Answers without **supporting work** or **necessary unit** will not be given full credit. If the meaning of the question isn't clear, please ask TA! You have **25mins** to complete this mini-test.

Q.1 Figure 1. is a RC circuit, the electric potential of battery is ε, the resistance of resister is R and capacitor with capacitance C. The capacitor is half charged at time $t = 0$ [sec], when switch is closed on **a** at $t = 0$ [sec], what's the electric potential of the capacitor after a capacitive time constant $V(t = RC) =$? (10 points)

$$q = C\varepsilon(1 - e^{-\frac{t}{RC}}) \quad \dots 1$$

$$\frac{1}{2}C\varepsilon = C\varepsilon(1 - e^{-\frac{t_0}{RC}}) \quad \dots 2$$

$$e^{-\frac{t_0}{RC}} = \frac{1}{2} \quad \dots 1$$

$$q(t = t_0 + RC) = C\varepsilon(1 - e^{-\frac{t_0+RC}{RC}}) \quad \dots 2$$

$$V(t = t_0 + RC) = \frac{q}{C} = \varepsilon(1 - e^{-\frac{t_0+RC}{RC}}) \quad \dots 2$$

$$V(t = t_0 + RC) = \varepsilon\left(1 - \frac{1}{2e}\right) \sim 0.82\varepsilon \quad \dots 2$$

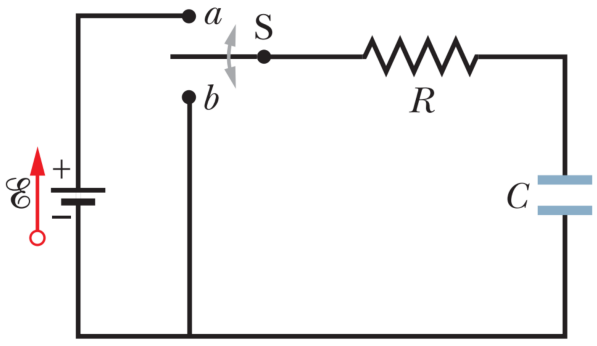

Figure 1

Q.2 A charged particle P with mass $M = 8\ kg$ and charge $Q = -4\ C$, having an instantaneous velocity $\vec{V} = (0\,\hat{x} + 3\,\hat{y} + 7\,\hat{z})\ \frac{m}{s}$ at position $(3\,\hat{x} + 0\,\hat{y} + 0\,\hat{z})\ m$, is moving through the magnetic field $\vec{B} = (0\,\hat{x} + 0\,\hat{y} + 2\,\hat{z})\ T$. What is the position of that particle after $\frac{3}{4}$ period? (10 points)