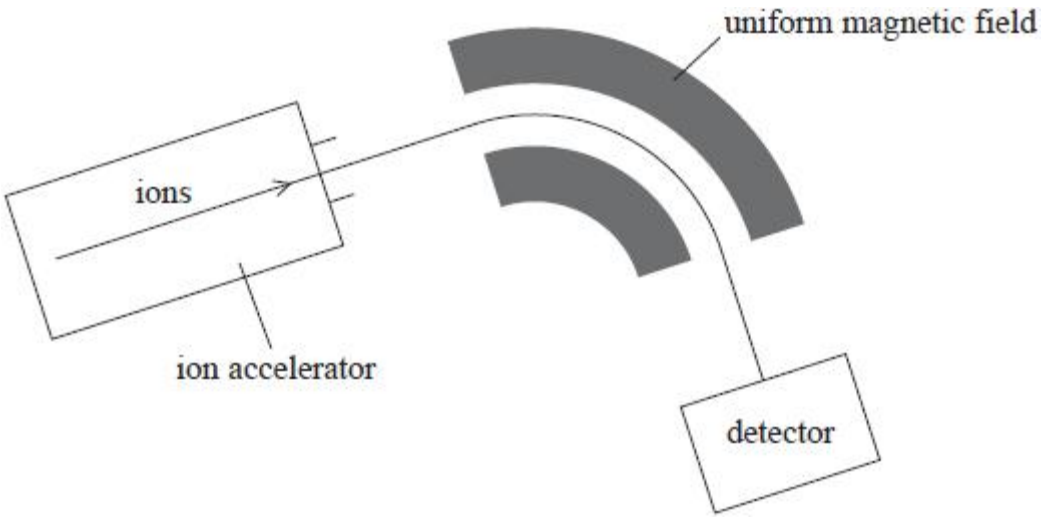
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Student:_____
Max. Marks : 17 Marks **Time : 17 Minutes**

Q1.

Mass spectrometry is a technique used to separate ions based on their charge to mass ratio.

The atoms in a sample are ionised and then accelerated and formed into a fine beam.
This beam is passed into a region of uniform magnetic field and the ions are deflected by different amounts according to their mass.



Analysis of mass spectrometer data shows that chlorine exists in nature as two isotopes, chlorine-35 and chlorine-37.

After passing through the velocity selector the ion beam enters a region of uniform magnetic flux density 0.35 T with the ions travelling at right angles to the field direction.

(i) Explain why the ions travel in a circular path.

(2)

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(ii) Calculate the radius of the circular path.

(2)

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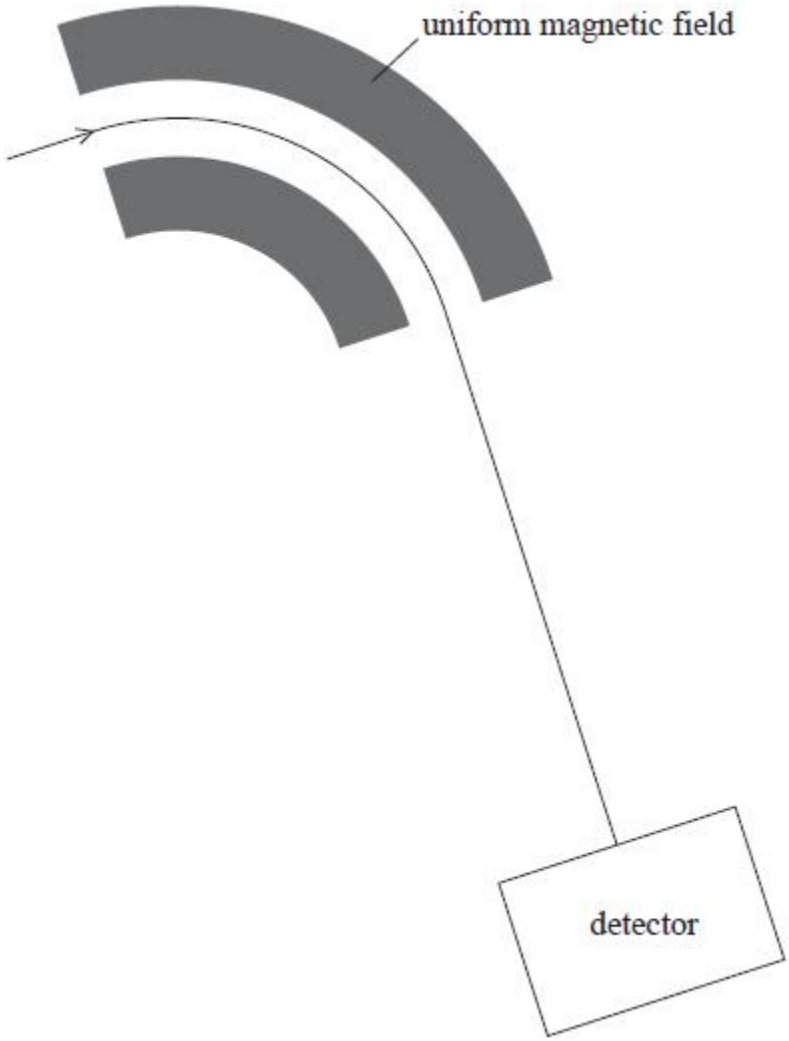
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Radius = ...

(iii) The diagram shows the path of the chlorine-35 ions in the field. Chlorine-37 ions enter the magnetic field with the same velocity.



1. Add another line to the diagram to show the path of these chlorine-37 ions.

(1)

2. Explain any differences in the paths.

(2)

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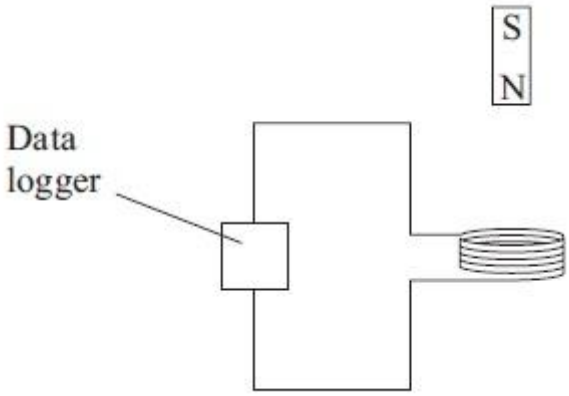
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(Total for question = 7 marks)

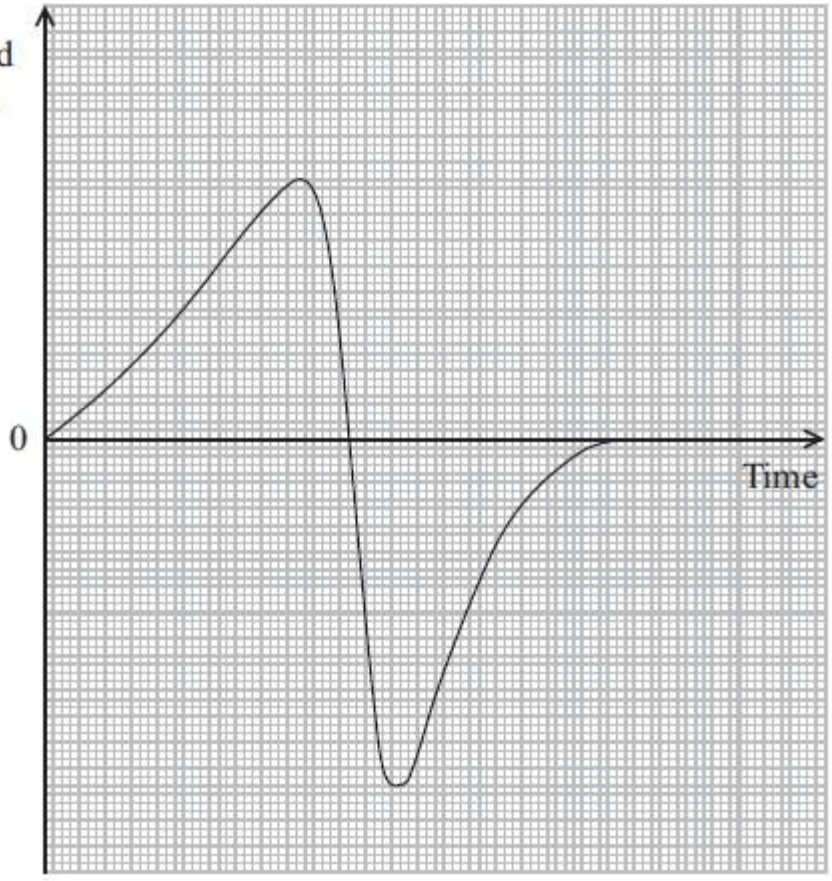
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Q2.

A teacher demonstrates electromagnetic induction by dropping a bar magnet through a flat coil of wire connected to a data logger.



The data from the data logger is used to produce a graph of induced e.m.f. across the coil against time.



*(a) Explain the shape of the graph and the relative values on both axes.

(6)

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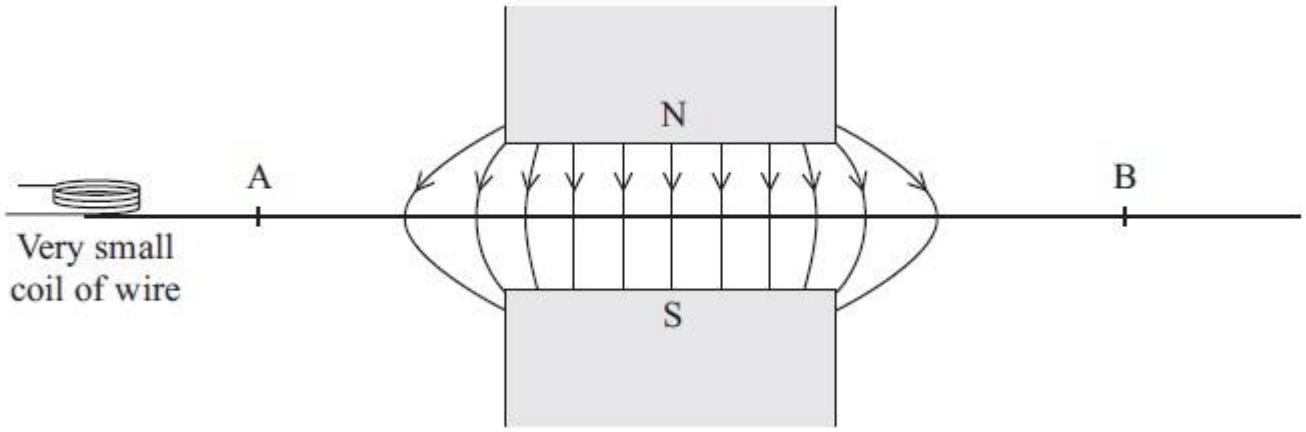
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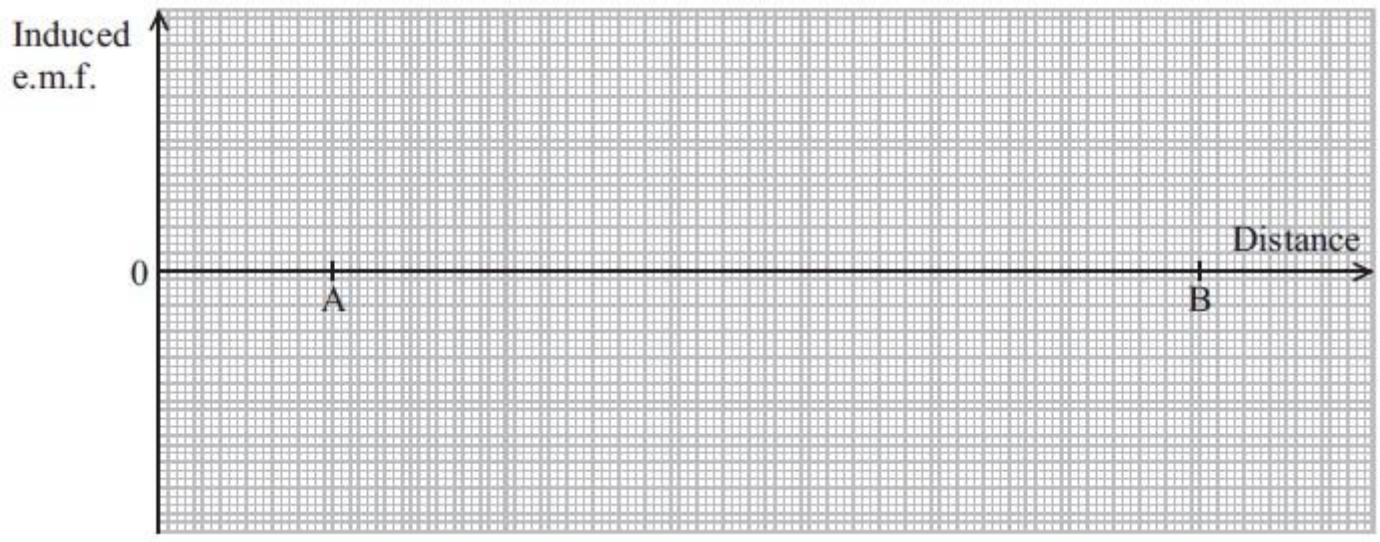
*(b) The teacher then sets up another demonstration using a large U-shaped magnet and a very small coil of wire which is again connected to a data logger.

The north pole is vertically above the south pole and the coil is moved along the line AB which is midway between the poles. The magnetic field due to the U-shaped magnet has been drawn. The plane of the coil is horizontal.



Sketch a graph to show how the e.m.f. induced across the coil varies as the coil moves from A to B at a constant speed.

(4)



(Total for question = 10 marks)

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