Physics 24 Problem Set 5

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due Monday, February 13

Please make your work neat, clear, and easy to follow. It is hard to grade sloppy work accurately. Generally, make a clear diagram, and label quantities. Derive symbolic answers, and then plug in numbers after a symbolic answer is available.

1. Gasoline has a mass density of $0.803\,\mathrm{gm/cm^3}$. A gallon of gasoline, when burned chemically, releases about 1.2×10^8 Joules. If all the mass of a gallon of gasoline were converted to energy, by what factor would the energy release increase?

2. A $1\,\mathrm{kg}$ rest mass block moves at velocity $v = 0.95 \times c$, where c is the speed of light. Compute, using both relativistic equations and non-relativistic equations:

   (a) The kinetic energy of the mass (the kinetic energy is the difference between the total energy and the rest energy).

   (b) The mass of the block.

   (c) The momentum of the block.

   (d) The energy-momentum invariant: $(E/c^2)^2 - (p/c)^2$.

3. Purcell, Problem 5.1

4. Purcell, Problem 5.4