This print-out should have 13 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

**Electron in a Field 03**  
001 (part 1 of 3) 10.0 points

The magnetic field over a certain range is given by \( \vec{B} = B_x \hat{i} + B_y \hat{j} \), where \( B_x = 4 \) T and \( B_y = 8 \) T. An electron moves into the field with a velocity \( \vec{v} = v_x \hat{i} + v_y \hat{j} + v_z \hat{k} \), where \( v_x = 6 \) m/s, \( v_y = 8 \) m/s and \( v_z = 6 \) m/s.

The charge on the electron is \(-1.602 \times 10^{-19}\) C.

What is the \( \hat{i} \) component of the force exerted on the electron by the magnetic field?

Correct answer: \( 7.6896 \times 10^{-18} \) N.

002 (part 2 of 3) 10.0 points

What is the \( \hat{j} \) component of the force?

Correct answer: \(-3.8448 \times 10^{-18}\) N.

003 (part 3 of 3) 10.0 points

What is the \( \hat{k} \) component of the force?

Correct answer: \(-2.5632 \times 10^{-18}\) N.

**Particle Deflection 01**  
004 10.0 points

A positively charged particle moving parallel to the \( z \)-axis enters a magnetic field (pointing into of the page), as shown in the figure below.

\[ \vec{F} = \frac{1}{\sqrt{2}} \left( -\hat{k} + \hat{i} \right) \]

1. \( \hat{F} = +\hat{k} \)
2. \( \hat{F} = -\hat{j} \)
3. \( \hat{F} = 0 \); no deflection
4. \( \hat{F} = +\hat{i} \) correct
5. \( \hat{F} = +\hat{j} \)
6. \( \hat{F} = -\hat{k} \)
7. \( \hat{F} = -\hat{i} \)

**Particle Deflection 02**  
005 10.0 points

A negatively charged particle moving at 45° angles to both the \( x \)-axis and \( y \)-axis enters a magnetic field (pointing out of of the page), as shown in the figure below.

\[ \vec{F} = \frac{1}{\sqrt{2}} \left( -\hat{j} + \hat{i} \right) \]

1. \( \hat{F} = \frac{1}{\sqrt{2}} \left( -\hat{k} - \hat{i} \right) \)
2. \( \hat{F} = \frac{1}{\sqrt{2}} \left( -\hat{k} + \hat{i} \right) \)
3. \( \hat{F} = 0 \); no deflection
4. \( \hat{F} = \frac{1}{\sqrt{2}} \left( -\hat{j} + \hat{i} \right) \)
5. \( \hat{F} = \frac{1}{\sqrt{2}} \left( -\hat{j} - \hat{i} \right) \) correct
6. \( \hat{F} = \frac{1}{\sqrt{2}} (\hat{j} + \hat{k}) \)
7. \( \hat{F} = \frac{1}{\sqrt{2}} (\hat{k} + \hat{i}) \)
8. \( \hat{F} = \frac{1}{\sqrt{2}} (-\hat{j} + \hat{k}) \)
9. \( \hat{F} = \frac{1}{\sqrt{2}} (\hat{j} + \hat{i}) \)
10. \( \hat{F} = \frac{1}{\sqrt{2}} (-\hat{j} - \hat{k}) \)

**Electron in a Magnetic Field 006 10.0 points**

An electron in a vacuum is first accelerated by a voltage of 61500 V and then enters a region in which there is a uniform magnetic field of 0.116 T at right angles to the direction of the electron’s motion.

The mass of the electron is \( 9.11 \times 10^{-31} \) kg and its charge is \( 1.60218 \times 10^{-19} \) C.

What is the magnitude of the force on the electron due to the magnetic field?

Correct answer: \( \boxed{1.77 \text{ N}} \).

**Alpha Particle 02 007 (part 1 of 3) 10.0 points**

An alpha particle has a mass of \( 7.34 \times 10^{-27} \) kg and bears a double elementary positive charge. Such a particle is observed to move through a 4.4 T magnetic field along a circular path of radius 0.16 m.

The charge on a proton is \( 1.60218 \times 10^{-19} \) C. What speed does it have?

Correct answer: \( 3.07339 \times 10^7 \) m/s.

**008 (part 2 of 3) 10.0 points**

What is its kinetic energy?

Correct answer: \( 3.46657 \times 10^{-12} \) J.

**009 (part 3 of 3) 10.0 points**

What potential difference in MV would be required to give it this kinetic energy?

Correct answer: 10.8183 MV.

**Suspended Rectangular Loop 02 010 10.0 points**

A rectangular loop with dimensions (horizontal = 0.058 m) \times (vertical= 0.1334 m), is suspended by a string, and the lower horizontal section of the loop is immersed in a magnetic field.

If a current of 5 A is maintained in the loop, what is the magnitude of the magnetic field required to produce a tension of 0.077 N in the supporting string? Assume: Gravitational force is negligible.

Correct answer: \( \boxed{2.0 \text{ T}} \).

**Serway CP 19 27 011 10.0 points**

A 3.09012 \( \mu \text{C} \) charged particle with a kinetic energy of 0.116916 J is placed in a uniform magnetic field of magnitude 0.0557942 T.

If the particle moves in a circular path of radius 3.42511 m, find its mass.

Correct answer: \( \boxed{1.6 \times 10^{-10} \text{ kg}} \).

**AP B 1993 FR 3 v1 012 (part 1 of 2) 10.0 points**

A particle of mass \( 4.316 \times 10^{-26} \) kg and charge of \( 4.8 \times 10^{-10} \) C is accelerated from rest in the plane of the page through a potential difference of 308 V between two parallel plates as shown. The particle is injected through a hole in the right-hand plate into a region of space containing a uniform magnetic field of magnitude 0.0792 T. The particle curves in a semicircular path and strikes a detector.
Which way does the magnetic field point?

1. toward the upper right corner of the page
2. toward the upper left corner of the page
3. out of the page **correct**
4. to the left
5. toward the lower right corner of the page
6. toward the top of the page
7. to the right
8. into the page
9. toward the lower left corner of the page
10. toward the bottom of the page

**013 (part 2 of 2) 10.0 points**
What is the magnitude of the force exerted on the charged particle as it enters the region of the magnetic field $\vec{B}$?

Correct answer: $3.14656 \times 10^{-15}$ N.