PH 113 Spring Term 2016

Physics III

Practice Problems – Set A

1. List the three primary differences between the electric field force and the magnetic field force.

2. Explain how a velocity selector works.

3. Will a current bearing loop (with an arbitrary shape) placed in a uniform magnetic field experience a net force? Explain.

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4. Describe the difference between a solenoidal coil and a toroidal coil.

5. What is a magnetic bottle? Explain how it works.

6. Describe how the earth's magnetic field protects us from most solar particles.

7. Describe the condition that allows us to treat a wire as an infinite conductor when calculating the magnetic field due to the current in a wire.

8. Does a moving, charged particle always experience a magnetic force? Explain your answer.

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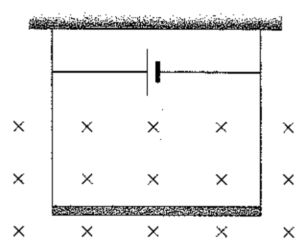
9. A singly charged ion has a mass of 3.2×10^{-26} kg. After being accelerated through a potential difference of 833 V, the ion enters a magnetic field of 0.920 T along a direction perpendicular to the direction of the field. (A) Calculate the radius of the path of the ion in the field. (B) If the particle is accelerating, determine the acceleration of the particle. (C) Calculate the period of the motion of the ion in the field. (D) Determine the amount of work done by the field on the particle.

10. A conductor suspended by two flexible wires, as shown below, has a mass per unit length of 0.040 kg/m. (A) What current must exist in the conductor in order for the tension in the supporting wires to be zero when the magnetic field is 3.6 T into the page? (B) What is the required direction for the current?



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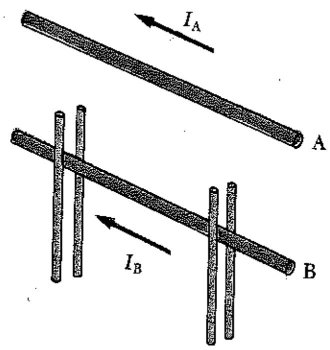
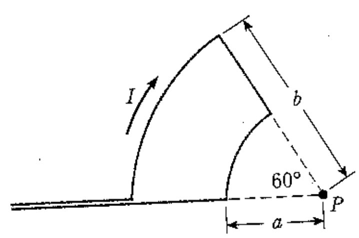
11. Two long, parallel conductors are carrying currents in the same direction, as shown below. Conductor A carries a current of 150 A and is held firmly in position; conductor B carries current I_B and is allowed to slide freely up and down (parallel to A) between a set of nonconducting guides. If the linear mass density of conductor B is 0.10 g/cm, what value of current I_B will result in equilibrium when the distance between the two conductors is 2.5 cm?



12. Consider the current-carrying loop shown below formed of radial lines and segments of circles whose centers are at point *P*. Find the magnitude and direction of the magnetic field at *P*.



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13. A closely wound, long solenoid of overall length 30.0 cm has a magnetic field of 5.00×10^{-4} T at its center produced by a current of 1.00 A through its windings. How many turns are on the solenoid?

14. A rectangular coil of 225 turns and area 0.45 m^2 is in a uniform magnetic field of 0.21 T. Measurements indicate that the maximum torque exerted on the loop by the field is 8.0×10^{-3} Nm. (A) Calculate the magnetic moment for the coil. (B) Calculate the current in the coil. (C) Would the value found for the required current be different if the 225 turns of wire were used to form a single-turn coil with the same shape of larger area? Explain.

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15. Four long, parallel conductors carry equal currents of 5.00 A. The figure below is an end view of the conductors. The direction of the current is into the page at points *A* and *B* (indicated by the crosses) and out of the page at *C* and *D* (indicated by the dots). Calculate the magnitude and direction of the magnetic field at point *P*, located at the center of the square with an edge of 0.200 m.