NAME

Please explain your answers in detail. What you write is all I have to grade the problem. Little credit will be given if your explanations involves generic phrases (such as "use Hamiltons principle") without a detailed explanation.

1. Explain how the moving charge applet relates to your understanding of electric fields?

- charges moving at constant speed have field lines compressed
- acceleration of a charge generates waves in E
- wave amplitude decreases with distance from accelerating charge.

2. Explain how the applet of a point charge near an infinite half plane of linear dielectric relates to your understanding of electric fields in matter.

- initially the dipoles align with the field from the point charge.
- then nearby dipoles generate a field which causes dipoles to realign with $\vec{E}_{tot} = \vec{E}_{point} + \vec{E}_{other\ dipoles}$
- net effect is that E_{tot} bends at the interface
- equipotentials get farther away $\Rightarrow$ E_{tot} is less inside dielectric than in vacuum

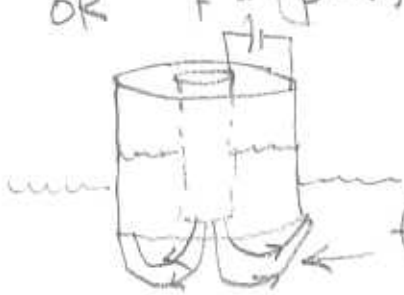
3. Explain why oil is sucked up a cylindrical capacitor made of two concentric metal cylinders with a potential between the cylinders which are aligned with the cylinder symmetry axis along $\vec{g}$.

Field energy + $W_{battery}$ + $W_{gravity}$ is minimized when fluid rises.

$dW = -F dy$ from Work-Energy theorem.

$F_{up} = -\frac{dW}{dy}$ where W is field energy $= \frac{1}{2}\epsilon(y)V^2$

OR $\vec{F} = (\vec{p}\cdot\vec{\nabla})\vec{E}$ where $\vec{E}$ fringes gives non-zero $\vec{F}$



fringing field causing force up