Physics 150 (Opportunity I)   October 24, 2007

Make sure your name and student ID number are on all pages of your test. **Show all work clearly!!!** The question is wrong if all work is not clearly shown. It is your responsibility to make sure you understand the question before attempting it. Assume ideal conditions unless otherwise stated. Label things clearly. The final answer must include units where appropriate. If you notice someone cheating, you may report it to me in confidence.

1) If a circuit is not working properly, which of the following trouble shooting techniques is **LEAST** likely to solve the problem? Circle one answer.

a) Taking off your goggles and inspecting all electrolytic capacitors closely.

b) Checking to make sure things are plugged in and turned on.

c) Checking for loose wires and/or bad connections.

d) Double checking the circuit diagram.

e) Checking to make sure that the components (resistors, capacitors, etc.) are the right values.
2)  

a) You wish to select a 1k resistor with a 10% tolerance. What color sequence should you look for?

The remaining parts have little, or nothing, to do with part a. Consider three resistors placed in series, as shown in the diagram. \( R_1 = 1\Omega, \ R_2 = 2\Omega, \) and \( R_3 = 3\Omega. \) Also, \( V = 4V. \)

b) What is the voltage drop across \( R_3 \) the 3 \( \Omega \) resistor?

c) What is the current through the \( R_3 \), the 3 \( \Omega \) resistor?

d) What is the current through the \( R_1 \), the 1 \( \Omega \) resistor?

e) What should be the power rating of the 1k resistor? (1/8 W, ¼ W, or ½ W)
3) Consider the following oscilloscope display.

![Oscilloscope Display](image)

a) What is the most likely input to the oscilloscope? Circle one answer.
   i) a battery
   ii) an AC source
   iii) a DC power supply.
   iv) a half wave rectifier circuit.

b) What is the frequency of the input signal? Be sure to include units.

c) What is the peak to peak voltage amplitude (V_{pp}) of the signal? Be sure to include units.

The remaining parts have little, or nothing, to do with parts a through c. Now, suppose that the 3 kHz AC signal with a peak to peak amplitude of 5 V is applied to the following circuit:

R = 5 kΩ, L = 100 mH and C = 0.02814 μF.

d) What is the capacitive reactance X_c?

e) What is the inductive reactance X_L?
4) Consider the following graph, which represents a particular electrical component.

![Graph with Electric Potential Difference (V) on the x-axis and Current (mA) on the y-axis.]

a) What is the slope of the line in the graph? Be sure to give **UNITS** with your answer.

b) What is the resistance of the electrical component? Be sure to give **UNITS** with your answer.

c) What is the power being dissipated in the electrical component when it is drawing a current of 0.5 milliamperes? Be sure to give **UNITS** with your answer.

d) If an electric potential difference of 5.6 V were applied to the electrical component, what would you predict for the current flowing in the component? Be sure to give **UNITS** with your answer.

e) If an electric potential difference of **NEGATIVE** 5.6 V were to be applied to the electrical component, what would you predict for the current flowing in the component? Is the direction of the current flow the same or opposite from part e?
5) Consider the following circuit diagram.

\[ V = 12V, \ R_1 = 2\ \Omega \text{ and } R_2 = 4\Omega \]

\( \text{a)} \) What is the Voltage difference between point a and point b?

\( \text{b)} \) What is the Voltage difference between point c and point d?

\( \text{c)} \) What is the current through the battery?

\( \text{d)} \) What is the current through \( R_1 = 2\ \Omega \)?

\( \text{e)} \) What is the current through \( R_2 = 4\Omega \)?