In the circuit shown the switch S is closed at t = 0.

4(a) Calculate the current in $R_2$ just after the switch is closed.
4(b) Calculate the current in $R_2$ a very long time after the switch is closed.
4(c) Calculate the voltage across the capacitor a very long time after S is closed.
13(d) Calculate the charge on the capacitor 125 $\mu$s after the switch is closed.

No short cuts learned in other classes allowed. Part (d) requires the full solution as discussed in class.

\[
\begin{align*}
\epsilon &= 125 \text{ V} \\
R_1 &= 150 \text{ } \Omega \\
R_2 &= 250 \text{ } \Omega \\
R_3 &= 250 \text{ } \Omega \\
C &= 1.65 \times 10^{-6} \text{ F}
\end{align*}
\]

\[
\begin{align*}
a) \quad I_1 &= \frac{\epsilon}{R_1 + R_2} = 0.455 \\
I_2 &= \frac{I_1}{2} = 0.227 \text{ A} \\
b) \quad I_2 &= \frac{\epsilon}{R_1 + R_2} = 0.313 \text{ A} \\
c) \quad V_C &= I_2 R_2 = 78.1 \text{ V}
\end{align*}
\]
1. \( \varepsilon - I_1 R_1 - I_2 R_2 = 0 \)
2. \( \varepsilon - I_1 R_1 - \frac{Q}{C} - I_3 R_3 = 0 \)
3. \( I_1 = I_2 + I_3 \)
4. \( I_3 = \frac{dQ}{dt} \)

\[
I_3 = \frac{dQ}{dt} = -\frac{Q}{(R_1 R_2 + R_1 R_3 + R_2 R_3) C} + A
\]

\[
Q = Q_\infty (1 - e^{-\frac{t}{\tau}})
\]

\[
= \left(\frac{\varepsilon R_2}{R_1 + R_3}\right) C (1 - e^{-\frac{t}{\tau}})
\]

\[
= 129 \times 10^{-6} (1 - 0.802)
\]

\[
Q = 2.55 \times 10^{-5} \, C
\]

\[\varepsilon = 7 = 567 \times 10^{-6}\]