OCR
Oxford Cambridge and RSA

# A Level Physics A

**H556/02** Exploring physics

# Question Set 27

**1** Fig. 20 illustrates a device used to determine the relative abundance of charged rubidium ions.

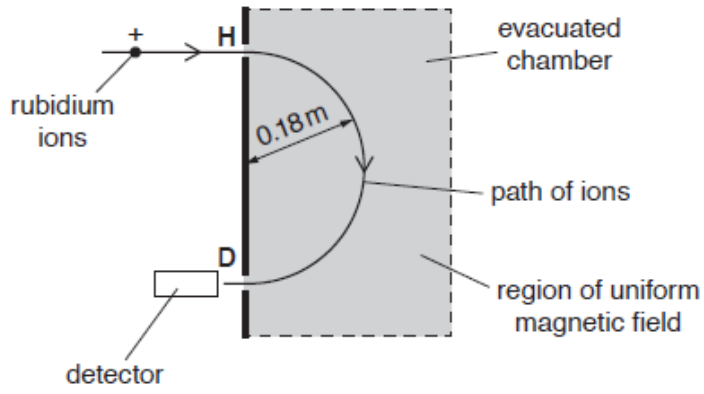


**Fig. 20**

A uniform magnetic field is applied to an evacuated chamber. The direction of the magnetic field is perpendicular to the plane of the paper.

A beam of positive rubidium ions enters the chamber through a hole at **H**. The ions travel in a semi-circular path in the magnetic field. The ions are detected at point **D**.

**(a)** Each rubidium ion has charge $+1.6 \times 10^{-19}$ C and speed $4.8 \times 10^{4}\,m\,s^{-1}$.
The radius of the semi-circular path of the ions is 0.18 m.
The mass of a rubidium ion is $1.4 \times 10^{-25}$ kg.

Calculate the magnitude of the magnetic flux density $B$ of the magnetic field.

$B$ = ..... T **[3]**

**(b)**

The chemical composition of ancient rocks found on the Earth can be used to estimate the age of the Earth.
Nuclei of rubidium-87 ($^{87}_{37}Rb$) decay spontaneously into nuclei of strontium-87 ($^{87}_{38}Sr$).
The half-life of rubidium-87 is 49 billion years.

**(i)** Name the two leptons emitted in the decay of a rubidium-87 nucleus.

1. .....

2. .....

**[1]**

**(ii)** The percentage of rubidium **left** in a sample of an ancient rock is 95%.

Estimate the age of the Earth in billion years.

age = ..... billion years **[3]**

## Total Marks for Question Set 27: 7