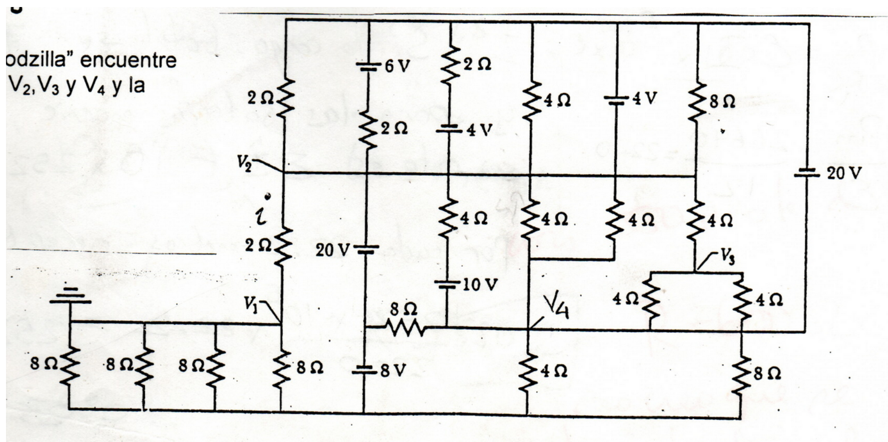
Name ___________________________

PHY2049C, Homework 5

A- Submit a handwritten version of the solutions (clearly readable) at the beginning of class.

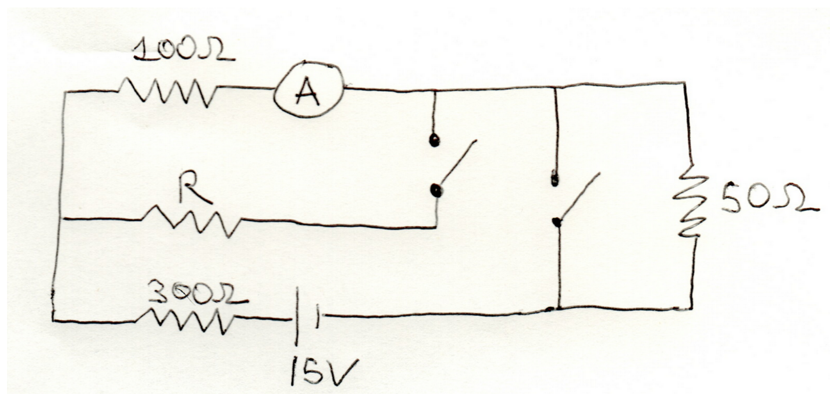
Problem 1

In the "Godzilla" circuit, find the potentials V_1, V_2, V_3 and V_4, and the current *i* .



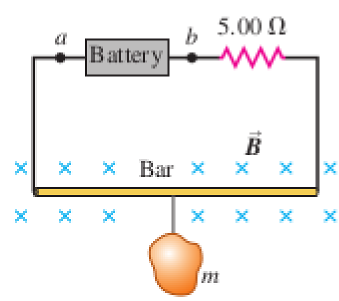
Problem 2

In this circuit, the current measured by the A device is the same when both switches are open than when they are both closed. Find the resistance R.



Problem 3

The circuit shown in the figure to the right is used to make a magnetic balance to weigh objects. The mass m to be measured is hung from the center of the bar that is in a uniform magnetic field of 1.00 T, directed into the plane of the figure. The battery voltage can be adjusted to vary the current in the circuit. The horizontal bar is 50.0 cm long and is made of extremely light-weight material. It is connected to the battery by thin vertical wires that can support no appreciable tension; all the weight of the suspended mass m is supported by the magnetic force on the bar. A resistor with R = 4.00 Ω is in series with the bar; the resistance of the rest of the circuit is much less than this. (a) Which point, a or b, should be the positive terminal of the battery? (b) If the maximum terminal voltage of the battery is 175 V, what is the greatest mass m that this instrument can measure?



Problem 4 (Sears and Zemansky)

A magnetic lift uses a cylinder with radius R and width W wrapped by conducting wire, as shown in Figure 2. A uniform external magnetic field B points downward while current I flows in the sense indicated. A mass M is hung from the cylinder by a cable attached to its rim on the axis of the coil. The height above the lowest possible position of the mass is h.

(a) What is the minimum current I for M which the mass can be suspended with h > 0?

(b) What is the height of the mass $h = h_{top}$ when the cable attachment rotates one-half turn to the top of the cylinder, in terms of R? Define a dimensionless parameter $\sigma = 2\frac{NIWB}{Mg}$ and express subsequent results in terms of σ and other given quantities.

Problem 5

Show that the orbital radius of a charged particle moving at right angles to a magnetic field B can be written as

$$r = \sqrt{2\frac{Km}{qB}}$$

where K is the kinetic energy in joules, m the particle mass, and q its charge.