

2018-2019 Term 2

PHYS1001 Essential Physics

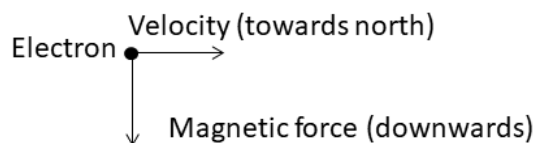
Assignment 9

Due date: 16th April, 2019 by 6:00 pm

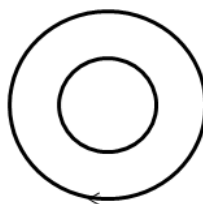
(Please leave your homework in the box with the label “PHYS 1001” outside room 213 in Science Centre North Block)

Please answer all five questions

1. An electron experiences the largest force when it travels at a speed 2.5×10^6 m/s in a magnetic field when it is moving northward. The magnetic force is vertically upward and of magnitude 6.3×10^{-13} N.

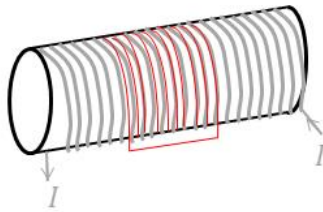


- (a) What is the direction of the magnetic field?
 - (b) What is the magnitude of the magnetic field?
2. A square loop (the length of each side is 10 cm) is perpendicular to a magnetic field of 0.5 T. The field is reduced to 0.1 T in 2 s.
 - (a) Calculate the average induced EMF in the coil.
 - (b) If the resistance of the square loop is $4 \times 10^{-3} \Omega$, calculate the value of the induced current.
 3. A metal ring with a smaller diameter is placed in a larger metal ring as shown in the figure below. Suddenly the large ring is connected to a battery, current flows in the large ring in the clockwise direction as shown below. What is the direction of the induced current in the small ring? Explain your answer.



4. A 500 turn solenoid, 20 cm long, has a diameter of 2.5 cm. A 10 turn coil is wound tightly around the centre of the solenoid as shown in the figure below.

10 turn solenoid
500 turn solenoid



- (a) Calculate the magnetic field in the solenoid when the current in the longer coil is 5.0 A.
- (b) If the current in the solenoid increases uniformly from 0 to 5.0 A in 0.5 s, calculate the induced EMF in the 10 turn coil during this time.

5. As shown in the figure below, two parallel smooth guides 1 and 2 are fixed near the current-carrying straight wire. The guides are parallel to the straight wire and in the same horizontal plane. Two conducting cylindrical sticks AB and CD are free to slide on the guide rail. The current in the current-carrying straight wire increases gradually.

- (a) What is the direction of the induced current in the loop ABCD? Explain your answer.
- (b) Using the results in (a), what is the direction of magnetic force on stick AB? What is the magnetic force on stick CD? Describe the subsequent motion of the two sticks AB and CD. Explain your answer.

