HOMEWORK SET 18: MAXWELL-BOLTZMANN SPEED DISTRIBUTIONS II
Due Friday, March 28, 2025

PROBLEMS FROM TREX[1]

9.2) The result of Problem 9.1 (shown right), can be used to extimate the relative probabilities of various velocitites. Pick a small interval $\Delta v_x = 0.002 v_{x,\,rms}$. For 1 mole of an ideal gas, compute the number of molecules within the range Δv_x centered at

$$g(v_x)dv_x = \sqrt{\frac{1}{2\pi}}\frac{1}{v_{x,rms}}e^{-\frac{1}{2}v_x^2/v_{x,rms}^2}dv_x$$

a) $v_x = 0.01\ v_{x,\,rms}$, **b)** $v_x = 0.20\ v_{x,\,rms}$, **c)** $v_x = v_{x,\,rms}$, **d)** $v_x = 5\ v_{x,\,rms}$, and **e)** $v_x = 100\ v_{x,\,rms}$.

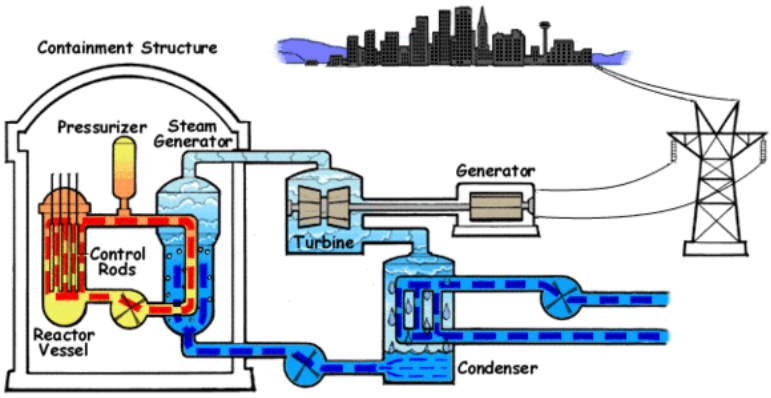
COMMENT ON YOUR ANSWERS ... ARE THEY REASONABLE? DO THEY MAKE SENSE?

9.7) It is important for nuclear engineers to know the thermal properties of neugrons in a nuclear reactor. Assuming that a gas of neutrons is in therma equilibrium, find $\bar{v}$ and v* for neutrons at

a) 300 K and

b) 630 K (a typical temperature inside a modern light-water nuclear reactor).

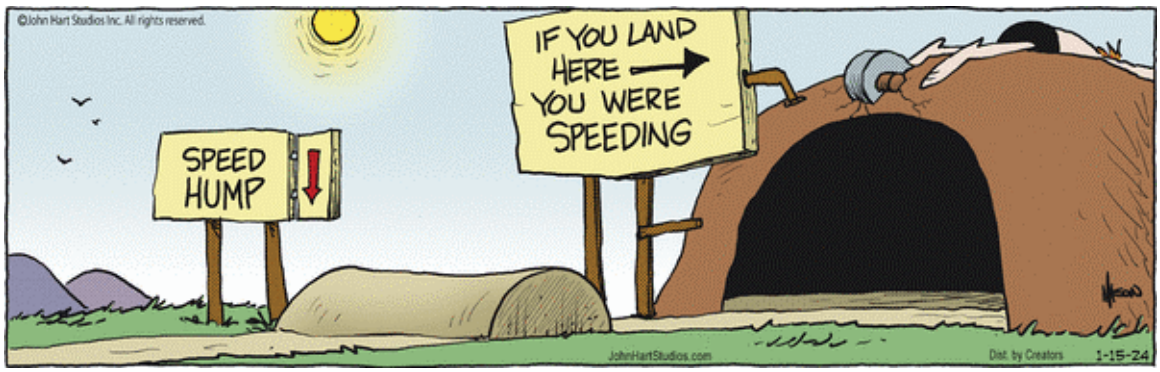
COMMENT ON YOUR ANSWERS ... ARE THEY REASONABLE? DO THEY MAKE SENSE?



https://en.wikipedia.org/wiki/Light-water_reactor

9.9) Find v* for N_2 gas in air **a)** on a cold day at T = -15°C and b) on a hot day at T = 35°C.

COMMENT ON YOUR ANSWERS ... ARE THEY REASONABLE? DO THEY MAKE SENSE?



[1] Thornton and Rex, *Modern Physics for Scientists and Engineers*, 3rd Editon, Cengage Learning, 2013