

NAME: \_\_\_\_\_

SECTION #: \_\_\_\_\_

TA: \_\_\_\_\_

Problem	Points	Score
1	15	
2	15	
3	20	
4	10	
5	20	
6	20	
7	10	
8	10	
9	15	
10	15	
Total	150	

- You may use only the formula sheet you brought with you to the exam. No other books or notes are permitted.
- Write your final answer in the box provided.
- All answers should include units.
- To get credit for a problem you need to show your work in the space provided. If no work is shown you will get no credit, even if the answer in the box is correct. You are expected to work all problems using the basic laws of physics and the equations provided on the formula sheet. If you happen to remember the answer to a particular problem or know a shortcut formula you must still work the problem to get full credit.
- If you need more space, use the back of one of the sheets, and make a note that the work is continued on the back.
- Turn your exam in to your TA when you are finished.



3) The nucleus  $^{110}\text{Ag}$  has a half-life of 2.4 minutes.

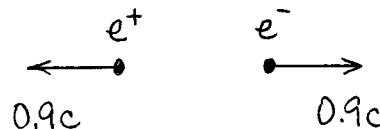
(a) Find the activity (decays per second) of a source consisting of  $3 \times 10^{10}$  atoms of  $^{110}\text{Ag}$ .

(b) What will the activity of the source be after 6 minutes have gone by?

4) Find the deBroglie wavelength of an electron with a kinetic energy of 20 eV. The electron mass is  $9.11 \times 10^{-31}$  kg.

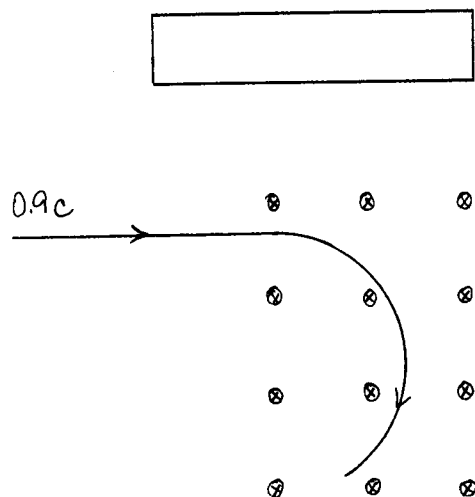
- 5) An unstable particle,  $x$ , at rest in the lab decays spontaneously into an electron and a positron (both of which have rest mass  $9.11 \times 10^{-31}$  kg). In the decay the electron and the positron are emitted in opposite directions, each with speed  $0.9c$ .

(a) What was the mass of particle  $x$ ?

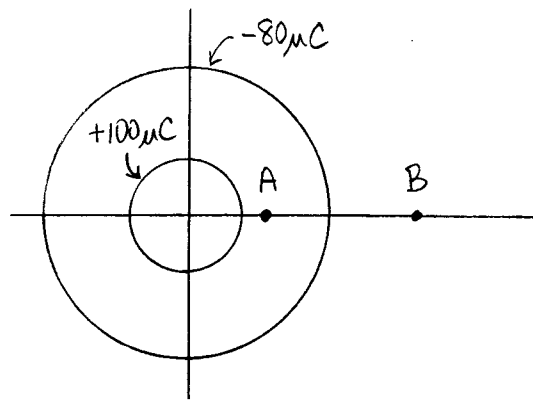


Relativity - you can ignore (a)  
but should understand what to do in (b)

- (b) Suppose the electron enters a region in which there is a uniform magnetic field of  $0.8$  T (into the page in the drawing). As it moves through the field the electron will follow a circular path. Find the radius of the circle.



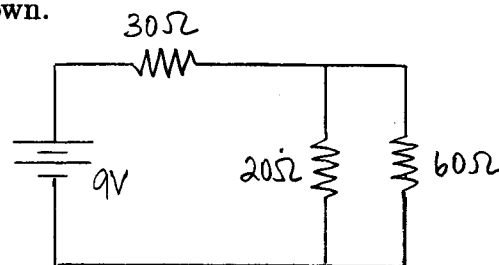
- 6) Two concentric hollow metal spheres have radii of 20 cm and 50 cm respectively. A charge of  $+100\mu\text{C}$  is placed on the smaller sphere, and a charge of  $-80\mu\text{C}$  is placed on the larger one. Find the magnitude of the electric field at point A (30 cm from the center of the spheres) and at point B (80 cm from the center).



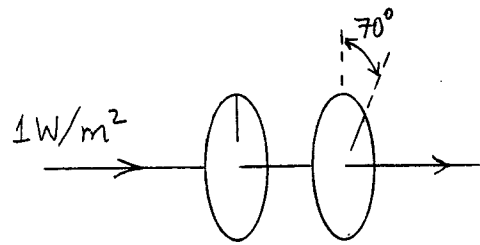
Point A:

Point B:

- 7) Find the total current supplied by the battery in the circuit shown.



- 8) Unpolarized light of intensity  $1 \text{ W/m}^2$  passes through a pair of linear polarizers. Find the intensity of the transmitted light if the axis of the second polarizer is rotated by  $70^\circ$  relative to the first.



- 9) Suppose your near point is 90 cm. What focal length would your eyeglass lenses need to have in order to read a newspaper held 25 cm in front of your eyes. Assume that the lenses are 2 cm in front of your eyes.

- 10) A long straight wire carries a current of 15 A. A proton is moving parallel to the wire at a speed of  $2 \times 10^5 \text{ m/s}$ . The proton is 5 cm from the wire and directly below it. Find the magnitude of the force acting on the proton.

