27. (a) If $v$ is the speed of the positron then $v \sin\phi$ is the component of its velocity in the plane that is perpendicular to the magnetic field. Here $\phi$ is the angle between the velocity and the field (89°). Newton's second law yields $eBv\sin\phi = m_e(v\sin\phi)^2/r$, where $r$ is the radius of the orbit. Thus $r = (m_e v/eB)\sin\phi$. The period is given by

$$T = \frac{2\pi r}{v\sin\phi} = \frac{2\pi m_e}{eB} = \frac{2\pi(9.11\times10^{-31}\,\text{kg})}{(1.60\times10^{-19}\,\text{C})(0.10\,\text{T})} = 3.6\times10^{-10}\ \text{s}\ .$$

The equation for $r$ is substituted to obtain the second expression for $T$.

(b) The pitch is the distance traveled along the line of the magnetic field in a time interval of one period. Thus $p = vT\cos\phi$. We use the kinetic energy to find the speed: $K = \frac{1}{2}m_e v^2$ means

$$v = \sqrt{\frac{2K}{m_e}} = \sqrt{\frac{2(2.0\times10^3\,\text{eV})(1.60\times10^{-19}\ \text{J/eV})}{9.11\times10^{-31}\,\text{kg}}} = 2.651\times10^7\ \text{m/s}\ .$$

Thus

$$p = (2.651\times10^7\,\text{m/s})(3.58\times10^{-10}\,\text{s})\cos 89^\circ = 1.7\times10^{-4}\ \text{m}\ .$$

(c) The orbit radius is

$$R = \frac{m_e v\sin\phi}{eB} = \frac{(9.11\times10^{-31}\,\text{kg})\left(2.651\times10^7\,\text{m/s}\right)\sin 89^\circ}{(1.60\times10^{-19}\,\text{C})\,(0.10\text{T})} = 1.5\times10^{-3}\ \text{m}\ .$$