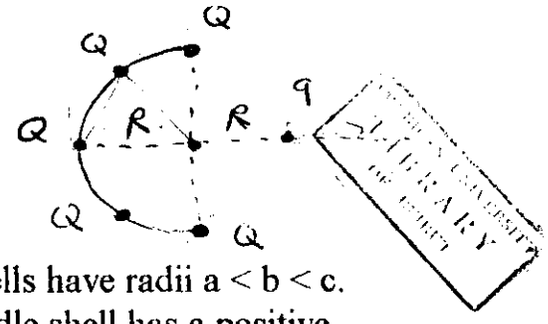
PHYSICS 205 - FINAL EXAM

1. What is the ratio of the wavelengths of a 200 eV photon and a 200 eV electron?

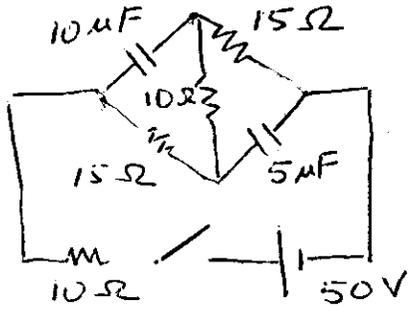
2. Five equal charges Q are equally spaced on a semicircle of radius R. Find the force on a charge q located as shown.



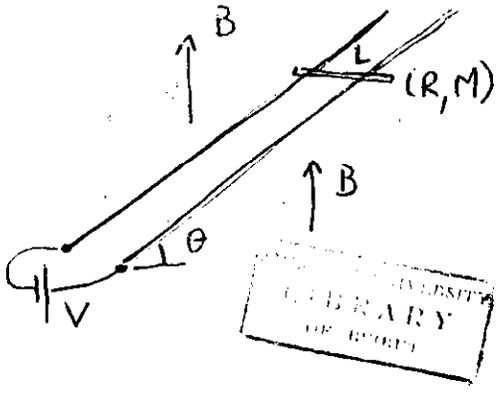
3. Three concentric spherical thin conducting shells have radii $a < b < c$. Initially the inner shell is not charged, the middle shell has a positive charge +Q and the outer shell has a negative charge -Q. Find the electric potential of the three shells.

4. Design a network of capacitors that has a capacitance of 2 nF and a breakdown voltage of 400 V using as many 2 nF capacitors that have individual breakdown voltages of 100 V as needed.

5. The capacitors in the circuit shown are initially uncharged. a)What is the initial battery current when the switch is closed.
b)What is the battery current after a long time.
c) What are the final charges on the capacitors?



6. A metal bar of mass M, resistance R and length L rides on a pair of long frictionless perfectly conducting rails that are inclined so that they make an angle θ with the horizontal. The rails are connected to a battery V.
The bar is released from rest in the presence of a vertical magnetic field B.
Describe the subsequent motion.
Find the final value of the current.



7. A series LRC circuit is driven at a frequency of 500 Hz. An oscilloscope measurement determines the phase angle between current and voltage to be 75° . If R=35Ω and L=0.15 H, Find C.

8. An X-ray undergoes scattering by a stationary free electron and emerges with a wavelength of 0.2 nm at an angle of 100° . What is the kinetic energy of the scattering electron?

9. What is the radius of ^{56}Fe nucleus?
10. Find the binding energy per nucleon of ^{7}Li .
11. The neutron decays into a proton. Write the equation for this decay. What the energy released in this decay? Where does this energy go?
12. The counting rate of a radioactive source is 8000/s at t=0. 10 min later the rate is 1000/s. What is: a) The half life, b) the decay constant and c) the count rate at t=30 min?

atomic mass of (atomic mass units)
$^{7}Li = 7.016004$
$^{1}H = 1.007825$
neutron = 1.008665
electron = 0.000548
1 amu = 931.5 MeV/c^2

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