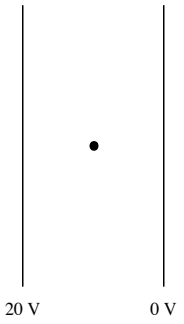
$$e = 1.6 \times 10^{-19} \text{ C} \qquad m_e = 9.11 \times 10^{-31} \text{ kg}$$

An electron is placed midway between two large metal plates, as shown below. The left plate is held at a potential of 20 V and the right plate is held at a potential of 0 V. The electron is released.



a) Toward which plate does the electron move?

b) When it reaches the plate, how fast is it moving?

SOLUTION

(a) Since the electric field points to the right (from high to low potential) the electron will be pushed to the left.

(b) Use conservation of energy. Midway between the plates, the potential is 10 V:

$$\Delta PE = -e(20 - 10)$$
$$\Delta PE + \Delta KE = 0$$
$$\longrightarrow \Delta KE = e(10 \text{ V})$$
$$\frac{1}{2} m_e v^2 = e(10 \text{ V})$$
$$v = \sqrt{\frac{2(1.6 \times 10^{-19})(10)}{9.11 \times 10^{-31}}} = 1.9 \times 10^6 \text{ m/s}$$