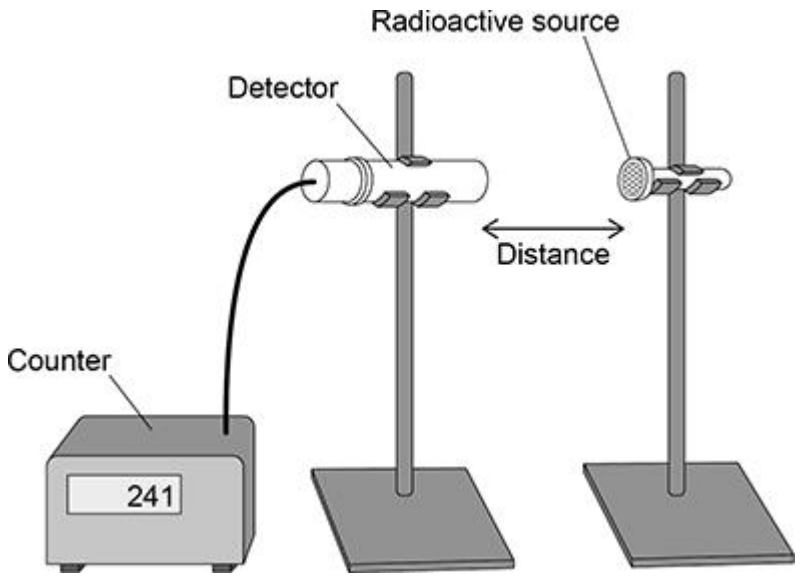
Questions are for separate science students only

Q1.

A teacher investigated the radiation emitted by two different radioactive sources, **A** and **B**.

Figure 1 shows a radiation detector positioned near one of the radioactive sources. **(Physics only)**

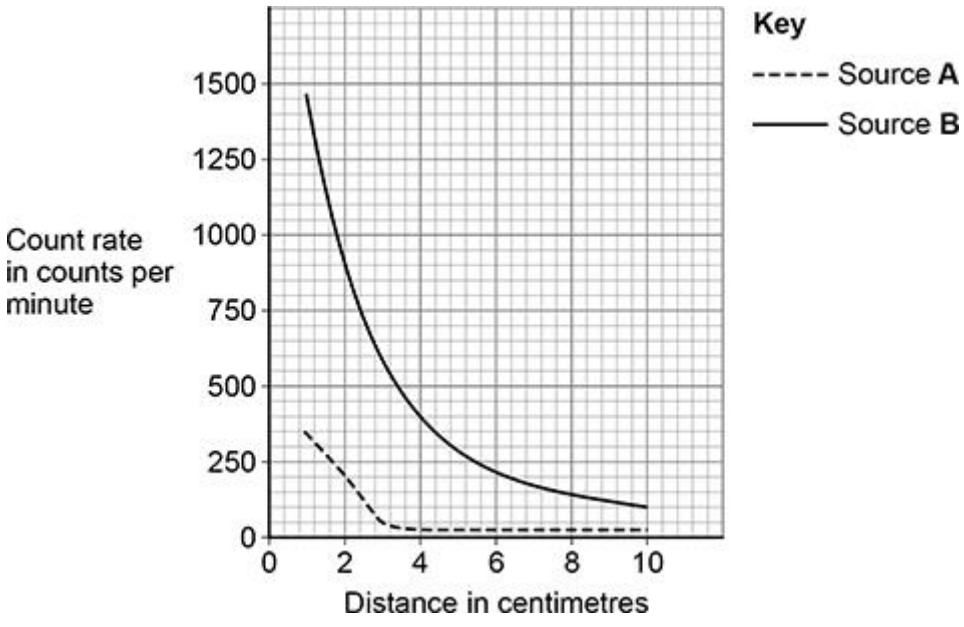
Figure 1



The teacher measured the count rate at different distances for each radioactive source.

Figure 2 shows the results.

Figure 2



(a) Explain how **Figure 2** shows that Source **A** only emits alpha radiation. **(HT only)**

(3)

(b) **Figure 2** can **not** be used to determine if Source **B** emits beta radiation or gamma radiation.

Explain how an absorbing material could be used to show which type of radiation is emitted by Source **B**. **(HT only)**

(2)

The teacher took safety precautions during the experiment.

(c) Suggest **one** safety precaution the teacher would have taken to reduce the radiation dose the teacher received.

(1)

(d) Suggest **one** safety precaution that the teacher would have taken to avoid becoming contaminated.

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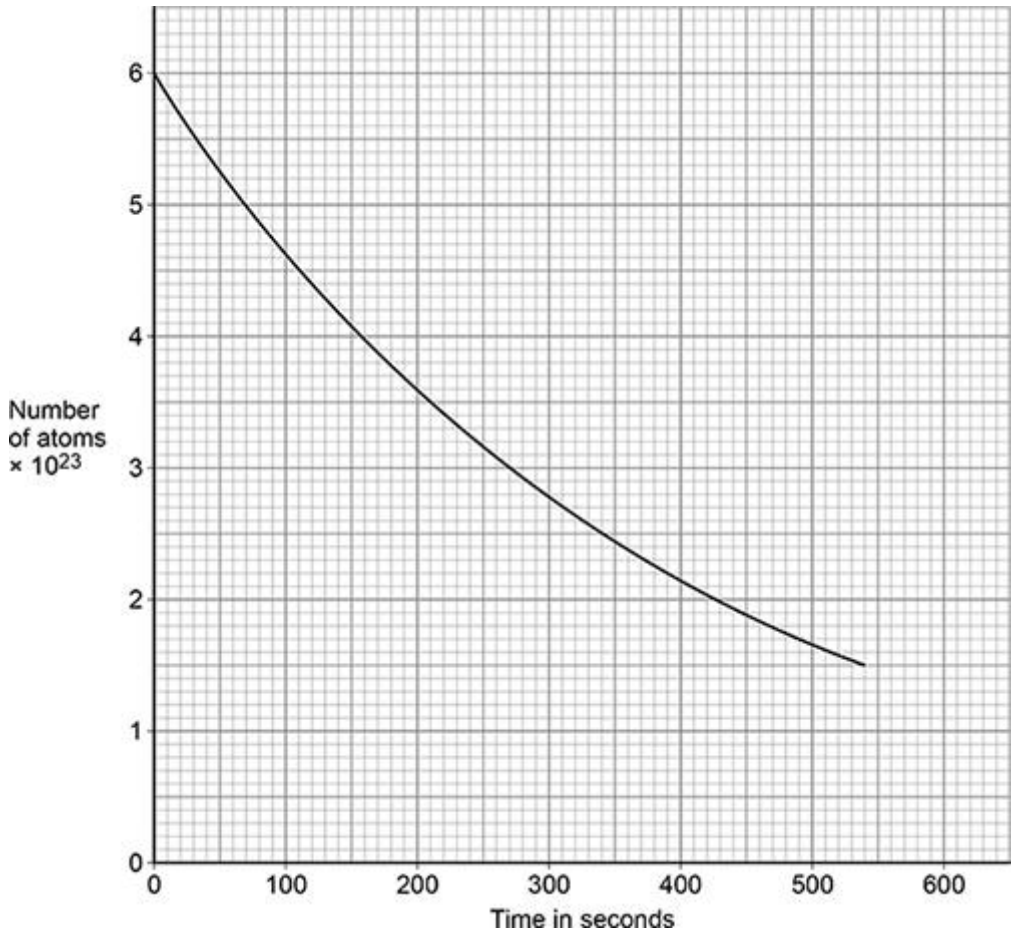
(1)

(e) **Figure 3** shows how the number of atoms of a radioactive element in a sample varied with time.

Figure 3



Activity is the rate at which a source of unstable nuclei decays.

Determine the activity of the radioactive sample at 300 seconds.

Give the unit.

_____

_____

_____

_____

Activity = _____ Unit _____

(4)

(Total 11 marks)

Q2.

(a) Carbon-14 is a radioactive isotope. **(Physics only)**

Carbon-14 has a half-life of 5700 years.

What does 'a half-life of 5700 years' mean?

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(1)

The table below gives the half-life of some other radioactive isotopes.

Isotope	Half-life in seconds
Nitrogen-18	0.62
Nitrogen-17	4.17
Fluorine-17	64.37
Fluorine-18	6584.34

(b) A sample of fluorine-17 has an activity that is one quarter of its original activity.

Calculate the age of the sample of fluorine-17. **(HT only)**

_____

_____

_____

Age = _____ s

(2)

(c) All of the isotopes in the table above emit beta radiation.

Explain which isotope would cause the biggest risk to a person's health based only on the half-life of each isotope. **(HT only)**

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_____

(3)

(d) People who work in the nuclear power industry need to be aware of irradiation and contamination.

Describe the difference between irradiation and contamination.

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_____

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_____

(2)

(e) Give **one** health risk to a person working close to a source of nuclear radiation.

_____

(1)

(f) Workers in nuclear power stations are monitored to check the radiation they emit.

A worker stands 1 cm away from a radiation detector.
The amount of radiation the worker emits is recorded.

Explain why the worker needs to stand close to the radiation detector.

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(2)

(g) Workers in the nuclear power industry are exposed to nuclear radiation.

Pilots on aircraft are exposed to cosmic radiation from space.

daily dose caused by working in a nuclear power station = 0.00050 mSv

hourly dose from cosmic rays to a pilot while flying = 0.0030 mSv

Calculate the number of days it takes for a nuclear power station worker to receive the same dose as a pilot flying for 24 hours.

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_____

_____

_____

_____

Number of days = _____

(3)

(Total 14 marks)