

20. (a) Using Eq. 29-16, we obtain

$$v = \frac{rqB}{m_\alpha} = \frac{2eB}{4.00 \text{ u}} = \frac{2(4.50 \times 10^{-2} \text{ m})(1.60 \times 10^{-19} \text{ C})(1.20 \text{ T})}{(4.00 \text{ u})(1.66 \times 10^{-27} \text{ kg/u})} = 2.60 \times 10^6 \text{ m/s} .$$

(b) $T = 2\pi r/v = 2\pi(4.50 \times 10^{-2} \text{ m})/(2.60 \times 10^6 \text{ m/s}) = 1.09 \times 10^{-7} \text{ s}.$

(c) The kinetic energy of the alpha particle is

$$K = \frac{1}{2}m_\alpha v^2 = \frac{(4.00 \text{ u})(1.66 \times 10^{-27} \text{ kg/u})(2.60 \times 10^6 \text{ m/s})^2}{2(1.60 \times 10^{-19} \text{ J/eV})} = 1.40 \times 10^5 \text{ eV} .$$

(d) $\Delta V = K/q = 1.40 \times 10^5 \text{ eV}/2e = 7.00 \times 10^4 \text{ V}.$