A particle with electric charge \( q = +1.00 \) microcoulombs moves from left to right through a magnetic field \( B = 0.01 \) tesla directed into the page, as illustrated above.

1. What will be the subsequent trajectory of the particle?
   A. along the downwardly curved path A
   B. along the straight path B
   C. along the upwardly curved path C
   D. a curved path into the page
   E. a curved path out of the page

2. After the particle has moved 5.00 cm (about the same distance shown for each path in the illustration above) its speed will be______.
   A. smaller than at the time shown
   B. the same as at the time shown
   C. larger than at the time shown

3. For speed = 1000 m/sec, the magnetic force on the above particle is ______
   A. \( 4\pi \times 10^{-7} \) Newtons
   B. \( 10^{-7} \) Newtons
   C. \( 10^{-5} \) Newtons
   D. \( 4\pi \times 10^{-5} \) Newtons
   E. zero

5. At point C, 1.00 cm from the center of the wire, the magnetic field is 12.0 µT (microteslas). What is the field at point E, 3.00 cm from the center of the wire?
   A. 12.0 µT
   B. 6.00 µT
   C. 4.00 µT
   D. 3.00 µT
   E. 1.33 µT

6. Under these same conditions, what is the current in the wire?
   A. 1.9 A
   B. 600 mA
   C. 19. mA
   D. 1.2 mA
   E. 6.0 µA
One battery, two resistors, a capacitor, a switch and a voltmeter are connected to form the circuit diagrammed at upper left.

**B** 7. If the switch is initially in the up position (position 1), which of the curves at right best represents how the voltmeter reading changes with time just after the switch is thrown to the down position (position 2)?

**E** 8. If the switch is initially in the down position (position 2), which of the curves at right best represents how the voltmeter reading changes with time just after the switch is thrown to the up position (position 1)?

One battery, two resistors, an inductor, a switch and a voltmeter are connected to form the circuit diagrammed at upper left.

**B** 9. If the switch is initially in the up position (position 1), which of the curves at right best represents how the voltmeter reading changes with time just after the switch is thrown to the down position (position 2)?

**E** 10. If the switch is initially in the down position (position 2), which of the curves at right best represents how the voltmeter reading changes with time just after the switch is thrown to the up position (position 1)?
Two long parallel wires carry the same current \( I \) in opposite directions as indicated above. The net magnetic field due to these currents at point \( B \) midway between the wires has a magnitude of 3.00 mT (three millitesla).

**B** 11. What is the direction of the magnetic field at point \( B \)?
   A. Into the page
   B. Out of the page
   C. To the right
   D. To the left
   E. Toward the top of the page
   F. Toward the bottom of the page

**A** 12. What are the magnitude and direction of the magnetic field at point \( C \), which is the same distance below the bottom wire as point \( B \) is above it?
   A. 1.00 mT into the page
   B. 1.00 mT out of the page
   C. 0.33 mT into the page
   D. 0.33 mT out of the page
   E. zero

Two flat, circular, concentric coils lie flat in the plane of the paper as illustrated above. The larger coil has \( N_1 \) turns and radius \( R_1 \); the smaller coil has \( N_2 \) turns and radius \( R_2 \).

**C** 13. Which of the following formulas correctly gives the magnetic flux through the smaller coil 2 when a current \( i_1 \) flows through the larger coil 1?
   A. \( \Phi = \mu_0 \pi N_1 N_2 R_1 R_2 i_1/2 \)
   B. \( \Phi = \mu_0 \pi N_1 N_2 R_1 i_1/(2R_2) \)
   C. \( \Phi = \mu_0 \pi N_1 N_2 R_2^2 i_1/(2R_1) \)
   D. \( \Phi = \mu_0 \pi N_1 N_2 R_1^2 i_1/(2R_2) \)
   E. \( \Phi = \mu_0 \pi N_1 N_2 i_1/(2R_2^2) \)
14. A beam of ions passes through a “velocity filter” consisting of perpendicular uniform electric and magnetic fields. If the electric field is \( E = 100 \text{ volts/meter} \) in the x-direction and the magnetic field is \( B = 0.01 \text{ tesla} \) in the y-direction, what is the velocity of the ions that are not deflected from straight line paths?
A. 100 m/sec in the x-direction  
B. \( 10^4 \) m/sec in the z-direction  
C. 100 m/sec in the z-direction  
D. \( 10^{-4} \) m/sec in negative z-direction  
E. \( 10^4 \) m/sec in the y-direction

15. The S.I. unit for magnetic field, the tesla, is the same as _______?
A. ohm-second  
B. volt-sec/m²  
C. N-sec/m  
D. joule/coul  
E. weber-meter

16. Two coils with inductance \( L_1 = 4.0 \text{ millihenries} \) and \( L_2 = 3.0 \text{ millihenries} \), respectively, are connected in parallel. The equivalent inductance of this parallel combination is ______ millihenries.
A. 7.0  
B. 5.0  
C. 3.5  
D. 1.7  
E. 0.56

17. (20 points) Three very long wires carry current into and out of the page as diagrammed below in cross-section. Draw sufficient number of lines of magnetic field in the space around the wires to show the direction and relative strength of the field in their vicinity. Make the diagram as complete and accurate as you can.