$\boxed{19.1}$

$V_{BA} = 0.070\ V$

$q_0 = e = 1.60 \times 10^{-19} C$

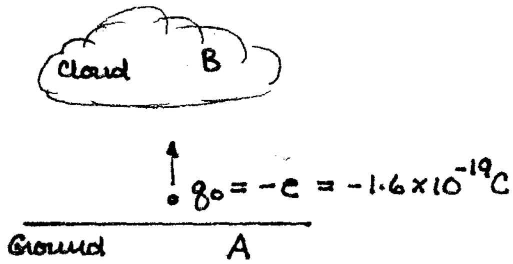
$\mathcal{W}_{BA} = ?$

Since $V_{BA} = \dfrac{\mathcal{W}_{BA}}{q_0}$

$$\mathcal{W}_{BA} = q_0 V_{BA} = (1.60 \times 10^{-19} C)(0.070\ V) = \boxed{1.1 \times 10^{-20}\ J}$$

$\boxed{19.2}$

Since $V_{BA} = \dfrac{W_{BA}}{q_0} \longrightarrow W_{BA} = q_0 V_{BA}$



Letting the cloud be B and the ground be A, we are given that

$V_{BA} = 1.3 \times 10^{8}\, V$

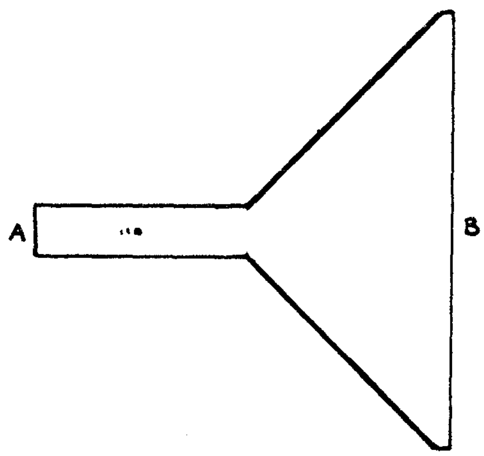
Because the charge is an electron,

$q_0 = -e = -1.6 \times 10^{-19} C$

$$\therefore\ W_{BA} = (-1.6 \times 10^{-19} C)(1.3 \times 10^{8} V) = -2.08 \times 10^{-11} J$$

Because the work is negative, the electron's potential energy has $\boxed{\text{decreased by } 2.1 \times 10^{-11} J}$

19.7



$V_{BA} = 25000\ V$

$q_0 = -e = -1.60 \times 10^{-19}\ C$

$v_A = 0$

$v_B = ?$

$m = 9.109 \times 10^{-31}\ kg$ (from the front cover of text book)

Since $V_{BA} = \dfrac{W_{BA}}{q_0} \longrightarrow W_{BA} = q_0 V_{BA}$

$\therefore W_{BA} = (-1.60 \times 10^{-19}\ C)(25000\ V) = -4.00 \times 10^{-15}\ J$

Negative work represents a decrease in potential energy and a corresponding increase in kinetic energy. Thus, the kinetic energy increases by $4.00 \times 10^{-15}\ J$

$$\therefore \quad \tfrac{1}{2} m v_B^2 - \tfrac{1}{2} m v_A^2 = 4.00 \times 10^{-15}\ J$$

Since $v_A = 0$, this becomes $\tfrac{1}{2} m v_B^2 = 4.00 \times 10^{-15}\ J$

Now we can solve for v_B:

$$v_B = \pm\sqrt{\frac{2(4.00 \times 10^{-15}\ J)}{m}} = \pm\sqrt{\frac{2(4.00 \times 10^{-15}\ J)}{9.109 \times 10^{-31}\ kg}} = \boxed{9.4 \times 10^{7}\ m/s}$$

$\boxed{19.12}$

$$V_{BA} = kq\left(\frac{1}{r_B} - \frac{1}{r_A}\right)$$

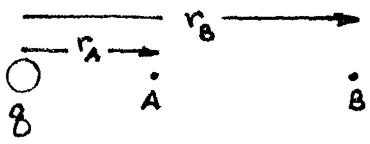
$$\therefore V_{BA} = \left(9.0\times10^{9}\,\frac{N\cdot m^2}{C^2}\right)\left(-2.1\times10^{-9}\,C\right)\left(\frac{1}{0.50\,m} - \frac{1}{0.25\,m}\right) = 37.8\ V$$

Rounded to two significant figures, $V_{BA} = \boxed{38\ V}$

$\boxed{19.29}$

The potential V_p at a point P located r_p away from a point charge q is given by

$$V_p = \frac{kq}{r_p} \longrightarrow r_p = \frac{kq}{V_p} \quad \#1$$



At point A,

$$r_A = \frac{kq}{V_A}$$

At point B,

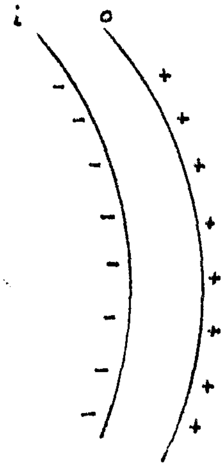
$$r_B = \frac{kq}{V_B}$$

So, the distance $r_B - r_A = \frac{kq}{V_B} - \frac{kq}{V_A} = kq\left(\frac{1}{V_B} - \frac{1}{V_A}\right)$

$$\therefore r_B - r_A = \left(9.0\times10^{9}\,\frac{N\cdot m^2}{C^2}\right)\left(1.50\times10^{-8}\,C\right)\left(\frac{1}{75V} - \frac{1}{190V}\right) = 1.0895\,m$$

Rounded to two significant figures, $r_B - r_A = \boxed{1.1\,m}$

$\boxed{19.30}$



$V_{oi} = 0.070\ V$ (this is the potential difference of the outer surface of the cell membrane relative to the inner surface)

$s_{oi} = 8.0 \times 10^{-9}\ m$ (this thickness can be thought of as the distance traveled to reach the outer surface from the inner surface

$$E = \frac{-V_{oi}}{s_{oi}} = -\frac{(0.070\ V)}{8.0 \times 10^{-9}\ m} = -8.8 \times 10^{6}\ N/C$$

The negative sign indicates that the electric field is directed toward the inner surface and has a magnitude of $\boxed{8.8 \times 10^{6}\ N/C}$