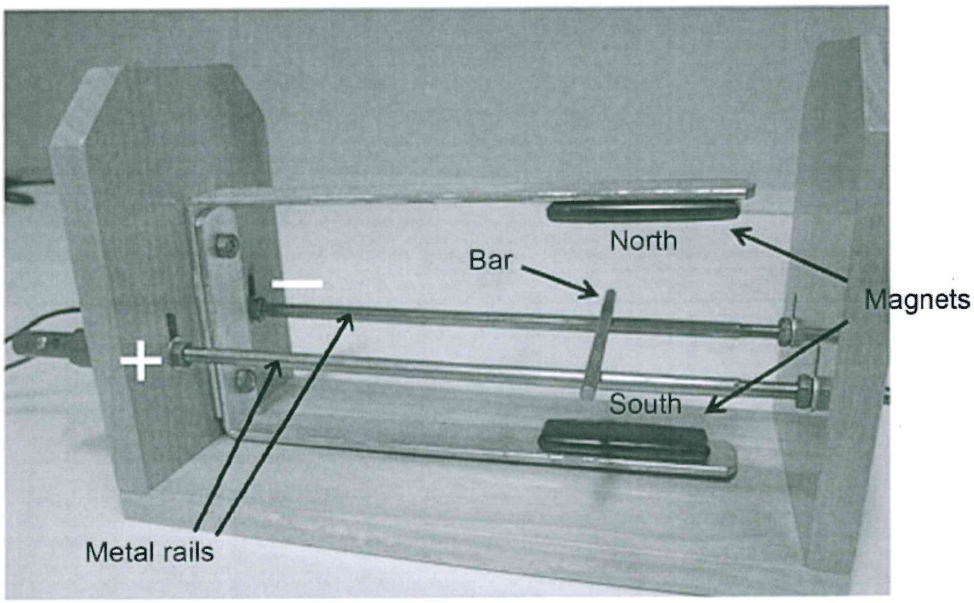
Exam Questions
Chapter 4.1 - Magnetic Fields
Question 1 2011:2:16

(10 marks)

An apparatus that demonstrates the interactions between a current and a magnetic field is shown below. There are two metal rails on which a metal bar is free to roll. Contact between the rails and bar allows a current to flow through them from the power pack attached to the metal rails. Two magnets provide a uniform magnetic field around the bar.



(a) Draw the magnetic fields associated with the following situations. (4 marks)

The bar carrying current into the page	The current carrying bar in a uniform magnetic field
⊗	north ⊗ south

(b) The rails are 8.50 cm apart and the magnetic field strength due to the magnets is $B = 1.50 \times 10^{-3}$ T.

Calculate the magnitude of the force acting on the bar when an electric current of 5.00 A is passed through the bar.

Draw and label on the photograph on page 18 the direction of the force and current. (4 marks)

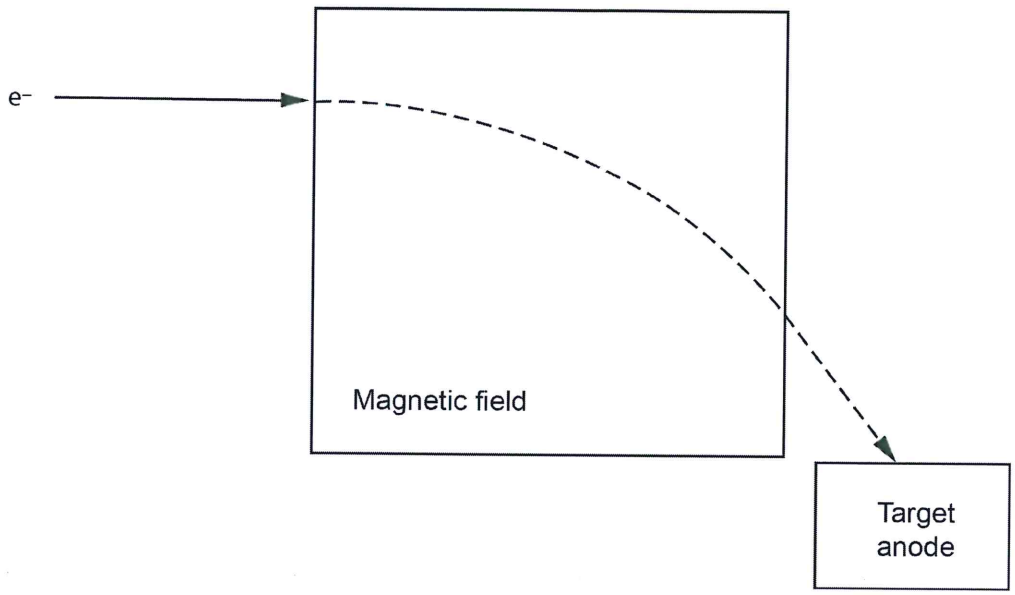
(c) The apparatus in the photograph is then tilted at a small angle to the horizontal by lifting the left side when the current is flowing. The bar rolls toward the right-hand side, away from where the power supply is connected, due to the effects of gravity acting on the bar.

Describe two changes that could be made, either to the circuit or apparatus, to enable the force due to the current's interaction with the magnetic field to hold the bar stationary. (2 marks)

Exam Questions
Chapter 4.1 - Magnetic Fields
Question 2 2013:2:18

(14 marks)

An electron moving at 0.9c enters a region of space and follows a path that has a constant radius of 0.348 m while in the magnetic field shown on the diagram, before striking a target anode.



(a) Draw the magnetic field enclosed in the indicated space. (2 marks)

(b) (i) Derive the formula $B = \frac{mv}{qr}$. (2 marks)

(ii) Use this formula to calculate the field strength needed to direct an electron along this path. Include units in your answer. (4 marks)

(iii) Describe how each of the changes below affect the charged particle's path in the magnetic field. (4 marks)

Property changed	Effect on radius of the path
Particle's charge is reversed	
Particle's charge is increased	
Particle's velocity is increased	
Magnetic field is increased	

(c) Relativistic effects were not considered when calculating the electron's path. Outline briefly the effects that special relativity predicts about the radius of the electron's motion. (2 marks)