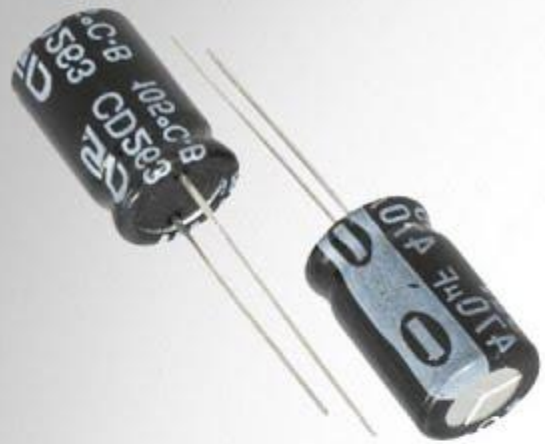
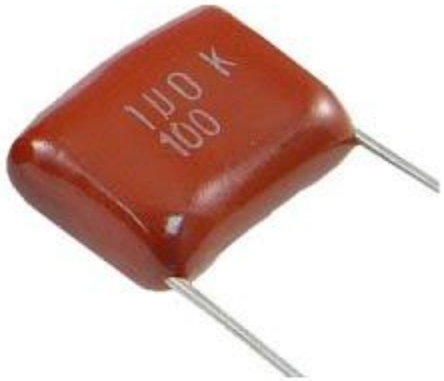
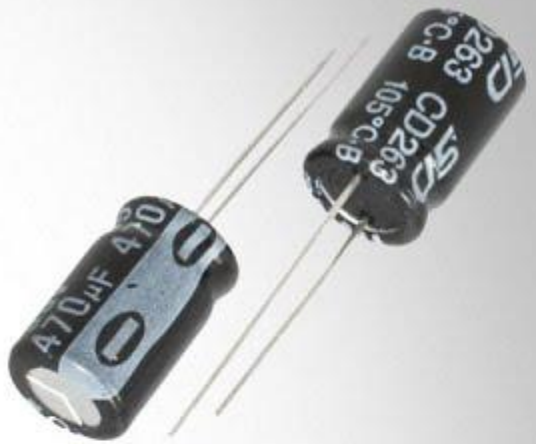
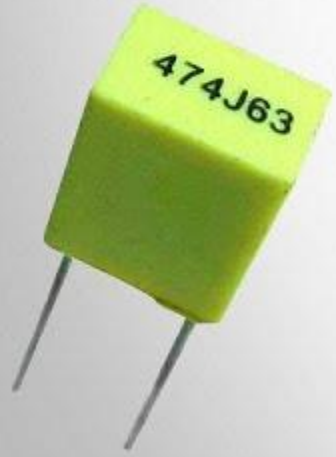
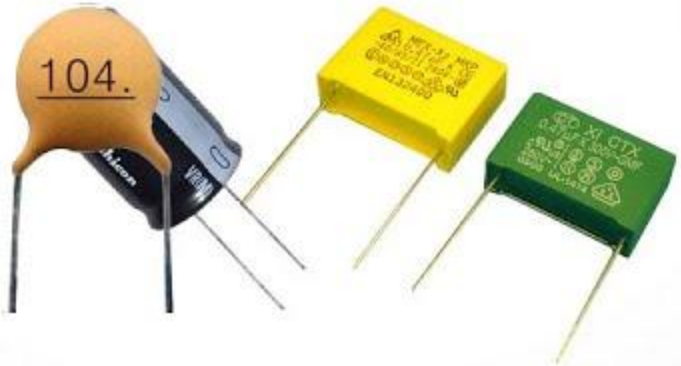
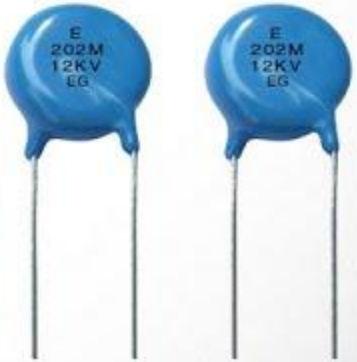
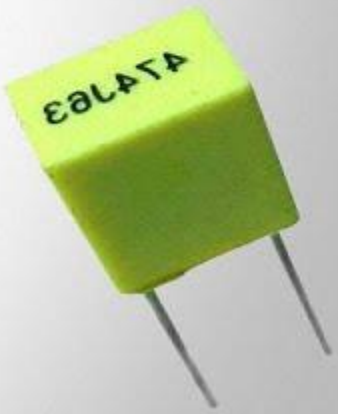



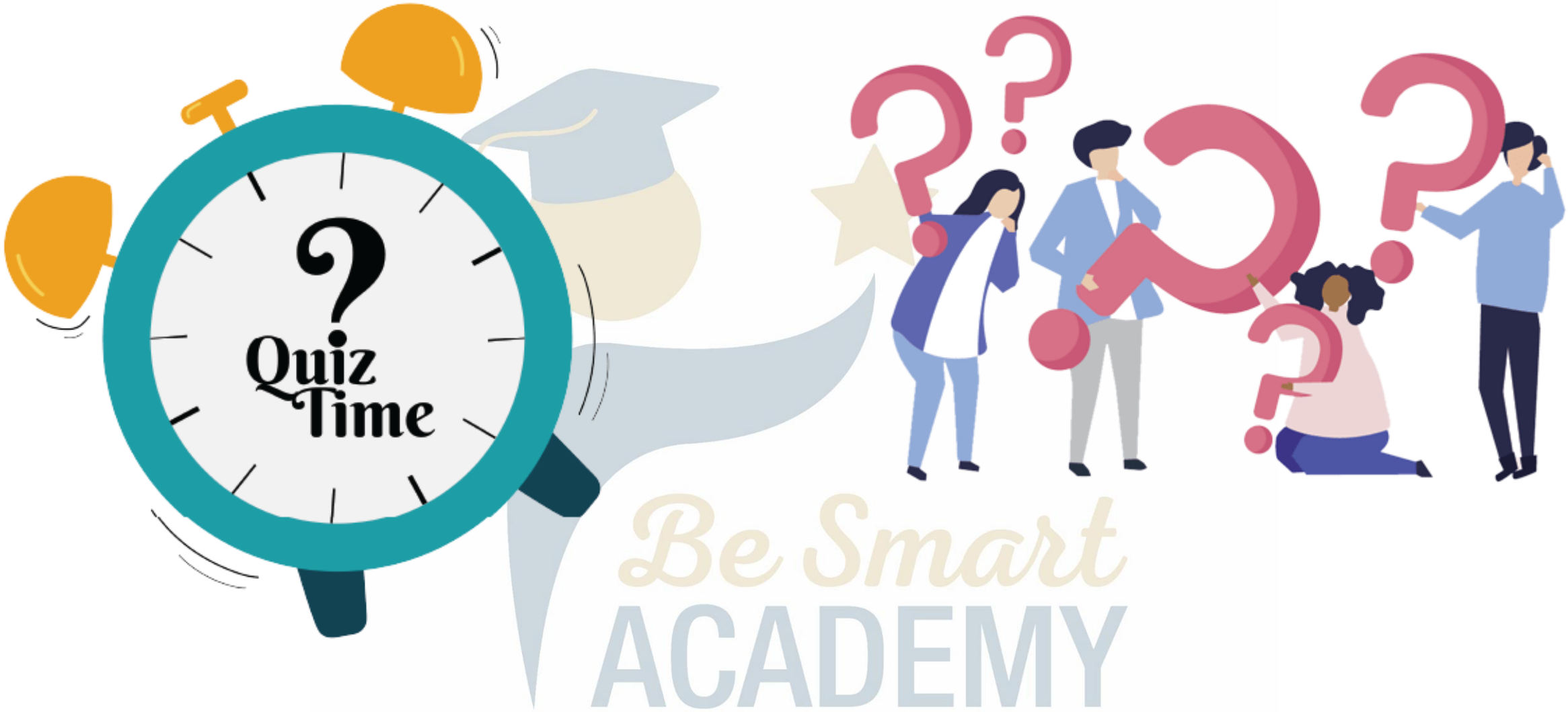



Grade 11 S – Physics

Chapter 13: Capacitor

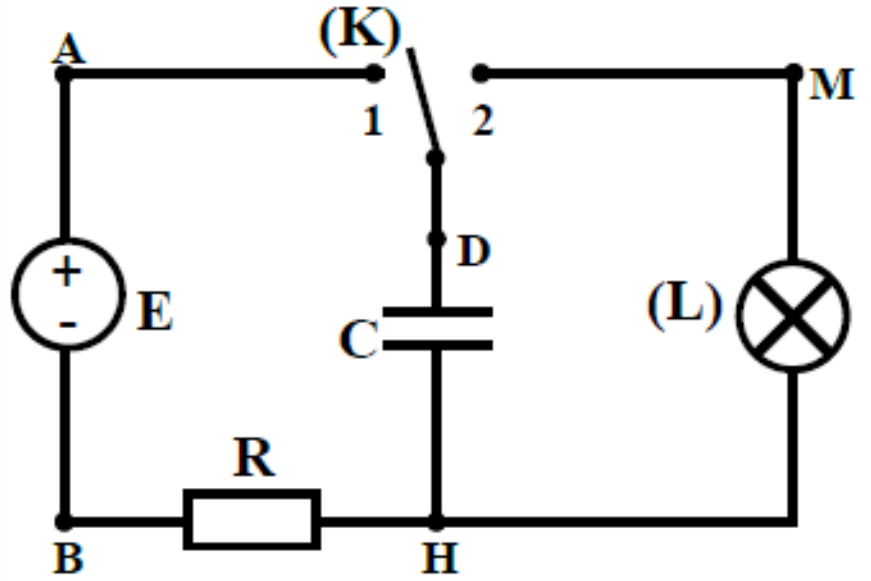





Quiz
Time
Be Smart
ACADEMY

Quiz Capacitor 20 min

The adjacent figure is a diagram of a simplified circuit of the flash of a camera.

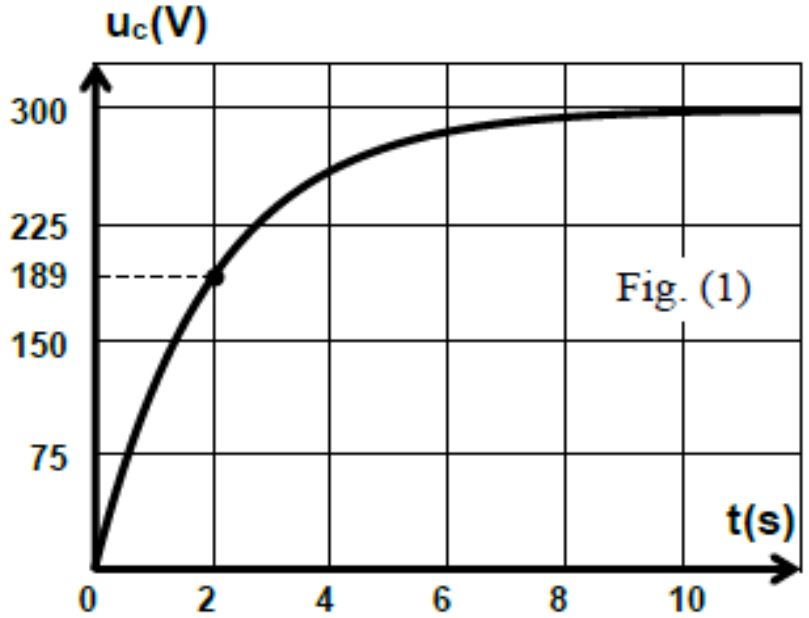
The circuit includes: a source of constant voltage $E = 300V$, a capacitor of capacitance C, a resistor of resistance $R = 10k\Omega$, a lamp (L) considered as a resistor of resistance r and a switch (K).



1)Charging the capacitor:

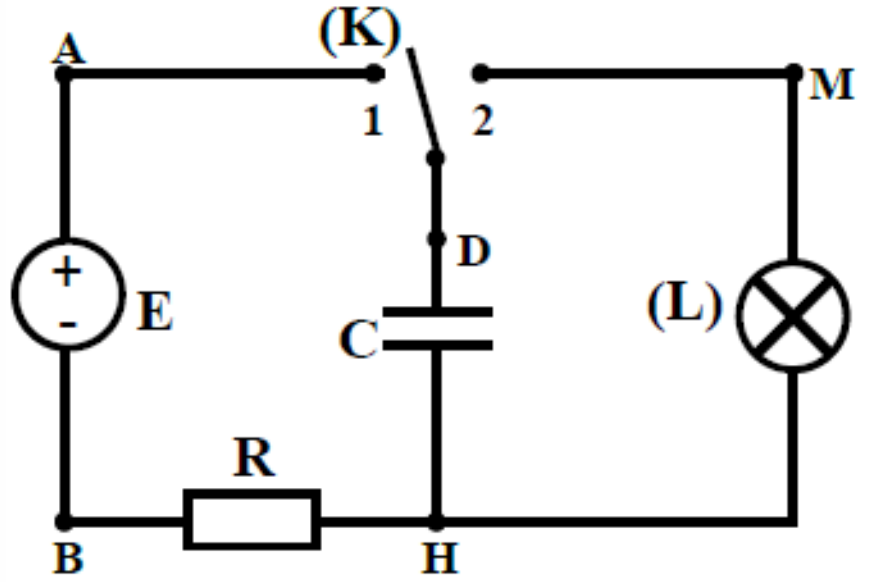
(K) is turned to position (1) at $t_0 = 0$ and the neutral capacitor starts charging.

The graph of figure (1) represents the voltage u_C across the capacitor as a function of time.



Quiz Capacitor 20 min

1. Indicate the value of u_C at the end of the charging process.
2. Use figure (1) to prove that the capacitance of the capacitor is $C = 2 \times 10^{-4} F$.
3. Determine the current flowing in the circuit when $u_C = 100V$.
4. Calculate the energy W_{stored} stored in the capacitor at the end of the charging process.



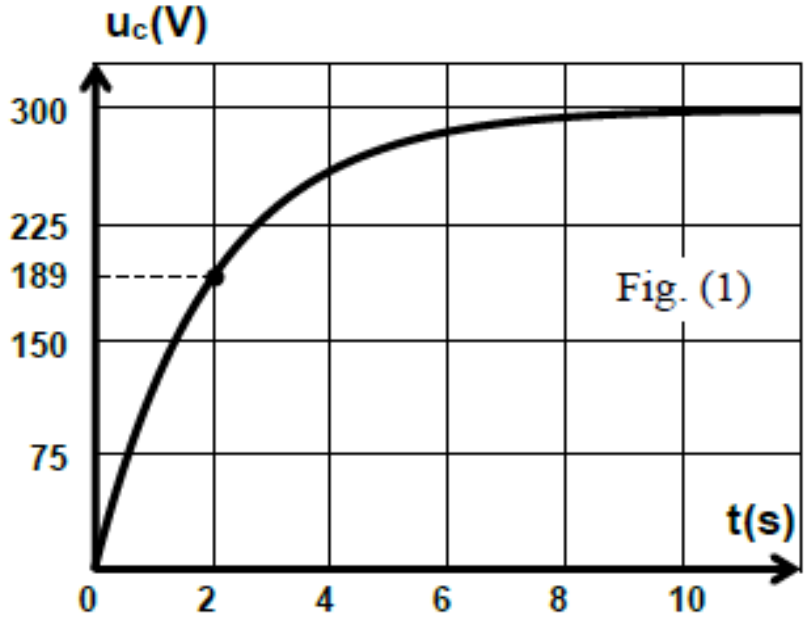


Fig. (1)

Quiz Capacitor 20 min

$\mathbf{E = 300V}, R = 10k\Omega$

1. Indicate the value of u_C at the end of the charging process.

At the end of charging $u_C = E = 300V$

2. Use figure (1) to prove that the capacitance of the capacitor is $C = 2 \times 10^{-4}F$.

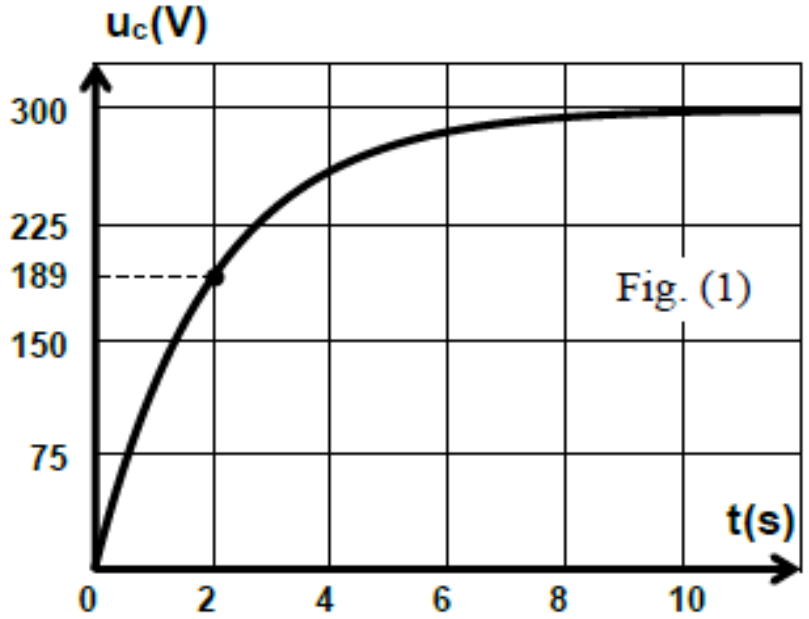


Fig. (1)

At $t = \tau$; $u_C = 0.63 \times E = 0.63 \times 300$

$\Rightarrow$ $u_C = 189V$ $\Rightarrow$ $\tau = 2s$

$\tau = RC$ $\Rightarrow$ $2 = 10000 \times C$ $\Rightarrow$ $C = 2 \times 10^{-4}F$

$\mathbf{E = 300V}, R = 10k\Omega$

3. Determine the current flowing in the circuit when $u_C = 100V$

Using law of addition of voltage:

$u_G = u_R + u_C \Rightarrow E = u_R + 100$

$\Rightarrow 300 = u_R + 100 \Rightarrow u_R = 200V$

$\Rightarrow u_R = R \times I \Rightarrow 200 = 10000 \times I$

$\Rightarrow I = 0.02A$

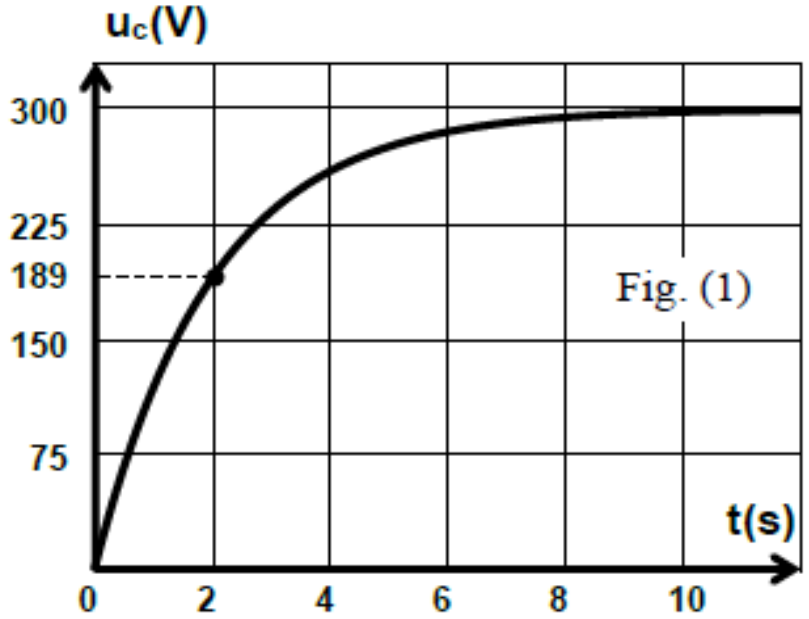
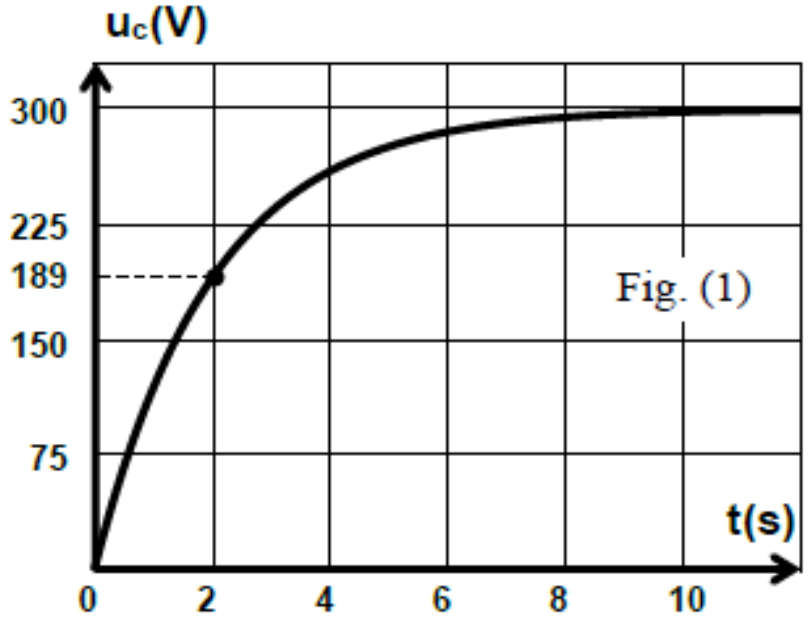


Fig. (1)

$\mathbf{E = 300V}, \boldsymbol{R = 10k\Omega}$

4.Calculate the energy W_{stored} stored in the capacitor at the end of the charging process

$$W = \frac{1}{2} C u_C^2$$



$$W = 0.5 \times 2 \times 10^{-4} \times (300)^2$$

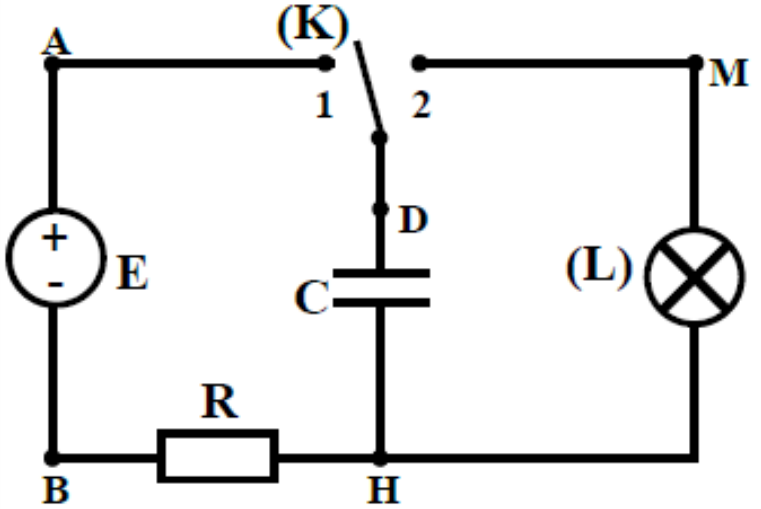
$$W = 9J$$

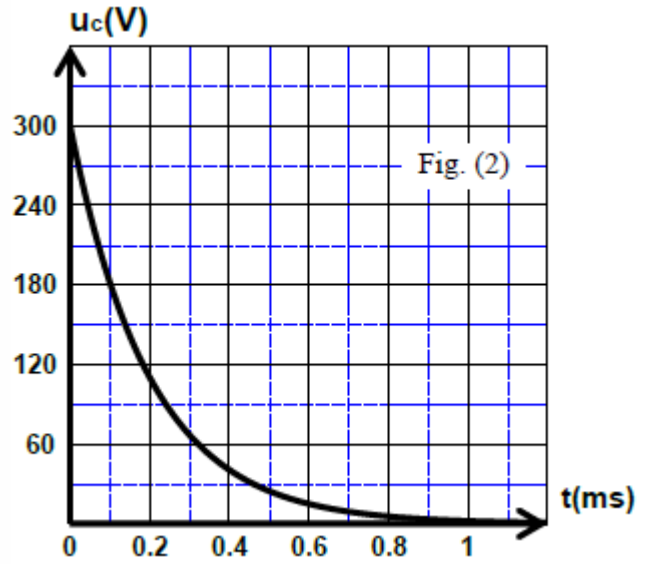
Quiz Capacitor 20 min

2) Discharging the capacitor:

When the capacitor is fully charged, the switch is turned to position (2) at an instant taken as a new origin of time. The capacitor discharges through the lamp (L). The camera's flash emits light as long as u_C is greater than 180 V. The graph of the figure (2) represents the voltage u_C as a function of time.

1. **Write the relation between u_C and the voltage across the lamp u_L in the discharging circuit.**
2. **Determine the time constant of the discharging circuit. Deduce r.**

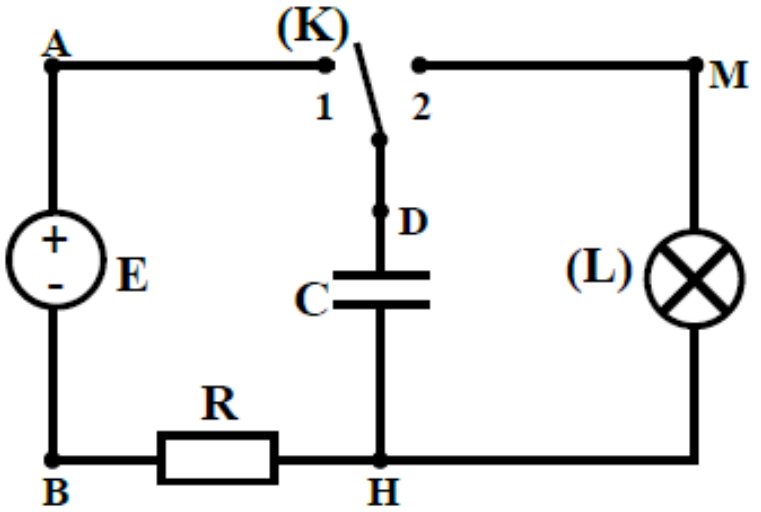




Quiz Capacitor 20 min

3. Refer to figure (2) to determine the time interval Δt during which $u_C \geq 180V$.

4. Calculate the value of the current in the circuit, and determine the energy stored in the capacitor when $u_C = 180V$.



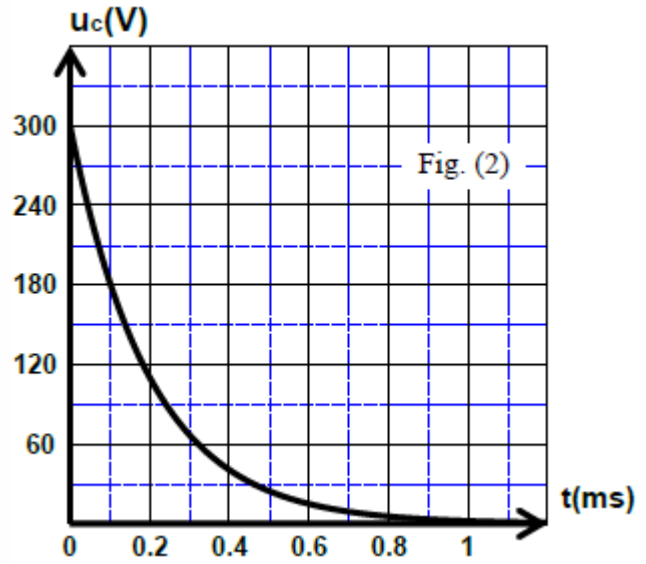
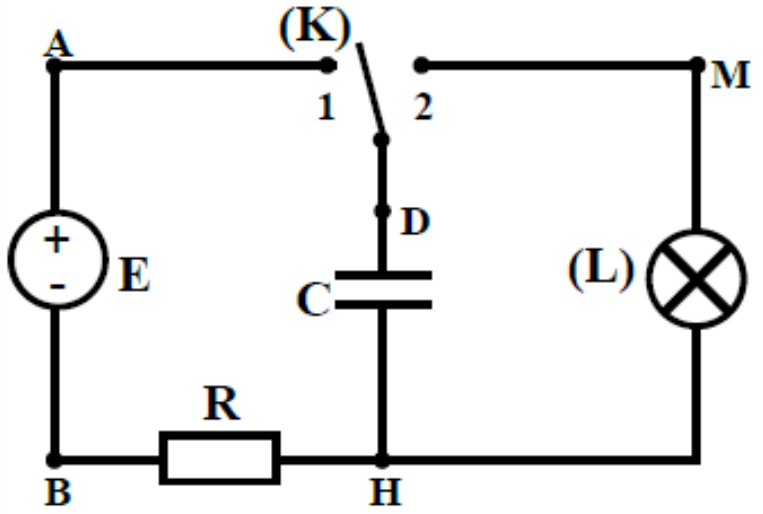


Fig. (2)

Quiz Capacitor 20 min

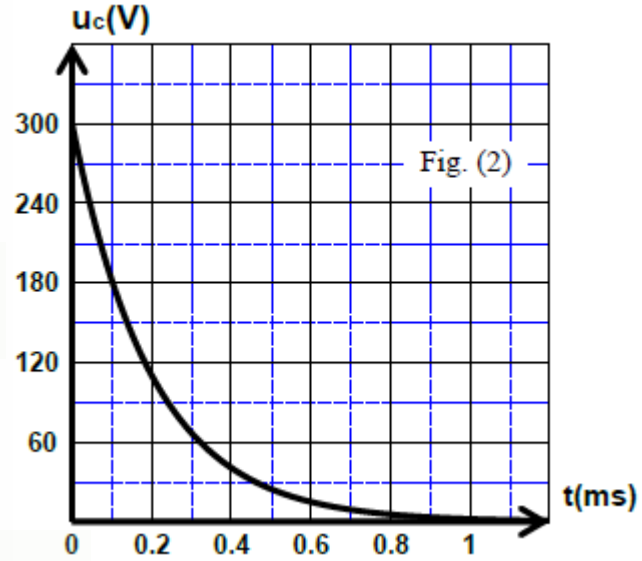
The camera's flash emits light as long as u_C is greater than 180 V.



1. Write the relation between u_C and the voltage across the lamp u_L in the discharging circuit.

In discharging process: $u_C = u_R$

2. Determine the time constant of the discharging circuit. Deduce r.



At $t = \tau$; $u_C = 0.37E = 0.37 \times 300$ ⇒ $u_C = 111V$

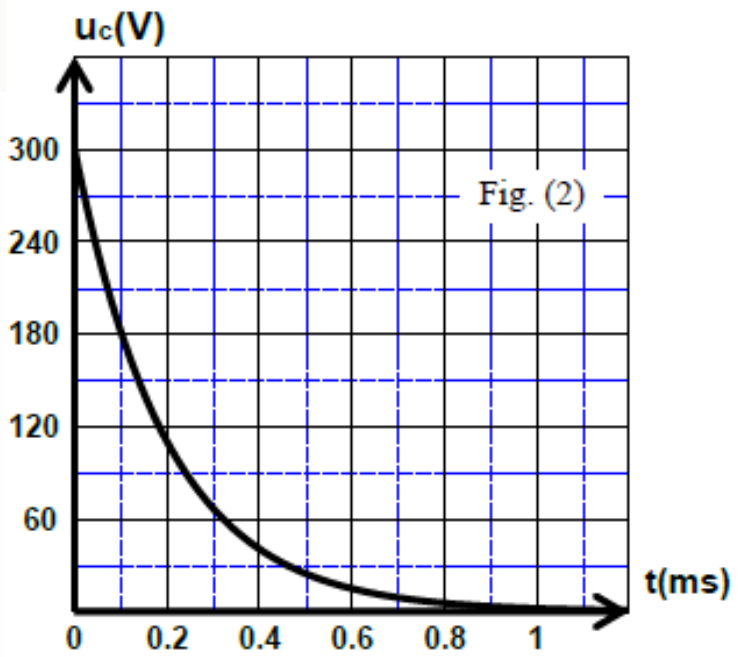
⇒ From the graph $\tau = 0.2s$

$\tau = RC$ ⇒ $0.2 = r \times 2 \times 10^{-4}$ ⇒ $r = 1000\Omega$

Quiz Capacitor 20 min

The camera's flash emits light as long as u_C is greater than 180 V.

3.Refer to figure (2) to determine the time interval Δt during which $u_C \geq 180V$.



$u_C \geq 180V$ **is when:** $0 \leq \Delta t \leq 0.2$

4. Calculate the value of the current in the circuit, and determine the energy stored in the capacitor when $u_C = 180V$.

$$u_R = u_C = 180V$$

$$u_R = R \times I \quad \Rightarrow \quad 180 = 1000 \times I$$

$$I = 0.18A$$

The End