

72. (a) For a proton (using Table 38-3), our results are:

$$E = \gamma m_p c^2 = \frac{938 \text{ MeV}}{\sqrt{1 - (0.990)^2}} = 6.65 \text{ GeV}$$

$$K = E - m_p c^2 = 6.65 \text{ GeV} - 938 \text{ MeV} = 5.71 \text{ GeV}$$

$$p = \gamma m_p v = \gamma(m_p c^2)\beta/c = \frac{(938 \text{ MeV})(0.990)/c}{\sqrt{1 - (0.990)^2}} = 6.59 \text{ GeV}/c$$

(b) For an electron:

$$E = \gamma m_e c^2 = \frac{0.511 \text{ MeV}}{\sqrt{1 - (0.990)^2}} = 3.62 \text{ MeV}$$

$$K = E - m_e c^2 = 3.625 \text{ MeV} - 0.511 \text{ MeV} = 3.11 \text{ MeV}$$

$$p = \gamma m_e v = \gamma(m_e c^2)\beta/c = \frac{(0.511 \text{ MeV})(0.990)/c}{\sqrt{1 - (0.990)^2}} = 3.59 \text{ MeV}/c$$