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General Physics I, Quiz 7
PHYS10200, Class year 98
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SN:_______________, Name:_______________

1 (a) $a = \frac{qE}{m} = \frac{1.602\times10^{-19}(640)}{1.67\times10^{-27}} = \boxed{6.14\times10^{10}\ \text{m}/\text{s}^2}$

(b) $K = \frac{1}{2}mv^2 = \frac{1}{2}\left(1.67\times10^{-27}\ \text{kg}\right)\left(1.20\times10^{6}\ \text{m}/\text{s}\right)^2 = \boxed{1.20\times10^{-15}\ \text{J}}$

2 (a) $\oint \mathbf{E}\cdot d\mathbf{A} = E\left(4\pi r^2\right) = \frac{q_{in}}{\epsilon_0}$

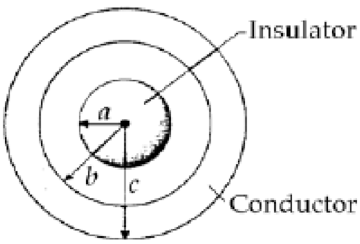

FIG. P24.57

For $r < a$, $q_{in} = \rho\left(\frac{4}{3}\pi r^3\right)$

so $E = \boxed{\frac{\rho r}{3\epsilon_0}}$.

For $a < r < b$ and $c < r$, $q_{in} = Q$.

So $E = \boxed{\frac{Q}{4\pi r^2 \epsilon_0}}$.

For $b \le r \le c$, $E = 0$, since $\boxed{E = 0}$ inside a conductor.

(b) Let q_1 = induced charge on the inner surface of the hollow sphere. Since $E = 0$ inside the conductor, the total charge enclosed by a spherical surface of radius $b \le r \le c$ must be zero.

Therefore, $q_1 + Q = 0$ and $\sigma_1 = \frac{q_1}{4\pi b^2} = \boxed{\frac{-Q}{4\pi b^2}}$.

Let q_2 = induced charge on the outside surface of the hollow sphere.
Since the hollow sphere is uncharged, we require

$$q_1 + q_2 = 0 \quad \text{and} \quad \sigma_2 = \frac{q_1}{4\pi c^2} = \boxed{\frac{Q}{4\pi c^2}}.$$