PHY2054 Spring 2019 Exam 2 Review Questions

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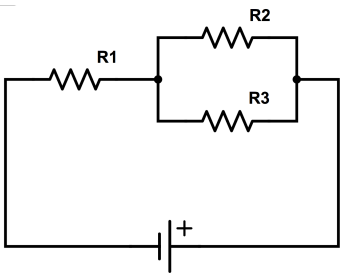
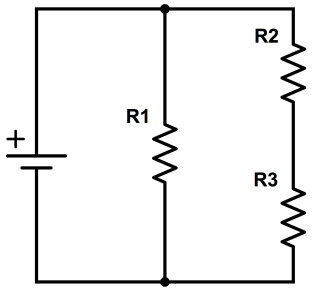
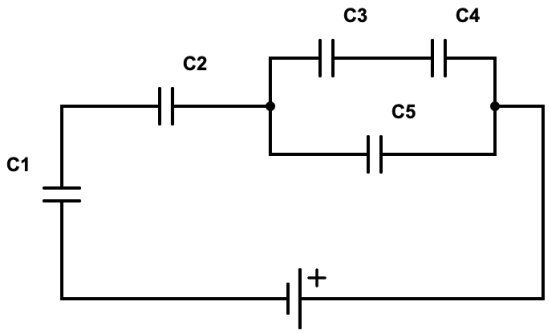
Chapter 21: Electric Current and Direct Current Circuits



1. For the circuit above, $R_1 = 2\Omega$, $R_2 = 3\Omega$, $R_3 = 1\Omega$, and the voltage of the battery is 5V.
   (a) What is the equivalent resistance of the circuit?
   (b) How much current produced by the battery?
   (c) What current flows through R_2?
   (d) What is the voltage across R_3?



2. For the circuit above, $R_1 = 4\Omega$, $R_2 = 1.5\Omega$, $R_3 = 3\Omega$, and the voltage of the battery is 2V.
   (a) What is the current through R_1?
   (b) How much power is produced by R_2?
   (c) What is the voltage across R_3?



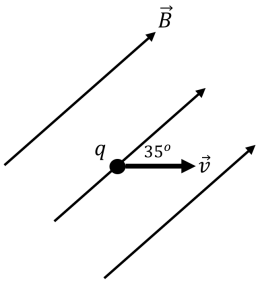
3. In the above circuit, the battery's voltage is 10V, $C_1 = 2$F, $C_2 = 5$F, $C_3 = 3$F, $C_4 = 1$F, and $C_5 = 2$F.

   (a) What charge is stored on C_1?

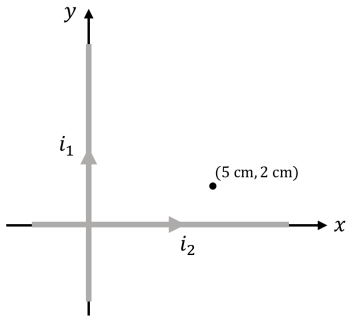
   (b) What is the voltage across C_3?

   (c) How much energy is stored by C_5?

Chapter 22: Magnetism



1. A charge $q = -9$ nC moves with a speed of $v = 10,000$ m/s in the presence of a magnetic field $B = 0.05$T, as shown in the figure above. What is the force, both magnitude and direction, on the charge?

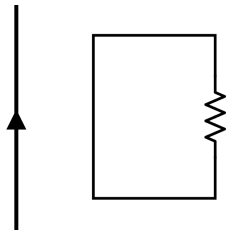


2. Two very long wires carry the currents $i_1 = 3000$ A and $i_2 = 2000$ A as shown in the figure above. What is the magnetic field, both magnitude and direction, at the point indicated in the figure?

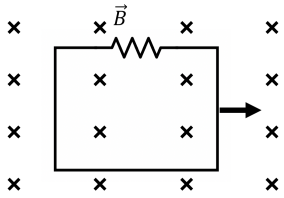
3. Two 10m long, parallel wires separated by a distance of 15cm carry currents in opposite directions. If one wire carries a current of 150 A and the other carries a current of 200 A, what is the magnetic force that each wire exerts on the other? Is the force attractive or repulsive?

4. A solenoid with 100 turns per cm is placed on top of a table, oriented so that it would produce a magnetic field to the East, with a compass placed just at the edge of the solenoid. If the Earth's magnetic field runs to the North and has a strength of $B_E = 10^{-4}$ T, what current must run through the solenoid so that the compass' needle points exact halfway between North and East?

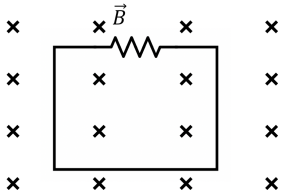
Chapter 23: Magnetic Flux and Faraday's Law of Induction



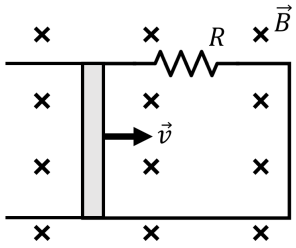
1. A very long wire carries a current upward next to a conducting loop, as shown in the figure above. If the current in the wire increases, in what direction does the induced current flow through the loop?



2. A conducting loop moves through a uniform magnetic field as shown in the above figure. In what direction does the induced current flow through the resistor?



3. A square, 15cm×15cm loop is immersed in a uniform magnetic field $\vec{B}$, as shown above.
   (a) If $B = 0.5$ T, how much magnetic flux passes through the loop?
   (b) If B increases at 0.01 T/s, and $R = 10\Omega$, what is the induced current?
   (c) In what direction would the induced current flow through the resistor?



4. A conductor of length 4cm moves to the right at 150m/s in the presence of a uniform 0.01T magnetic field, as shown in the figure above. The conductor slides along wires connected to a resistor with $R = 15\Omega$.

   (a) Why is there an induced current in this circuit?

   (b) What is the magnitude of the induced EMF in this circuit?

   (c) What is the magnitude of the induced current through the resistor?

   (d) In what direction does the current flow through the resistor?

Answers

Chapter 21

1. 2.75Ω, 1.82A, 0.46A, 1.37V
2. 0.5A, 0.29J, 1.32V
3. 9.4C, 0.86V, 11.7J

Chapter 22

1. 4.5×10^{-6} N into the page
2. -0.008 T out of the page
3. 0.4 N, repulsive
4. 0.008A

Chapter 23

1. Counter-clockwise
2. No current is induced because the magnetic flux is constant
3. 0.011 Wb, 2.25×10^{-5} A, to the left
4. Area of loop is decreasing causing a decreasing flux, 0.06V, 0.004A, to the right