**Reading Quiz – Week 7**

**Question. Charging a capacitor**

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| **Figure 1: Switch open** | **Figure 2: Switch close** |

A capacitor of capacitance C is connected to a circuit as shown in figure 1. There is no charge in the capacitor. (In figure 1, switch S is opened, so no charge flows out of the battery.)

At time t = 0, the switch S is closed. Current flows from the positive terminal of the battery bringing +q to the upper plate of the capacitor. For each positive charge added to the upper plate a positive charge leaves the lower plate towards the negative terminal of the battery leaving a negative charge on the lower plate. In this way, the charge in the capacitor increases until it is fully charged.

In this problem you will derive and solve the equation for the charge on the positive plate of the capacitor We will call the potential of the positive plate and the potential of the negative plate .

a) At the instant shown in the figure 2, when the charge in the capacitor is the difference in potential between the lower and the upper plate is:

b) Apply Kirchhoff’s loop rule to the circuit shown in the right figure above. Circulate the circuit in figure 2 in the same direction as the current. implies that the *differential equation* for is given by:

c) Watch this video: <https://www.youtube.com/watch?v=b7WTaSikcIU>

d) The solution to the differential equation obtained in part b) with the initial condition that at t=0 the charge of the capacitor is zero is:

e) Watch this video: <https://www.youtube.com/watch?v=JMc2mY0NPgs>

f) Which of the figures shown below best represents the plot of the charge as a function of time? Which one represents the plot of the current as a function of time? Pick the figure and fill in the rectangles in the vertical axis with the proper quantities.



g) What are the units of ? *Show your work!*