

What is “free energy”?



<https://www.youtube.com/watch?v=jiAhiu6UqXQ>



http://free-energi.com/4_05.jpg



No, this is free energy!!



<http://image.slidesharecdn.com>



<http://picture.yatego.com>



einerschreitimmer.com

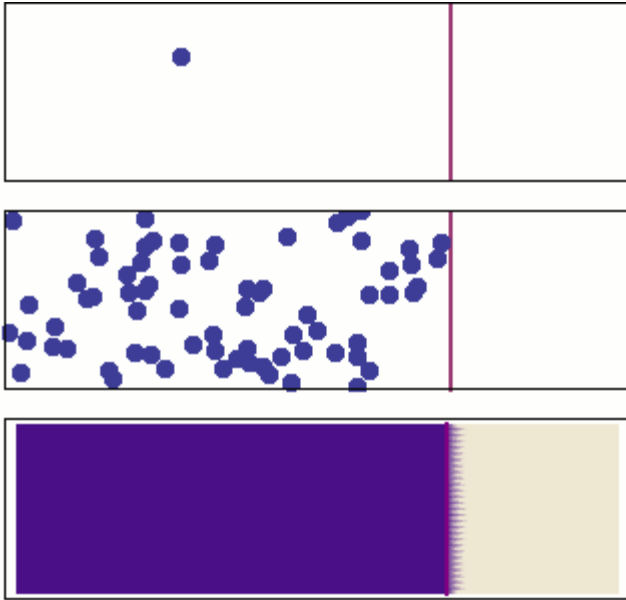
Ludwig Boltzmann



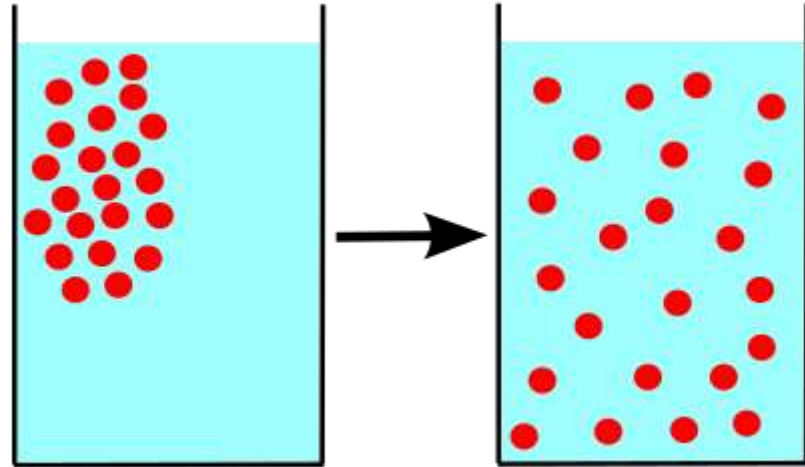
$$S = k_B \ln \Omega$$



Free energy determines, if a process happens spontaneously!



<https://en.wikipedia.org/wiki/Diffusion#/media/File:DiffusionMicroMacro.gif>



<https://en.wikipedia.org/wiki/Diffusion#/media/File:Diffusion.svg>



<http://image.slidesharecdn.com>



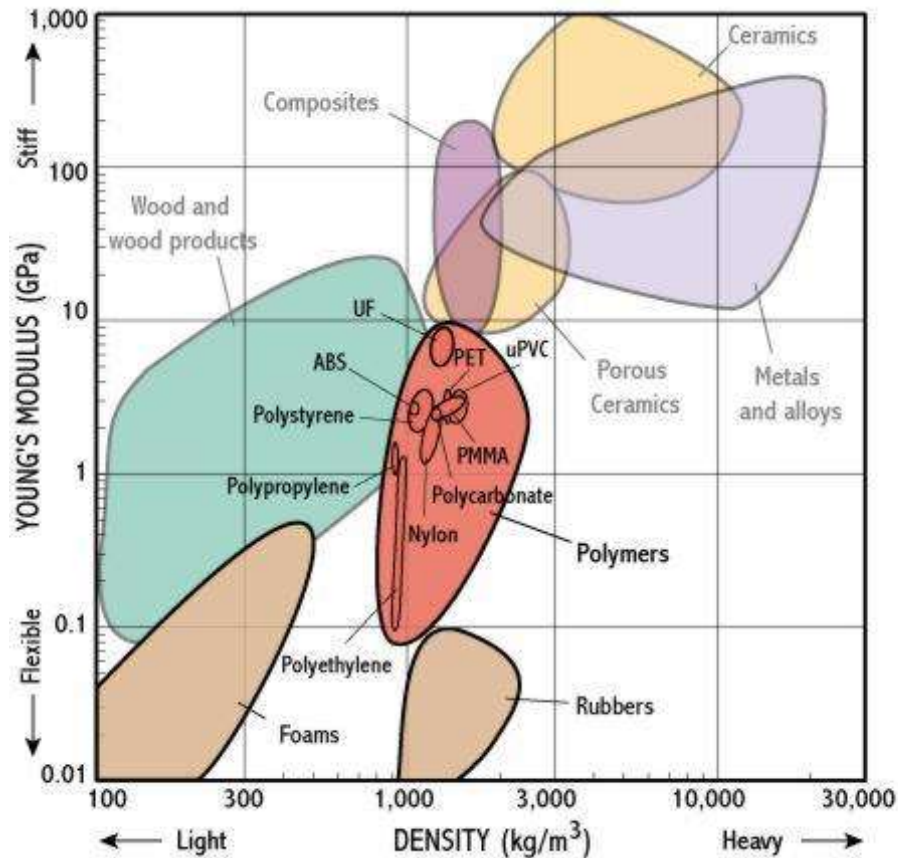
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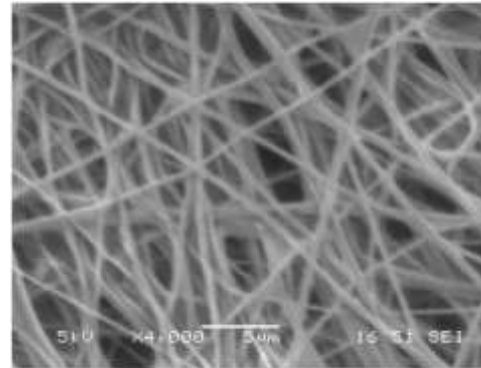
Polymers

Natural (organic) or synthetic polymers or elastomers

Historically, “rubber” = (from “rub out” pencil marks, invented 1770 by Edward Nairne)

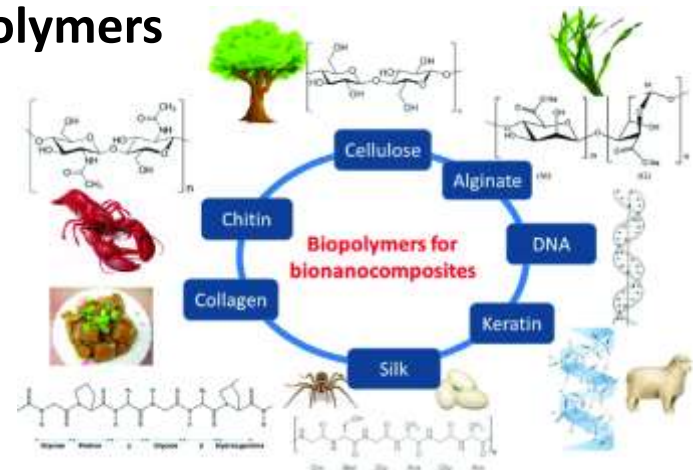


http://www-materials.eng.cam.ac.uk/mpsite/interactive_charts/stiffness-density/basic.html



https://upload.wikimedia.org/wikipedia/commons/b/b6/Scanning_Electron_Microscope_Picture_of_Nanofibrous_Electrospun_Membrane_Using_PVC_and_PEO_Polymers_2.png

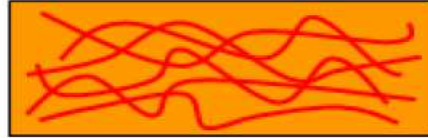
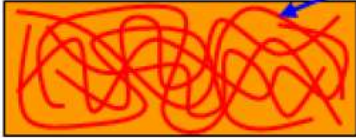
Bio-Polymers



Xiong *et al.* Mater. Sci. Eng. R Rep. **125** (2018),
DOI: 10.1016/j.mser.2018.01.002

Polymer Elasticity

Chain molecules



<https://www.quora.com>

<https://www.youtube.com/watch?v=4I5A9CYTTdc>

(Gough-)Joule effect

R. Feynman



<https://www.youtube.com/watch?v=XRxA2DRzgl>



<http://www.scientificamerican.com>

Amazing Rubber-Band Motor

The diagram on this page shows how this small **Joule-effect** engine works. While it doesn't develop a lot of power, it helps demonstrate what you might expect from a much larger motor—operating silently to a half-watt energy source like the sun, driving a practical job such as driving an electric generator.

See each part! This is distinguished by a number of features. Most basic: The steel rubber in the field, the pressure (the potential power).

Also, the Joule effect, it must be marked when tension on the rubber is greatest. However, sensitive something within the system. The for practical work it should not be described to more than three or four times its normal length.

The stronger the source of radiant energy, the faster the engine will run—and the more power it will develop. The rubber motor of most design then it heats up, as the practical test is likely to be set by the cooling phase of the cycle.

The demonstration engine runs at about 100 revolutions per hour, or three rpm, with a 100-watt portable heat lamp about 12" across. The first other band is a better. (Some rubbering film a 100-watt heater of this type, IN C 1100, for 10.00.) Heat from the 100-watt infrared bulb shows in the rubber runs the engine at a lower speed—only about one rpm.

Engineering considerations. Start by carrying a 20" coil of 1/2" plywood to make the engine frame. Use a tape measure to measure the circumference of the coil, and mark off 10 equal divisions along the edge. Draw a small nail into the edge on each mark, leaving part of the nail sticking out to hold the rubber band.

Cover the top surface of the engine frame with household aluminum foil. This will act as a reflector to maximize heating of the expanded rubber bands. Bend the foil over the edge of the frame between nails and staple it to the underside. The steel band strips to reinforce the foil where it's stapled.

Cut the heating block from wood. Drill a 1/2" hole through the motor to clear the candlestick. Counterbore the candlestick hole from top and bottom to take ball bearing into.

Simple exhibit demonstrates Joule effect

You can set up your own demonstration of the Joule effect. The following diagram shows how to set up a simple exhibit. The rubber band is a 1/2" wide, 1/2" thick, 1/2" long. The weight is a 1/2" diameter, 1/2" long. The weight is a 1/2" diameter, 1/2" long. The weight is a 1/2" diameter, 1/2" long.

How the Joule-effect engine operates

The Joule-effect engine can be built in many ways. The following diagram shows how to build a simple one. The engine is built from a 1/2" diameter, 1/2" long, 1/2" thick rubber band. The engine is built from a 1/2" diameter, 1/2" long, 1/2" thick rubber band. The engine is built from a 1/2" diameter, 1/2" long, 1/2" thick rubber band.

Joule-effect engine can build space

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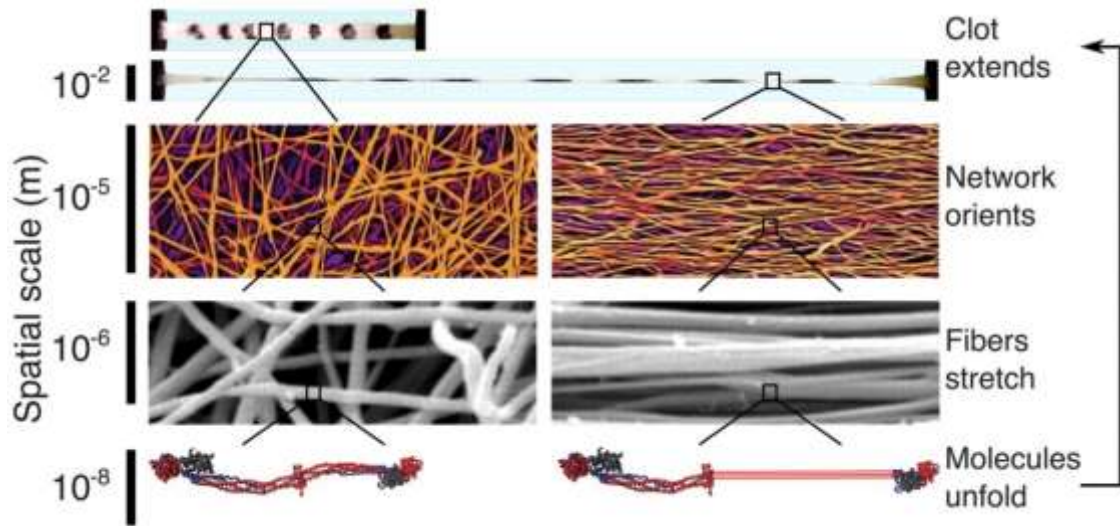
See how the Joule effect works

The Joule effect is the heating effect of the rubber band. The rubber band is heated by the heat source. The rubber band is heated by the heat source. The rubber band is heated by the heat source.

Popular Science, January 1972

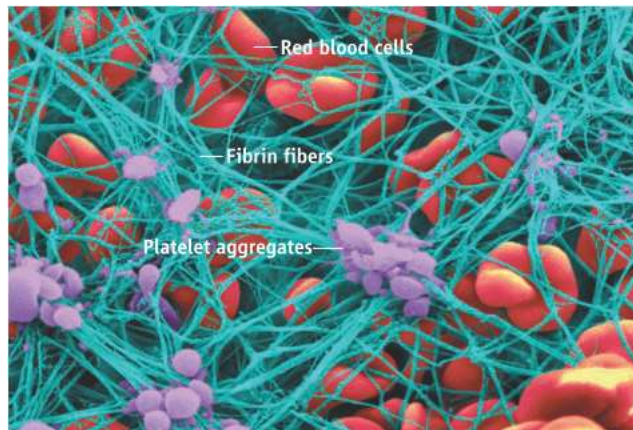
Biopolymer Elasticity

Fibrin polymer:

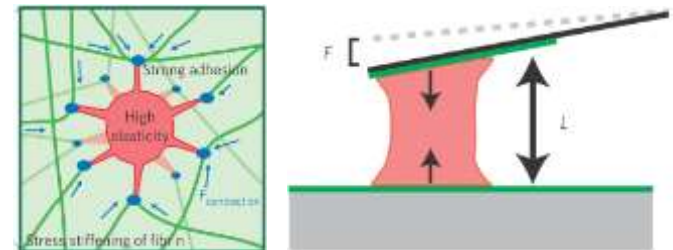


Brown *et al.* Science **325** (2009), DOI: 10.1126/science.1172484

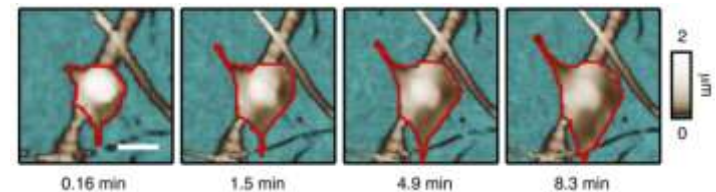
“Active” fibrin polymer:



Weisel *et al.* Science **320** (2008)
DOI: 10.1126/science.1154210



Lam *et al.* Nature Materials **10** (2011)
DOI: 10.1038/NMAT2903



Vogel *et al.* J. Clin. Invest. **125** (2015)
DOI: 10.1172/JCI81660