21. So that the magnetic field has an effect on the moving electrons, we need a non-negligible component of $\vec{B}$ to be perpendicular to $\vec{v}$ (the electron velocity). It is most efficient, therefore, to orient the magnetic field so it is perpendicular to the plane of the page. The magnetic force on an electron has magnitude $F_B = evB$, and the acceleration of the electron has magnitude $a = v^2/r$. Newton's second law yields $evB = m_e v^2/r$, so the radius of the circle is given by $r = m_e v/eB$ in agreement with Eq. 29-16. The kinetic energy of the electron is $K = \frac{1}{2} m_e v^2$, so $v = \sqrt{2K/m_e}$. Thus,

$$r = \frac{m_e}{eB}\sqrt{\frac{2K}{m_e}} = \sqrt{\frac{2m_e K}{e^2 B^2}} \; .$$

This must be less than d, so

$$\sqrt{\frac{2m_e K}{e^2 B^2}} \le d$$

or

$$B \ge \sqrt{\frac{2m_e K}{e^2 d^2}} \; .$$

If the electrons are to travel as shown in Fig. 29-33, the magnetic field must be out of the page. Then the magnetic force is toward the center of the circular path, as it must be (in order to make the circular motion possible).