzkYlw&mode=related&search=Video:look+for+the+flashover+near+the+end,+almost+gets+the+firefighter+on+the+roof)

<http://www.youtube.com/watch?v=Io15LR6XTJI> Big flashover near the end, almost gets the firefighters

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- Forbes, L. K., and B. F. Gray, "Burning down the house: the time to ignition of an irradiated solid," *Proceedings of the Royal Society of London A*, 454, 2667-2688 (1998)
- Nam, S., "Boilover upon suppression of cooking oil fire by water spray," *Fire Safety Journal*, 39, 429-432 (2004)

4.80 Cooking-oil fires

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

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4.81 Brush fires and forest fires

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

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4.82 Firestorms

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

Videos

<http://www.youtube.com/watch?v=gXzhYgOpvuw> San Diego fires 2007

<http://www.youtube.com/watch?v=5Fw1qiAld2U> Whirlwind races along burning material

<http://www.youtube.com/watch?v=Wwn-PHMnz6Q>

<http://www.youtube.com/watch?v=YFwzNNEuOSY&mode=related&search>

http://www.youtube.com/watch?v=XaX_Hm5DI5E Watch the swirling in the fire

<http://www.youtube.com/watch?v=YFwzNNEuOSY&mode=related&search=>
Dust devil (vortex) produced by a fire

<http://www.youtube.com/watch?v=OnevoZZvbig> Larger scale swirling from a fire

<http://www.youtube.com/watch?v=c8kQbGa72tM&mode=related&search=>
Swirling in a controlled fire demonstration

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4.83 Temperature regulation in mounds and buildings

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.youtube.com/watch?v=tdnVmOzYofw> Video showing Iranian “wind catcher”

<http://www.hinduonnet.com/fline/fl2208/stories/20050422000106500.htm> Scroll down to the cooling tower

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4.84 Warmth of greenhouses and closed cars

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4.85 Heat islands

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.youtube.com/watch?v=LPIFcABniYk> Pink Floyd’s “Money” is the music; images and photos of the development around Atlanta is the visual. (Mild cursing in the song.)

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4.86 Rubber-band thermodynamics

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.youtube.com/watch?v=OW6aEmOsXv0> Video of a rubber band heat engine

http://www.haverford.edu/physics-astro/Demonstrations/thermo/rubber_band_heat_engine.htm Photo and description of a rubber band heat engine

http://www.haverford.edu/physics-astro/Demonstrations/thermo/rubber_band_heat_engine.htm Photo and description of a rubber band heat engine

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4.87 The foehn and the chinook

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4.88 The boiling water ordeal

This item is discussed in the book *The Flying Circus of Physics, second edition*, by Jearl Walker, published by John Wiley & Sons, June 2006, ISBN 0-471-76273-3.

The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

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4.89 Energy in a heated room

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4.90 Icehouse orientation

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4.91 A radiometer toy and its reversal

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The material here is located at www.flyingcircusofphysics.com and will be updated periodically.

<http://www.newenergyshop.com/pic.Extraordinary.Engines/Extraordinary.Engines.Radiometer.jpg> Photo

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4.92 Water wells and storms

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4.93 Insect and shrimp plumes

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