Practice Question Set For A-Level
**Subject : Physics**
**Paper-1 Topic : 7_ Magnetic Field 1**
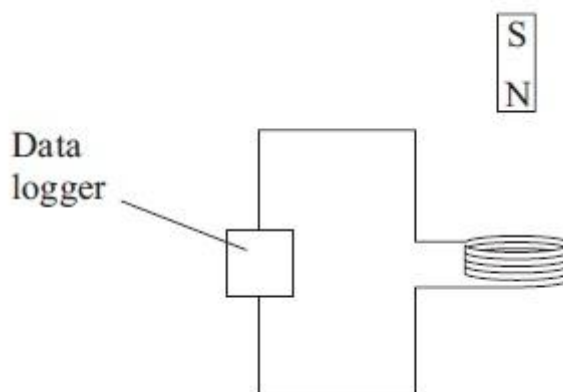
**Student**:_____

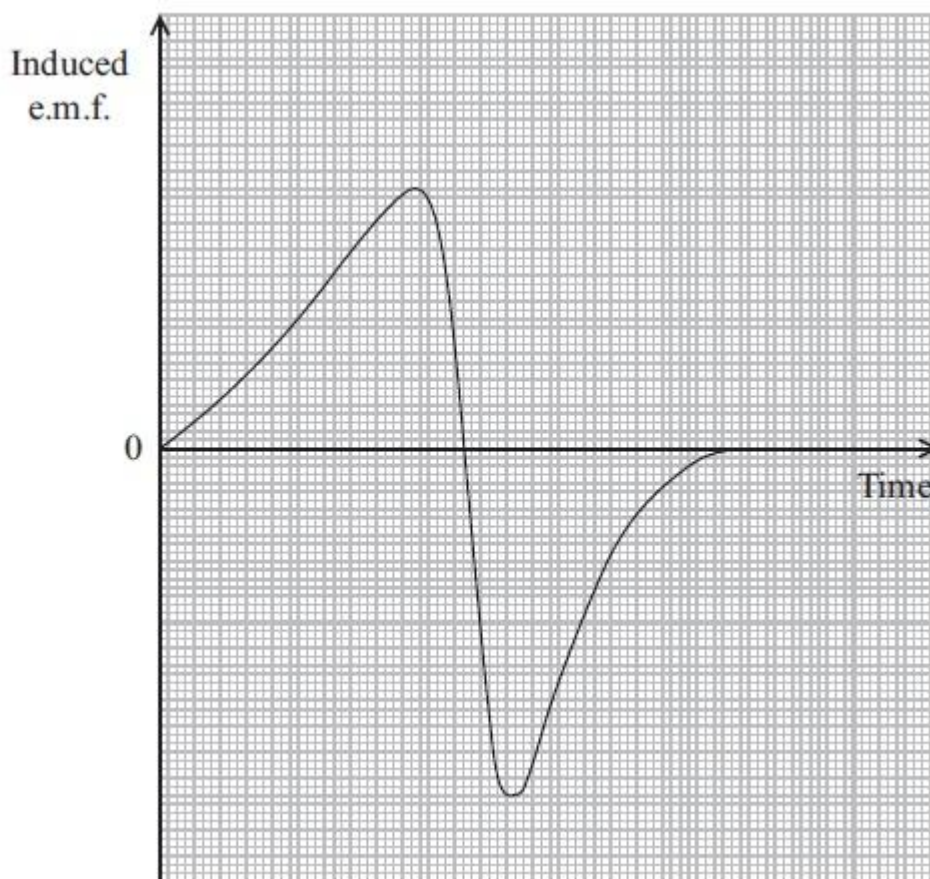**Max. Marks : 22 Marks**                                           **Time : 22 Minutes**

**Q1.**

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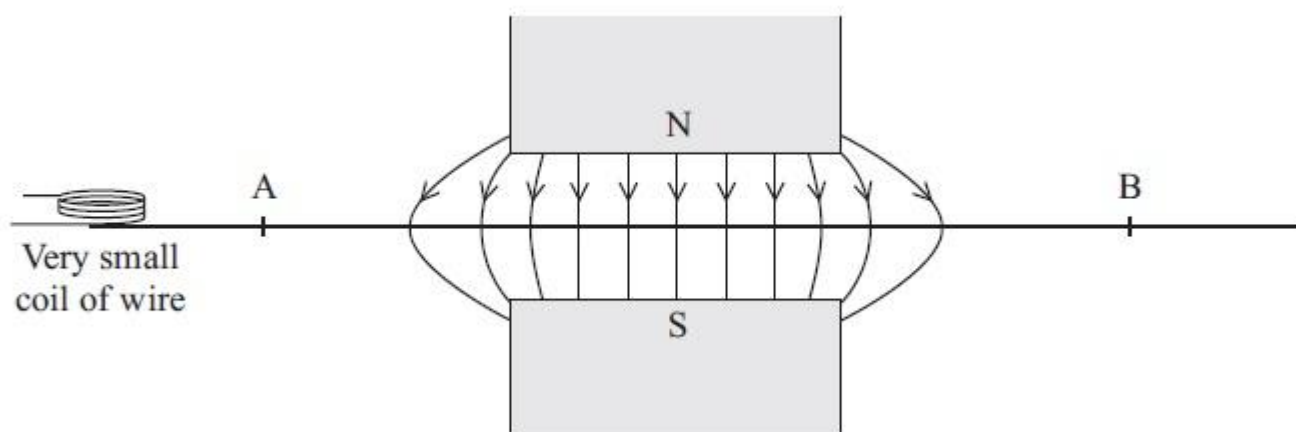


The data from the data logger is used to produce a graph of induced e.m.f. across the coil against time.
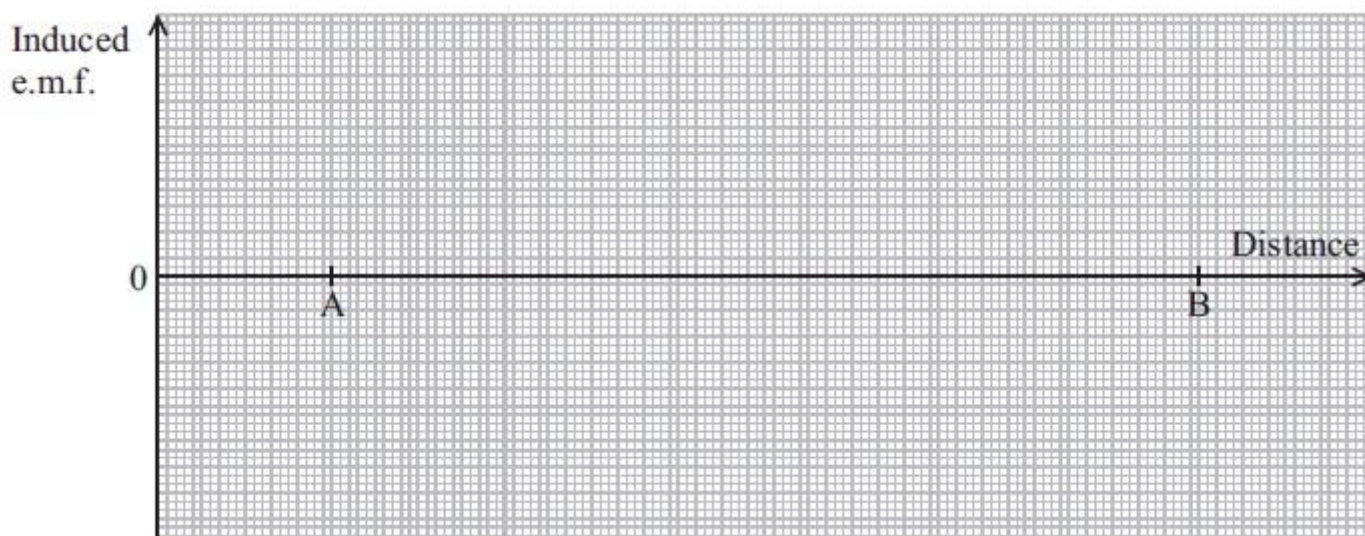


*(a) Explain the shape of the graph and the relative values on both axes.

....................................................................................................................

....................................................................................................................

....................................................................................................................

....................................................................................................................

....................................................................................................................

....................................................................................................................

....................................................................................................................

....................................................................................................................

....................................................................................................................

....................................................................................................................

....................................................................................................................

....................................................................................................................

*(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)**

**Q2.**

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.
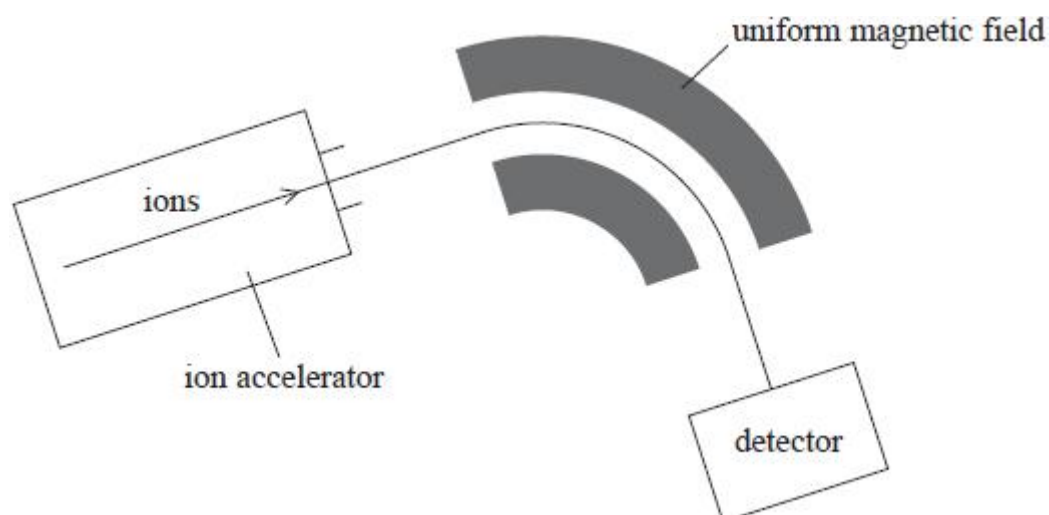


Analysis of mass spectrometer data shows that chlorine exists in nature as two isotopes, chlorine-35 and chlorine-37.

In most mass spectrometers the ions are passed through a velocity selector, after being accelerated, to produce a beam of ions of a particular velocity.
The velocity selector consists of a pair of parallel plates, across which a potential difference (p.d.) is applied to create an electric field.

+V

0V
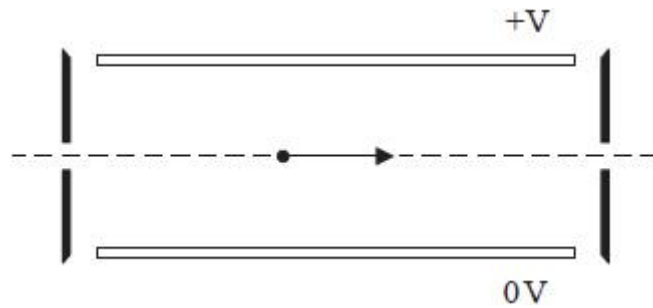
In one mass spectrometer the plates are 2.5 cm apart and a p.d. of 135 V is applied.

A magnetic field is also applied to produce a force on the ions in the opposite direction to the force from the electric field. For one particular speed the ions travel in a straight line and emerge from the selector.

(i) Add to the diagram to indicate the directions of the electric field and the magnetic field.

(2)

(ii) The magnetic flux density applied to the velocity selector is 24.5 mT.

Deduce whether this magnetic flux density is suitable to produce a beam of chlorine-35 ions of speed 2.2 × $10^5$ m s$^{-1}$.

(4)

...................................................................................................................................

...................................................................................................................................

...................................................................................................................................

...................................................................................................................................

...................................................................................................................................

...................................................................................................................................
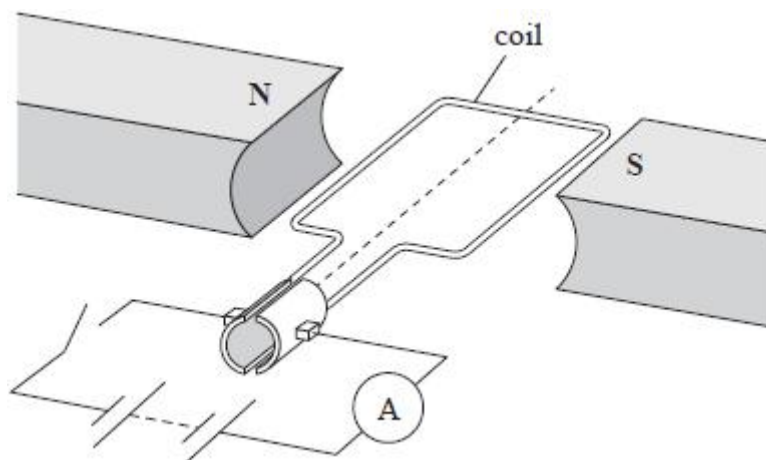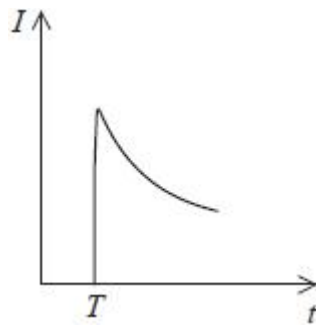
**(Total for question = 6 marks)**

**Q3.**

\* A simple electric motor consists of a coil that is free to rotate in a magnetic field.

A student connects the motor to an ammeter and a battery.



The graph shows how the current I in the coil varies with time t. The switch is closed at time T.

Explain why the current rises to a maximum then decreases.
Your answer should include a reference to Faraday and Lenz's laws.

(6)

..........................................................................................................................................

..........................................................................................................................................

..........................................................................................................................................

..........................................................................................................................................

..........................................................................................................................................

..........................................................................................................................................

..........................................................................................................................................

..........................................................................................................................................

..........................................................................................................................................

..........................................................................................................................................

..........................................................................................................................................

..........................................................................................................................................

..........................................................................................................................................

..........................................................................................................................................

**(Total for question = 6 marks)**