

Name: _____

Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page.

Multiple choice

1. (2 points) The electric force and the magnetic force are the following type of force:
 - ☐ a contact force
 - ☐ a field force
 - ☐ a normal force

2. (2 points) Ampere's law relates the the integral of the magnetic field around a loop with
 - ☐ Charge enclosed
 - ☐ Motion of Charges in loop
 - ☐ Current Enclosed
 - ☐ Magnetic Charges

3. (2 points) The difference between an AC circuit and a DC circuit is:
 - ☐ AC circuits are not full loops, DC circuits have full loops.
 - ☐ DC circuits are always in series while AC circuits are in parallel.
 - ☐ AC circuits have non-constant oscillating voltage, DC currents have constant voltage.
 - ☐ AC circuits have constant voltage, DC currents have oscillating voltage.

4. (2 points) A conductor is an object that:
 - ☐ that has free electrons and can transmit charges
 - ☐ that doesn't have free electrons and can't transmit charges
 - ☐ that can transmit charges between objects of only one charge
 - ☐ do not experience electric forces

5. (2 points) The Millikan Oil-Drop Experiment proved that:
 - ☐ Showed that charges are continuous.
 - ☐ Showed that electrons are massless.
 - ☐ Showed that the electric field only interacts with electrons.
 - ☐ Showed that charges come in integer multiples of the elementary charge e .

6. (2 points) Gauss's law tells us that the charges are
- ☐ never come in pairs.
 - ☐ Equal to the flux passing through an imaginary 3d surface enclosing the charges
 - ☐ inversely related to the flux passing through a loop around the charges.
7. (2 points) The electric potential energy is a [] and the electric force is a [].
- ☐ scalar/vector ☐ vector/scalar ☐ scalar/scalar ☐ vector/vector
8. (2 points) The loop rule for circuits says that
- ☐ The current passing through a circuit junction is conserved.
 - ☐ The current passing through a loop is equal to the size of the loop.
 - ☐ The voltage across each part of the loop is the same.
 - ☐ The voltage drop across each part of a circuit adds up to zero.
 - ☐ None of the above.
9. (2 points) The junction rule for circuits says that
- ☐ The input of a circuit junction is equal to the voltage across the junction.
 - ☐ The input of a circuit junction is equal to the output of a circuit junction.
 - ☐ The input of a circuit junction is equal to the equivalent resistance of the circuit.
10. (2 points) An inductor can store energy from a circuit
- ☐ in the form of heat.
 - ☐ in the form of a magnetic field.
 - ☐ in the form of resistance.
 - ☐ in the form of capacitance.

Problems

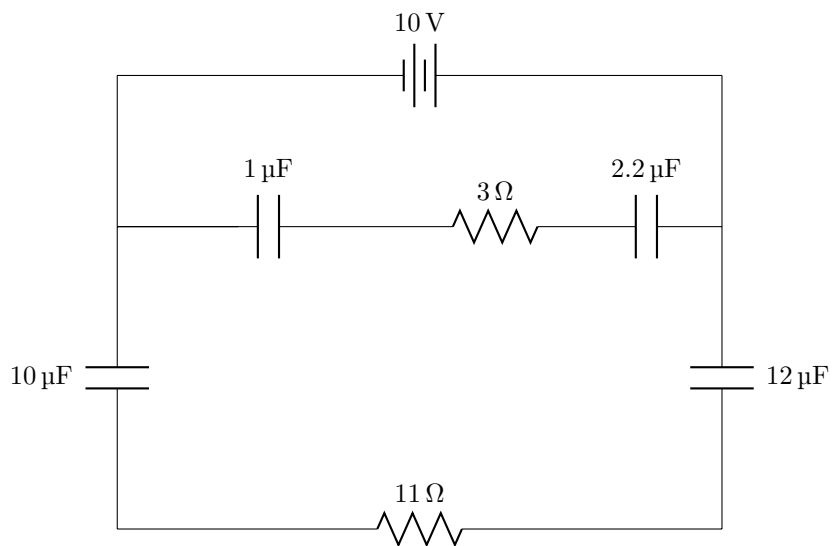
11. A spherical drop of water carrying a charge of 30 pC has a potential of 500 V at its surface (with $V=0$ at infinity).

(a) (3 points) What is the radius of the drop?

(b) (3 points) Assume the charge in the drop is distributed uniformly, using Gauss's law, create a formula for the electric field inside the charge.

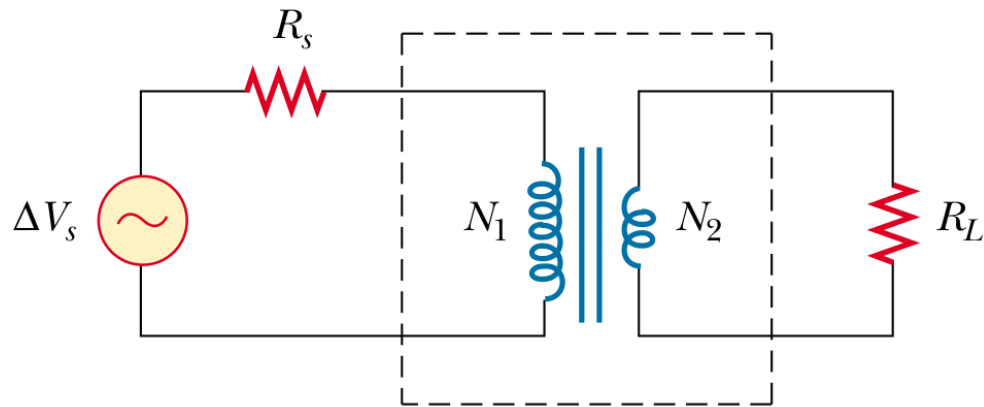
(c) (1 point) Assume that two charges are located near to each other, with one being positively charged, the other being negatively charged. Sketch the magnetic field lines for these charges (general sketch).

12. Find the equivalent circuit which has one resistor and one capacitor for the following circuit. What are the charges on the capacitors?



13. (4 points) A particle of mass 6.0 g moves at 4.0 km/s in an xy plane in a region with a uniform magnetic field given by $5.0\hat{i}$ mT. At one instant, when the particle's velocity is directed 37° counterclockwise from the positive direction of the x axis, the magnetic force on the particle is $0.48\hat{k}$ N. What is the particle's charge?

14. (6 points) In the transformer shown below, the load resistor is 50.0 Ohms. The turn ratio $N_1 : N_2$ is 5:2 and the source voltage is 80.0 V (rms). If a voltmeter across the load measures 25.0 V (rms), what is the source resistance R_s ?



15. (6 points) A series RLC circuit is driven by a generator at a frequency of 2000 Hz and an emf amplitude of 170 V. The inductance is 60.0 mH, the capacitance is $0.400\ \mu\text{F}$ and the resistance is 200 Ohms. What is the phase constant in radians and the current amplitude?