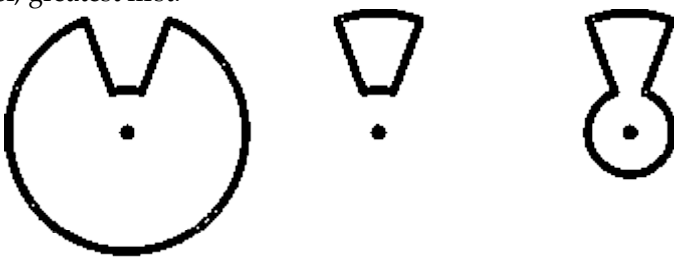
Physics 2B, Electricity and Magnetim -- Spring 2009 Instructor: B. Grinstein
Quiz # 7

INSTRUCTIONS: Fill, tear and return the bottom strip of the front page with your scantron. Keep the top portion of the front page and the rest of the quiz. Use a pencil #2 to fill your scantron. Write your code number and bubble it in under "EXAM NUMBER". Bubble in the quiz form (see letter A--D at bottom of page) in your scantron under "TEST FORM"

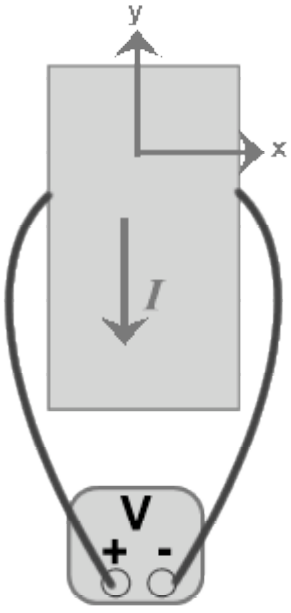
Useful numbers: $K = 9.0 \times 10^9\ Nm^2/C^2$, $\varepsilon_o = 8.85 \times 10^{-12}\ C^2/Nm^2$, $e = 1.60 \times 10^{-19}\ C$, $m_e = 9.11 \times 10^{-31}\ kg$
$\mu_o = 4\pi \times 10^{-7}\ T\,m/A$

1) The figure shows three circuits, each consisting of two concentric circular arcs, one of radius r and the other of a larger radius R, and two radial lengths. The circuits have the same current through them, and the radial lengths have the same angle between them. Rank the circuits according to the magnitude of the net magnetic field at the center, greatest first.



A) b, a, c B) b, c, a C) a, b, c D) a, c, b E) c, a, b

2) A voltmeter is used to measure the voltage across a Hall strip conducting a current in the negative y–direction as shown in the figure below. The charge carriers are known to be positive in this strip. What is the direction of the magnetic field used in this experiment if the reading on the voltmeter is negative when the probes are connected as shown? (Notes: 1. A voltmeter shows a positive measurement when the potential of the terminal labelled "+" is higher than the potential of the terminal labelled "–." 2. The z direction is out of the page).



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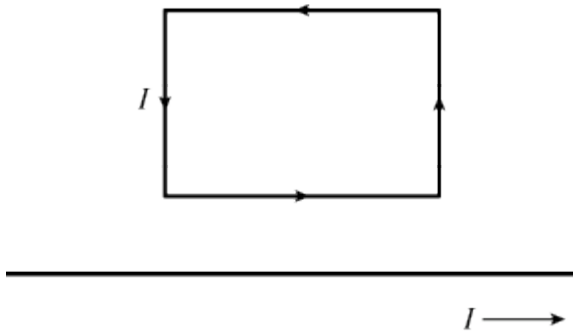
A) positive z direction
B) positive x direction
C) negative z direction
D) positive y direction
E) negative x direction

3) A particle with charge 4.0 C moving at $\vec{v} = 3.0\,\hat{i}$ m/s enters a magnetic field $\vec{B} = 18.0\,\hat{j}$ T and an electric field $\vec{E} = 25\,\hat{k}$ N/C. Find the acceleration of the particle if its mass is 0.00800 kg.

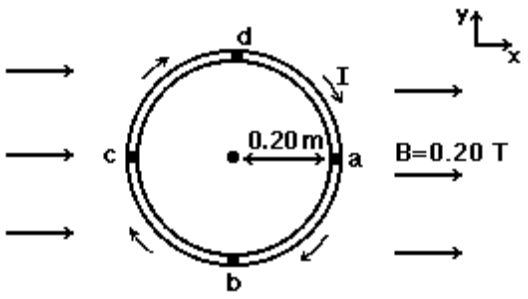
A) $-12{,}500\,\hat{j} + 27{,}000\,\hat{k}$ m/s2
B) $12{,}500\,\hat{j} + 27{,}000\,\hat{k}$ m/s2
C) $39{,}500\,\hat{k}$ m/s2
D) $14{,}500\,\hat{k}$ m/s2

4) A long straight wire has a constant current flowing to the right. A rectangular ring is situated above the wire, and also has a constant current flowing through it (as shown below). Which of the following statements is true?



A) The net magnetic force on the ring is zero, and the net torque is zero.
B) The net magnetic force on the ring is upward, and there is also a net torque on the ring.
C) The net magnetic force on the ring is downward, and there is also a net torque on the ring.
D) The net magnetic force on the ring is zero, but there is a net torque on the ring.
E) The net magnetic force on the ring is downward, and the net torque is zero.

5) A rigid circular loop has a radius of 0.20 m and is in the x–y plane. A clockwise current I is carried by the loop, as shown.



The magnitude of the magnetic moment of the loop is 0.75 A • m^2. A uniform external magnetic field, B = 0.20 T in the positive x–direction, is present. The loop is released from rest. The initial motion of the loop is described by:

A) points a, b, c, and d, move counterclockwise

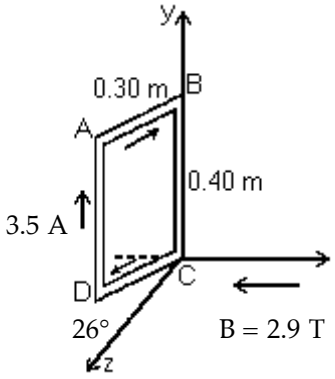
B) point a moves out of the plane; point c moves into the plane

C) point b moves out of the plane; point d moves into the plane

D) points a, b, c, and d move clockwise

E) point c moves out of the plane; point a moves into the plane

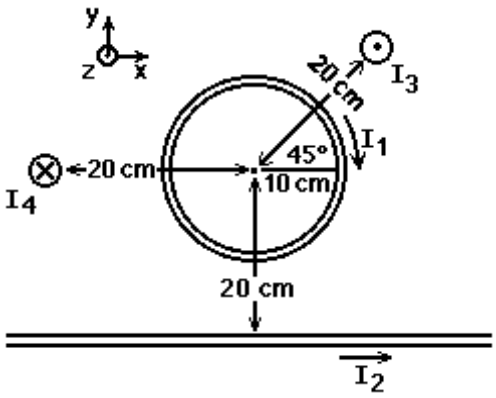
6)



A rigid rectangular loop, which measures 0.30 m by 0.40 m, carries a current of 3.5 A, as shown. A uniform external magnetic field of magnitude 2.9 T in the negative x–direction is present. Segment CD is in the x–z plane and forms a 26° angle with the z–axis, as shown. The y–component of the magnetic force on segment AB is closest to:

A) +2.7 N B) –2.7 N C) –1.3 N D) zero E) +1.3 N

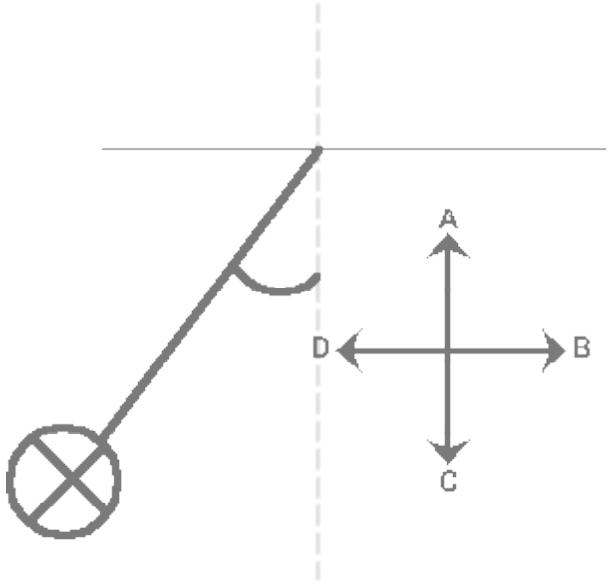
7) A circular loop of radius 10 cm and three long straight wires carry currents of I_1 = 80 A, I_2 = 40 A, I_3 = 30 A, and I_4 = 60 A, respectively, as shown.



Each straight wire is 20 cm from the center of the loop. In Figure 28.1, the z-component of the resultant magnetic field at the center of the loop is closest to:

A) −210 μT B) +460 μT C) −40 μT D) −460 μT E) +40 μT

8) A horizontal, long current-carrying rigid wire is hanging from a vertical thread. The current is oriented into the plane of the figure shown below. A uniform magnetic field is applied and the wire is pulled away from the vertical. Which of the arrows labeled A to D correctly indicate the direction of the magnetic field?



A) A
B) B
C) C
D) D
E) The magnetic field is oriented into the plane of the picture.

Answer Key
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1) E
2) C
3) C
4) E
5) B
6) A
7) D
8) C

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