Physics 201 Name _____

Final Exam – Comprehensive

May 8, 2007

This is a closed book examination. You may use a 5x8 inch index card stuffed with physics content (or suitable art work). There is extra scratch paper available. Please explain your answers. Your explanation is worth 3/4 of the points on multiple-choice questions.

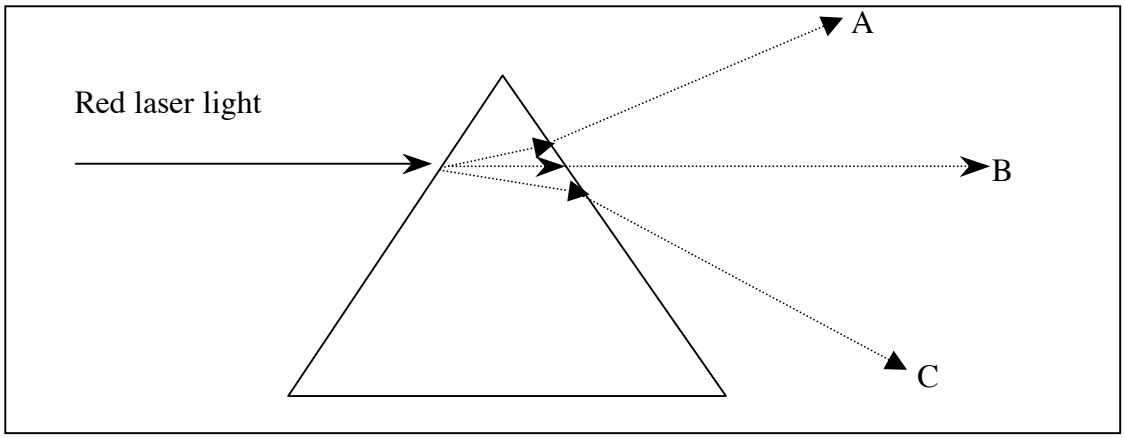
1) [4 PTS] A person wearing a green and red striped shirt enters a disco where the only illumination is a yellow light. What does the shirt look like to you? Explain.
   a) The shirt is still striped – blackish and green
   b) The shirt is still striped – blackish and red
   c) The shirt is still striped – orange and yellowish green
   d) The shirt looks solid – yellow (or whitish)
   e) The shirt looks solid – blackish

2) [4 PTS] A closed loop moves at a constant speed parallel to a long straight current-carrying wire. The loop moves in the opposite direction as the current in the wire.
   a) The induced current will vary with the speed at which the loop moves
   b) The induced current in the loop will progress clockwise
   c) The induced current in the loop will progress counterclockwise
   d) There will be no induced current
   e) None of the above

3) [4 PTS] When a straight metal sheet is charged very light metal strips hanging from each side stand out perpendicular from the surface. This is how you can tell there is charge on a surface – like hair on your head when you get charged from touching a Van de Graaff generator. The metal sheet is now carefully bent so it creates a cylinder (the edges touch) with no loss of charge. What happens to the thin metal strips?
   a) They now hang down inside and outside.
   b) They continue to point perpendicular from the surface
   c) They point perpendicular from the surface on the inside but hang down on the outside.
   d) They point perpendicular from the surface on the outside but hang down on the inside.
   e) They point strongly perpendicular from the surface on the inside and droop a bit on the outside.

4) [4 PTS] The volume of space between two conductors is found to have a constantly increasing potential. The change in potential across the space is linear. It follows that in that space
   a) the electric field is constant and nonzero.
   b) the potential has to be zero in the exact center.
   c) the electric field is constant and zero.
   d) the potential is inversely proportional to the electric field.
   e) none of these.

You have a plastic (n=1.2) rectangle with a prism shape cut through it. Assume the index of refraction of air is n=1.0 and water is n=1.33. You have a red laser you can shine at the prism.

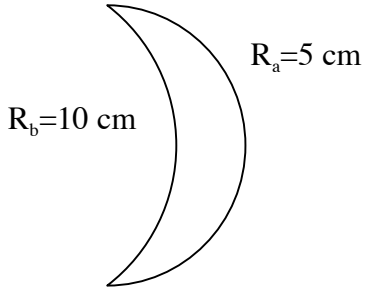


5) [4 PTS] The plastic rectangle is placed in water. Which ray most closely shows the path the laser beam follows? Explain.
   a) Ray A
   b) Ray B
   c) Ray C
   d) None of the rays closely resembles the correct path.
   e) The light is at the critical angle so it experiences total internal reflection.

6) [4 PTS] Suppose you are standing in front of a 0.25 m tall flat vertical mirror in which you can see some fraction of your body. What happens to that fraction when you step farther from the mirror? Explain
   a) You see a smaller fraction of your body.
   b) You see the same fraction of your body.
   c) You see a greater fraction of your body.

7) [12 PT] You have five identical light bulbs and a 9 V battery. You connect three of the light bulbs in series, which you then connect in parallel with the remaining two light bulbs and battery.
   a) Draw a schematic diagram of this setup.
   b) Knowing that power is related to brightness, quantify the change in brightness of each of the light bulbs when you disconnect one of the parallel light bulbs.
   c) Determine the change in power used by the light bulbs if you hooked your circuit to an AC voltage source with $V(t) = 9\sin(2\pi 60t)$?

8) [12 PTS] The thin plastic (n=1.2) lens to the right is used to form an image of an object 75 cm from the convex side.
   a) Describe the image – location, virtual or real, erect or upside down and its magnification?
   b) Describe qualitatively what would happen if the lens were placed in water (n=1.33).
   c) Describe what would happen if the concave side were filled with water (n=1.33). Note: you would not be able to keep the lens vertical - unless you had some plastic wrap.



You may find the following useful for creating a ray diagram.