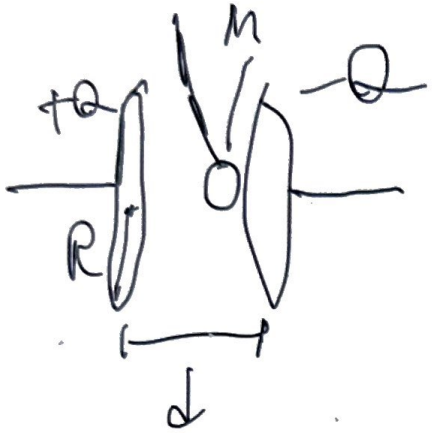
MT2 Q4 Rubric

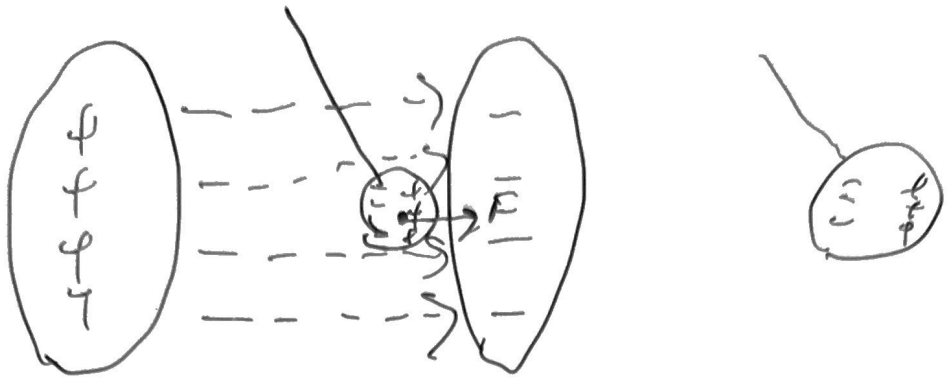


(a) $W = U = \boxed{\frac{1}{2}\frac{Q^2}{C}}$ (4 points)

(b) $C = \frac{\varepsilon_0 A}{d} = \frac{\varepsilon_0 \pi R^2}{d}$

- Capacitance equation (2 points)
- correct answer (1 point)

(c)



- Drawing charges (1 point)
- Drawing field (1 point)
- Drawing force (1 point)
- Discussion (2 points)

The uncharged pendulum gets charged slowly by induction due to the proximity to the capacitor plate. The pendulum will become positively charged causing it to strike the negative plate.

(d) The induced charges on the pendulum would cancel out with the opposite charges on the right plate through

charges on the right plate through conduction. The pendulum will acquire negative charge by contact and will be attracted to the left plate.

- Indicate charges canceling out (2 points)
- Mentioning opposite charges (1 point)
- Mentioning conduction (1 point)
- Mentioning negative charge (1 point)

(e) The total capacitance is **higher** than the capacitance of the doorbell before the insertion of the pendulum. This is because

$C_0 = \frac{\varepsilon_0 A}{d}$ and $C = kC_0$, where $k > 1$.

- Choosing **higher** (2 points) · $C = kC_0$ (1 point)
- $C_0 = \frac{\varepsilon_0 A}{d}$ (½ point) · $k > 1$ (½ point)