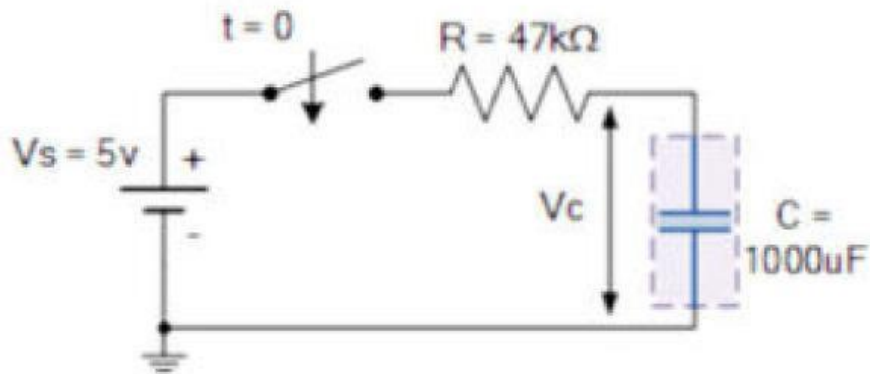Based on circuit below, find:

1. time constant
2. Voltage capacitor after switch closed at 150s
3. Current in circuit after switch closed at 150s
4. time taken to capacitor charged to 3V

SOLUTION:

1. Time Constant (τ)

The time constant for an RC circuit is:

$$\tau = \boxed{} \times \boxed{}$$

Given:

- $R = 47\,k\Omega = 47000\,\Omega$
- $C = 1000\,\mu F = 1000 \times 10^{\boxed{}} F = 0.001\,F$

$$\tau = 47000 \times 0.001 = \boxed{}\ \text{seconds}$$

2. Voltage Across Capacitor at $t = 150\,s$

The voltage across a charging capacitor is:

$$V_C(t) = V_s \left(1 - e^{-\frac{t}{\tau}}\right)$$

Given:

- $V_s = \boxed{}\,V$
- $t = \boxed{}\,s$
- $\tau = \boxed{}\,s$

$$V_C(150) = \boxed{} \left(1 - e^{-\boxed{}}\right) \approx 5\left(1 - e^{-\boxed{}}\right)$$

$$e^{-3.19} \approx \boxed{}$$

$$V_C(150) \approx \boxed{} \times \left(1 - \boxed{}\right) = \boxed{} \times \boxed{} = \boxed{}\,V$$

3. Current in Circuit at $t = 150\,s$

The current in an RC charging circuit is:

$$I(t) = \frac{V_s}{R} \cdot e^{-\frac{t}{\tau}}$$

$$I(150) = \frac{\boxed{}}{\boxed{}} \cdot e^{-\boxed{}} \approx 0.\boxed{}\,A \cdot \boxed{} \approx \boxed{}\,\mu A$$

4. Time Taken for Capacitor to Charge to 3V

We solve for t in:

$$V_C(t) = V_s \left(1 - e^{-\frac{t}{\tau}}\right)$$

$$\boxed{} = \boxed{}\left(1 - e^{\boxed{}}\right)$$

$$\frac{3}{\boxed{}} = 1 - e^{-\frac{t}{47}}$$

$$\Rightarrow e^{-\frac{t}{47}} = \boxed{}$$

Take natural log:

$$-\frac{t}{47} = \boxed{}(0.4)$$

$$\Rightarrow t = -47 \cdot \ln(0.4) \approx 47 \times \boxed{} = \boxed{}\ s$$

✅ **Summary:**

Quantity	Value
Time Constant (τ)	☐ s
Voltage at 150 s	≈ ☐ V
Current at 150 s	≈ ☐ µA
Time to reach 3 V	≈ ☐ s