Physics 1214 - General Physics II

Midterm - 2013.03.13

Name: _____

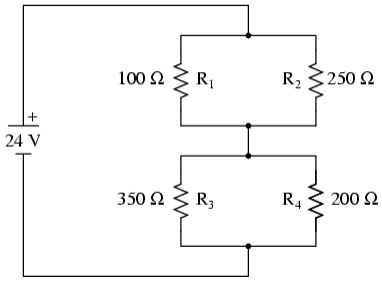
Instructions: Please show all work on each problem, and give full explanations where needed. No points will be awarded for a correct answer, points are awarded on the work shown for each problem. When you are finished, please attach your cheat sheet to this exam. Good luck!

problem	points	score
1 (a)	8	
1 (b)	8	
2 (a)	5	
2 (b)	5	
3 (a)	5	
3 (b)	5	
3 (c)	5	
3 (d)	5	
4 (a)	7	
4 (b)	3	
5 (a)	7	
5 (b)	5	
6 (a)	7	
6 (b)	3	
7 (a)	5	
7 (b)	5	
Total	88	

1. Within the nucleus of an atom, compute the strength of the electric field produced, and the force exerted by a proton (a) at a distance of 5.0×10^{-15} m away from another proton, and (b) at a distance of 5.0×10^{-10} m away from an electron.

2. A point charge has a charge of 2.50×10^{-11} C. At what distance from the point charge is the electric potential (a) 90.0 V and (b) 30.0 V?

3. Refer to the circuit diagram given to answer the following questions.



Circuit diagram for problem 3.

(a) Find the equivalent resistance R_{12} to the combination of resistors R_1 and R_2.

(b) Find the equivalent resistance R_{34} to the combination of resistors R_3 and R_4.

(c) Find the equivalent resistance R_{1234} to the combination of resistors R_1, R_2, R_3 and R_4.

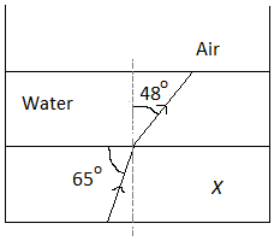
(d) Find the current through the 24 V battery.

4. A long straight cable contains 30 wires, each carrying a current of 1.25 A. The distances between the wires is negligible. (a) If the currents in all 30 wires are in the same direction, what is the magnitude of the magnetic field 6.0 m from the cable? (b) If the currents in half the cables is reversed, what is the new magnitude of the magnetic field 6.0 m from the cable?

5. One solenoid is centered inside another. The outer solenoid has a length of 50.0 cm and contains 6750 coils, while the coaxial inner solenoid is 3.0 cm long and 0.120 cm in diameter and contains 15 coils. The current in the outer solenoid is changing at 37.5 A/s. (a) What is the mutual inductance of these solenoids? (b) Find the emf induced in the inner solenoid.

6. A series ac circuit has a resonance angular frequency of 1525 rad/s using a 138 Ω resistor, a 10.5 μF capacitor, and an inductor. (a) What is the inductance of the inductor? (b) What is the impedance of this circuit when you in use with an ac voltage source having angular frequency 1525 rad/s?

7. A layer of water covers a slab of material X in a container. A ray of light traveling upwards follows the path in the image below. The angles in the figure are given by 65° in the unknown material X and 48° in the water. (a) Compute the index of refraction of the unknown material X and (b) the angle the light makes with the normal in the air. Remember that $n_{air} = 1.0$ and $n_{water} = 1.333$.



Cross section of beaker for problem 7.