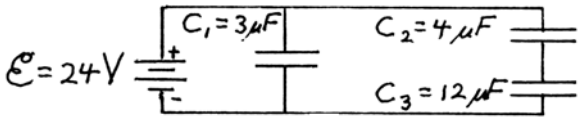
PHYSICS 2220 - PRACTICE EXAM #2

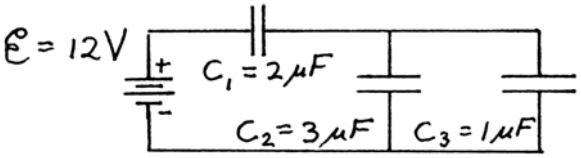
1. For the circuit shown at right, how much charge is on capacitor C_2?



2. What is the area of each plate of a 1 μF capacitor if the plates are separated by 1 mm?

3. If the capacitor in the previous problem is attached to a 12 V battery, what is the magnitude of the electric field between the plates?

4. Find the charge on each capacitor, and the voltage across each capacitor, in the circuit shown.

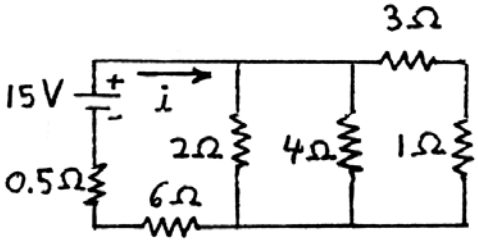


5. Find the energy stored in each capacitor in the previous problem.

6. When a 2 Ω load resistor is attached to a battery with an emf of 12 V, the power dissipated by the load resistor is 50 W. What is the internal resistance of the battery?

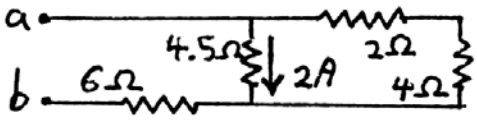
7. A 15 V battery has an internal resistance of 0.5 Ω (shown below the battery). What is the current i?

8. What is the voltage across the 4 Ω resistor in problem 7?

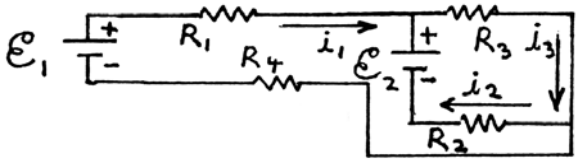


9. What is the power dissipated by the 3 Ω resistor in problem 7?

10. A current of 2 A flows through the 4.5 Ω resistor. Find the voltage between points a and b.



11. Write down three Kirchhoff's rules that are sufficient to solve the circuit shown.



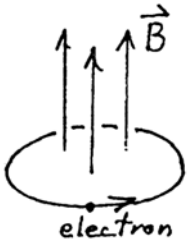
12. An RC circuit with $R = 2 \times 10^4$ Ω and $C = 5$ μF is charged with a 30 V battery. What is the time constant of the circuit?

13. In problem 12, find the time for the capacitor to reach 1/4 of its final charge Q, and find the final charge Q on the capacitor.

14. In problem 12, find the initial current at t = 0, and find the current at t = 0.1 s.

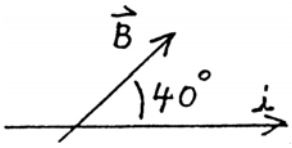
15. A proton with v = 3 x 10^6 m/s enters a magnetic field of 1.8 T at a 30^o angle. What is the force on the proton?

16. A proton moves perpendicular to a magnetic field of 0.005 T. What is the period of the proton's circular orbit?

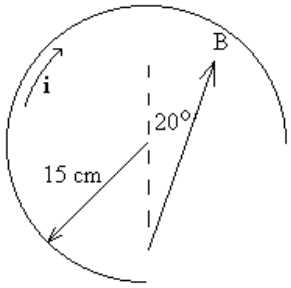


17. An electron with v = 4.47 x 10^5 m/s moves perpendicular to a magnetic field 5 x 10^{-5} T, as shown. What is the acceleration of the electron? What is the radius of the electron's orbit?

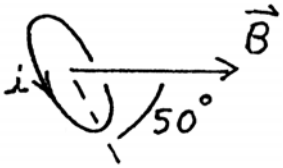
18. A horizontal wire 70 m long carries a current of 30 A. If the Earth's magnetic field is 5 x 10^{-5} T as shown, find the magnetic force on the wire.



19. A wire is bent in the shape of 3/4 of a circle of radius 15 cm. The wire is in a uniform magnetic field of 0.05 T directed 20^o from the vertical, as shown. If a 350 mA current flows clockwise in the wire, find the magnetic force on the wire.



20. A circular current loop of radius 18 cm has 250 turns of wire and carries a current of 25 mA. It is placed in a magnetic field of 0.06 T. Find the magnitude of the torque on the loop. Which way will the loop turn?



ANSWERS: (1) 72 μC (2) 1.13 x 10^2 m^2 (3) 1.2 x 10^4 V/m

(4) Q_1: 16 μC, 8 V; Q_2: 12 μC, 4 V; Q_3: 4 μC, 4 V

(5) C_1: 6.4 x 10^{-5} J; C_2: 2.4 x 10^{-5} J; C_3: 8 x 10^{-6} J

(6) 0.4 Ω (7) 2 A (8) 2 V (9) 0.75 W (10) 30 V

(11) $i_1 + i_2 = i_3$; $\mathcal{E}_1 - i_1R_1 - \mathcal{E}_2 + i_2R_2 - i_1R_4 = 0$;

$\mathcal{E}_2 - i_3R_3 - i_2R_2 = 0$ (12) 0.1 s (13) 2.88 x 10^{-2} s; 150 μC

(14) 1.5 x 10^{-3} A; 5.52 x 10^{-4} A (15) 4.32 x 10^{-13} N

(16) 1.31 x 10^{-5} s (17) 3.93 x 10^{12} m/s^2; 5.09 cm

(18) 6.75 x 10^{-2} N, out of page (19) 1.57 x 10^{-3} N, out of page

(20) 2.45 x 10^{-2} N·m, clockwise