33.36. **Model:** Assume the magnetic field is uniform over the plane of the loop.

Visualize: The oscillating magnetic field strength produces a changing flux through the loop and an induced emf in the loop.

Solve: **(a)** The normal to the surface of the loop is in the same direction as the magnetic field so that $\Phi = \vec{A} \cdot \vec{B} = BA$. The induced emf is

$$\mathcal{E} = \left|\frac{d\Phi}{dt}\right| = A\left|\frac{dB}{dt}\right| = \pi r^2 \left|\frac{dB}{dt}\right| = \pi r^2 \omega B_0 |\cos \omega t|$$

The cosine will oscillate between +1 and −1 so the maximum emf is

$$\mathcal{E}_{max} = \pi r^2 \omega B_0 = \pi r^2 (2\pi f) B_0 = 2\pi^2 (0.125)^2 (150 \times 10^6 \text{ Hz})(20 \times 10^{-9} \text{ T}) = 0.925 \text{ V}$$

(b) If the loop is rotated so that the plane is perpendicular to the electric field, then the normal to the surface will be parallel to the magnetic field. There is no magnetic flux through the loop and no induced emf.