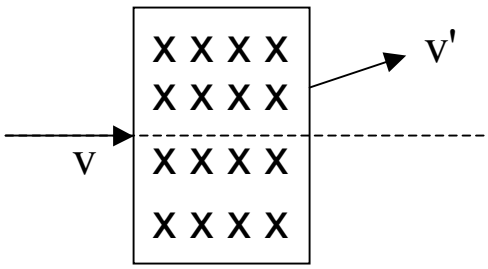
Name: _____ Sec. _____ **P212: Quiz 2 Week 7**

1) A proton (mass m, charge q) moving at velocity v enters a region of constant magnetic field ***B*** directed into the paper as shown. The proton exits the magnetic field region with velocity v' as shown. Compare v_x' (the x-component of this final velocity) with the initial velocity v. **[4]**

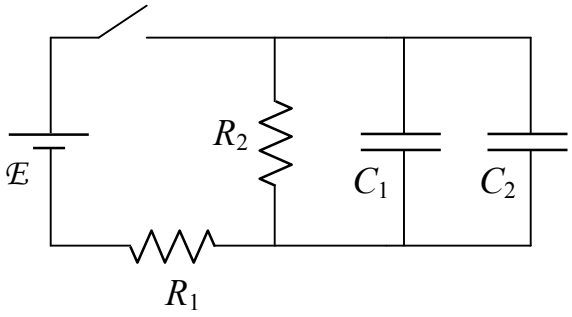


(a) $v_x' < v$ (b) $v_x' = v$ (c) $v_x' > v$

Rubric:
Correct solution (4)

In the circuit below, the switch is initially open (as shown) and the capacitors are uncharged.

$R_1 = 4\ \Omega$ $C_1 = 40\ \mu F$
$R_2 = 2\ \Omega$ $C_2 = 20\ \mu F$
$\mathcal{E} = 20V$



2) What is the current I_1 through resistor R_1 immediately after the switch is closed? **[3]**

$\Delta V_{cap} = 0$ initially → $E - I_1 R_1 = 0$ → $I_1 = 5A$

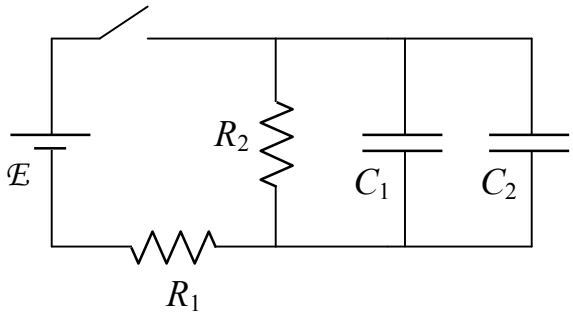
Rubric:
Setup (2)
Answer (1)

3) What is the current I_1 through resistor R_1 after the switch has been closed for a long time? **[3]**

$E - I_1 (R_1+R_2) = 0$ → $I_1 = 3.33$ A

Rubric:
Setup (2)
Correct answer (1)

$R_1 = 4\ \Omega$ $C_1 = 40\ \mu F$
$R_2 = 2\ \Omega$ $C_2 = 20\ \mu F$
$\mathcal{E} = 20\ V$



4) What is the charge Q_1 on capacitor C_1 a long time after the switch is closed? You will receive full credit for a correct algebraic or numerical answer. **[6]**

After a long time C_1 is like an open circuit
$\Delta V = I_1 R_2 = E\ R_2 / (R_1+R_2) = Q_1/C_1 \rightarrow Q_1 = 2.7\ 10^{-4}$ C

Rubric:
Correct setup (4)
Correct answer (2)

5) After a long time, the capacitors are fully charged and the switch is reopened. What is the time constant τ for discharging the capacitors? Specify your answer in units of seconds. **[4]**

$\tau = C_{12}\ R_2 = 1.2\ 10^{-4}$ s

Rubric:
Correct formula (2)
Correct result (2)