PH 122: Assignment #5 Magnetic Fields

Details
This assignment will be due in class on Wednesday, March 12.
- When you answer questions, please show your reasoning.
- When you answer multiple-choice questions, please show all of your work.
- Please answer problems in three steps, “Prepare”, “Solve” and “Assess”

Problems
Chapter 24: Magnetic Fields and Forces
Topic #1: Sources of the Magnetic Field
Questions: 4, 10
Problems: 12, 14, 16

Topic #2: Forces on Charges and Currents
Questions: 21, 23
Problems: 26, 30, 44, 52
Passage Problem (solve as one problem): 59-62

Topic #3: Magnets & Magnetic Materials
Questions: 28
Problems: 43

Past Exam Problem
Separation Anxiety
Uranium has three stable isotopes. Over 99% of naturally occurring uranium is $^{238}\text{U}$, about 0.7% is $^{235}\text{U}$, and a very small amount is $^{234}\text{U}$. During WWII, there was a tremendous push to separate out the $^{235}\text{U}$ for use in nuclear weapons. Much of the uranium was produced in a scaled up version of a mass spectrometer. Samples of uranium were ionized by removing one electron. The ions were accelerated to a uniform speed, then were sent into a region of uniform 0.25 T field where they followed semicircular paths of varying radius.

1) There are three beams noted in the diagram above, labeled 1, 2 and 3. In order, beams 1, 2 and 3 correspond to what isotopes?
A. $^{238}\text{U}$, $^{235}\text{U}$, $^{234}\text{U}$
B. $^{234}\text{U}$, $^{235}\text{U}$, $^{238}\text{U}$
C. $^{235}\text{U}$, $^{234}\text{U}$, $^{238}\text{U}$
D. $^{238}\text{U}$, $^{234}\text{U}$, $^{235}\text{U}$

2) A single atom of $^{235}\text{U}$ has a mass of approximately 235 u. To what approximate speed should the $^{235}\text{U}$ ions be accelerated to land in the collector after traversing the 0.25 T field region?
A. 125,000 m/s
B. 150,000 m/s
C. 175,000 m/s
D. 200,000 m/s

Grading
We will grade 2 items.
If we grade a question, we'll give it 0, 1 or 2 points. We’ll assign points as follows:
2 = essentially all correct; 1 = partially correct; 0 = mostly incorrect.
If we grade a problem, we'll give it 0, 1 or 2 points. We'll give 1 point for “Prepare” and 1 point for “Solve”. The “Assess” step will work as a fail safe. If you didn't get the solution quite right but your “Assess” step was thoughtful and well reasoned, you can still get the full 2 points.
We'll assign 1 “Completeness Point” - with “Completeness” broadly interpreted. You need to make a serious effort on all the problems, do legible and complete work throughout, and staple your pages together.

Additional Practice
If you want additional practice, you can try the following problems:
Chapter 24:
Problems: 11, 13, 25, 31, 35, 49