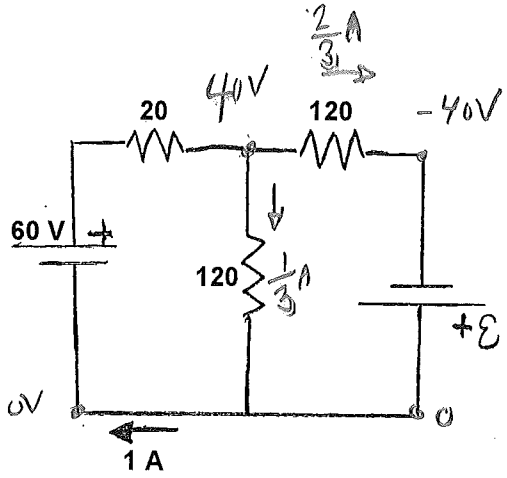
$CV=Q$ $V=IR$ $P_R=IV$ $U_{cap}=\frac{1}{2}CV^2$

$C_{pp}=\frac{\varepsilon_0 A}{d}$ $R_{cyl}=\frac{\rho L}{A}$

$\sum_{junction} I=0$ $\sum_{loop} V=0$ $\varepsilon_0=8.85\times10^{-12}\frac{C^2}{Nm^2}$

Physics 161 Fall 2010 Exam 5



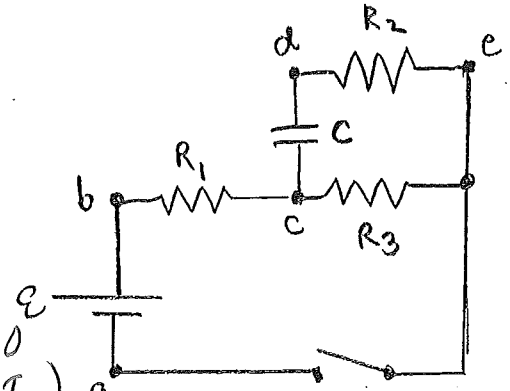
1&2. What is the unknown EMF (in V) in the circuit at right? 40V

3&4. What is the power (in watts) dissipated in the 20 ohm resistor? $P=I^2R=20W.$

5&6. In the circuit shown below, what is the current through the battery (in A) immediately after closing the switch? C = short. R_2 & R_3 in parallel. $R_{23}=(R_3^{-1}+R_2^{-1})^{-1}\simeq 5\Omega$.
EMF = 1000 V, R_1 =20 ohms, R_2=5 ohms, R_3=200 ohms. $R_{123}=25\Omega$ $I=40A.$

7&8. What is the current through the battery a long time after the switch is closed? C = open. $R_{13}=220\Omega$ $I=4.54A \Rightarrow 5A.$

9. To measure the current through the battery, an ammeter should be connected:
A] touching points a and b
B] touching points a and c
C] touching points c and d
D] touching points c and e
(E] the circuit must be broken at point a and the meter inserted
F] the circuit must be broken at point c and the meter inserted
G] the circuit must be broken at point e and the meter inserted
H] none of these will work



10. To measure the voltage across resistor R_3 , a voltmeter must be connected: (choose from the answers to Q9).
Best answer D. B ok if switch closed.

11&12. The capacitor is a parallel plate air-gap capacitor with area = 4 m^2 and a plate separation of 0.22 mm. A long time after the switch is closed, what is the electric field in the capacitor, in V/m? $C=\frac{\varepsilon_0 A}{d}=1.61\times10^{-7}F.$ $V_{cap}=V_c-V_d$ $V_d=0$

13&14. What is the charge on the capacitor, in microcoulombs? (no I_{R_2}) $V_c=1000V-4.54A\cdot 20\Omega=909V.$

15&16. How much energy (in microJoules) is stored in the capacitor? $E_{cap}=\frac{909V}{0.22mm}=4.1\times10^6\ V/m.$

$Q=CV=1.46\times10^{-4}\ Coul$

$=146\ \mu C.$

$U=\frac{1}{2}CV^2=6.65\times10^{-2}\ J=6.65\times10^4\times(10^{-6}\times10^{-2})\ J$

μ

$6.65\times10^4\ \mu J.$