Name of the Student:_____

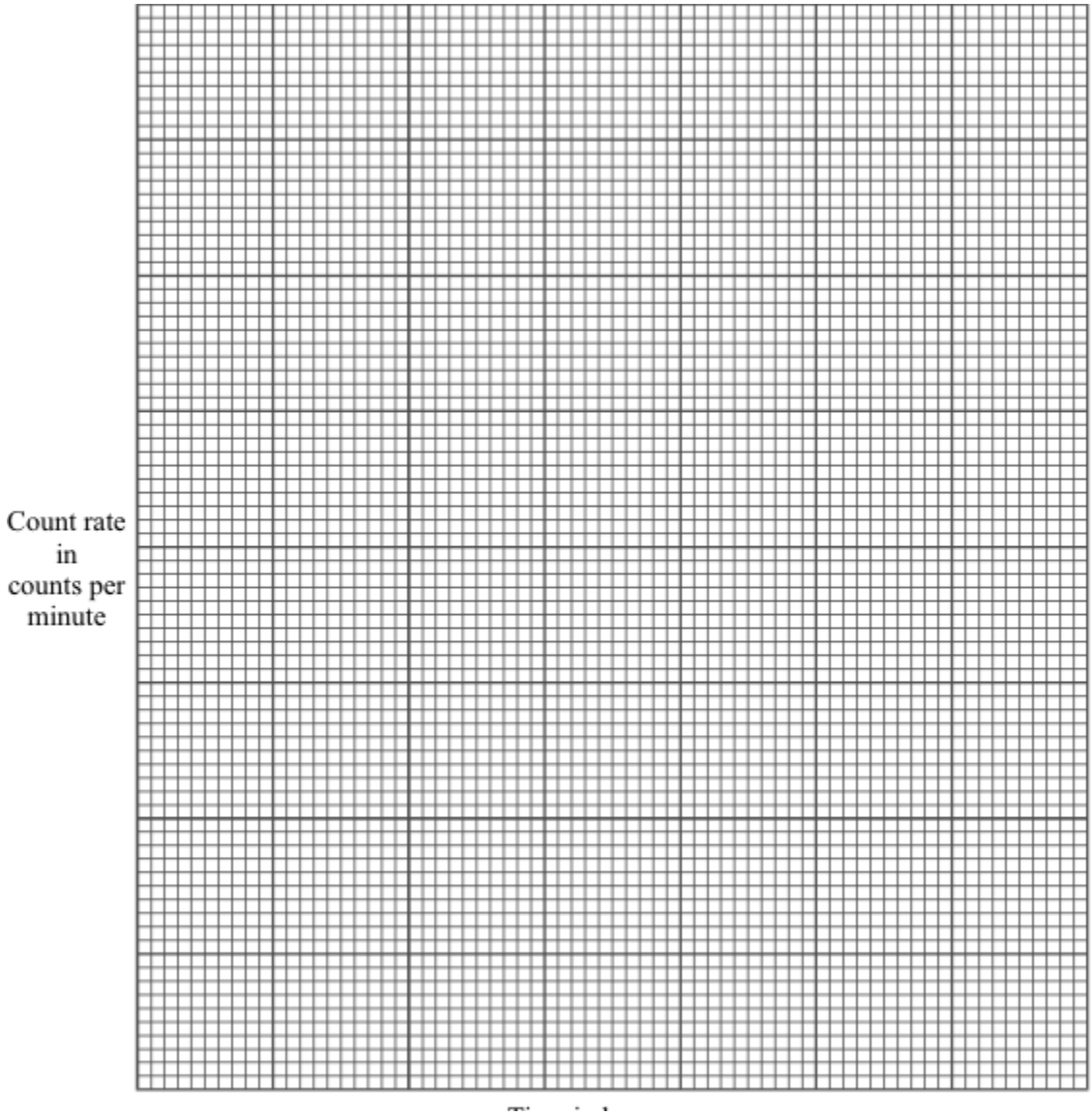
Max. Marks : 22 Marks **Time : 22 Minutes**

Q1.

The isotope of sodium with a mass number of 24 is radioactive. The following data were obtained in an experiment to find the half-life of sodium-24.

Time in hours	Count rate in counts per minute
0	1600
10	1000
20	600
30	400
40	300
50	150
60	100

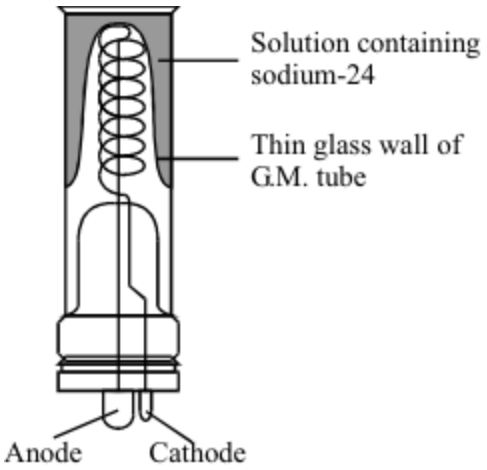
(a) Draw a graph of the results and find the half-life for the isotope. On the graph show how you obtain the half-life.



Half-life = _____ hours

(4)

(b) Sodium-24 decays by beta emission. The G.M. tube used in the experiment is shown in the diagram. Each beta particle which gets through the glass causes a tiny electric current to pass in the circuit connected to the counter.



(i) Why must the glass wall of the G.M. tube be very thin?

_____

_____

(1)

(ii) Why is this type of arrangement of no use if the radioactive decay is by alpha emission?

_____

_____

(1)

(c) Sodium chloride solution is known as saline. It is the liquid used in 'drips' for seriously-ill patients. Radioactive sodium chloride, containing the isotope sodium-24, can be used as a tracer to follow the movement of sodium ions through living organisms.

Give **one** advantage of using a sodium isotope with a half-life of a few hours compared to using an isotope with a half-life of:

(i) five years; _____

_____

(1)

(ii) five seconds. _____

_____

(1)

(Total 8 marks)

Q2.

(a) (i) Describe the structure of alpha particles.

_____

_____

_____

_____

(2)

(ii) What are beta particles?

_____

_____

_____

(1)

(b) Describe how beta radiation is produced by a radioactive isotope.

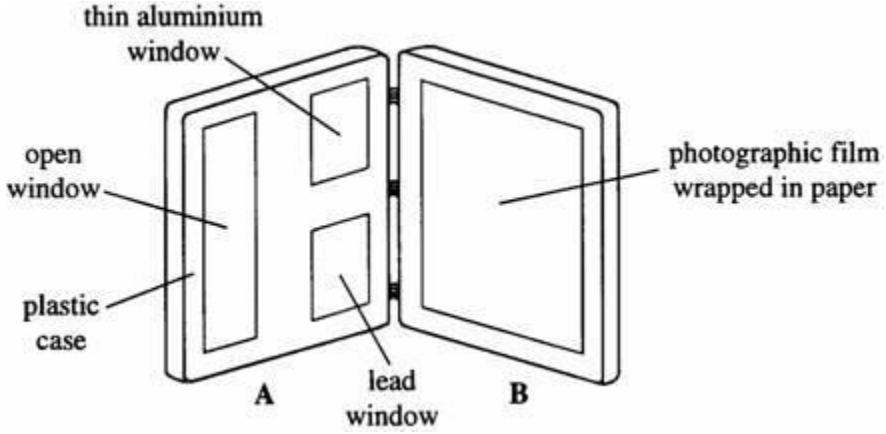
_____

(1)

(Total 4 marks)

Q3.

The diagram shows a film badge worn by people who work with radioactive materials. The badge has been opened. The badge is used to measure the amount of radiation to which the workers have been exposed.



(a) The detector is a piece of photographic film wrapped in paper inside part **B** of the badge. Part **A** has "windows" as shown.

Complete the sentences below.

When the badge is closed

(i) _____ radiation and _____ radiation can pass through the open window and affect the film.

(1)

(ii) Most of the _____ radiation will pass through the lead window and affect the film.

(1)

(b) Other detectors of radiation use a gas which is ionised by the radiation.

(i) Explain what is meant by *ionised*.

_____

_____

(1)

(ii) Write down **one** use of ionising radiation.

_____

(1)

(c) Uranium-238 has a very long half-life. It decays via a series of short-lived radioisotopes to produce the stable isotope lead-204.

Explain, in detail, what is meant by:

(i) *half-life*,

_____

_____

(1)

(ii) *radioisotopes*.

_____

_____

_____

_____

(2)

(d) The relative proportions of uranium-238 and lead-204 in a sample of igneous rock can be used to date the rock.
A rock sample contains three times as many lead atoms as uranium atoms.

(i) What fraction of the original uranium is left in the rock?

(Assume that there was no lead in the original rock.)

_____

_____

(1)

(ii) The half-life of uranium-238 is 4500 million years.

Calculate the age of the rock.

_____

_____

_____

Age _____ million years

(2)

(Total 10 marks)