

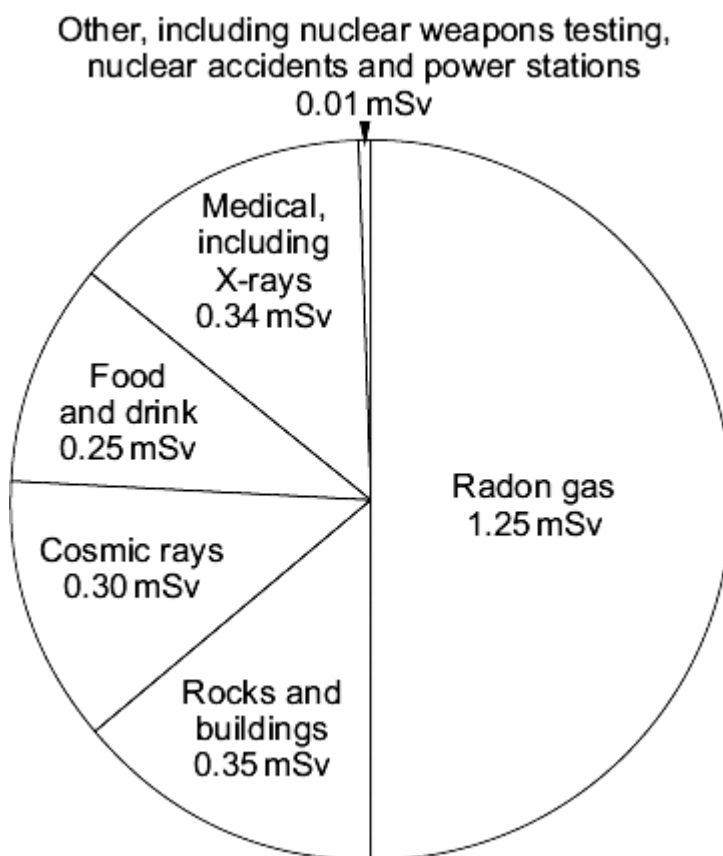
Name of the Student: _____

Max. Marks : 21 Marks

Time : 21 Minutes

Q1.

The pie chart shows the sources of the background radiation and the radiation doses that the average person in the UK is exposed to in one year.
Radiation dose is measured in millisieverts (mSv).



(a) (i) What is the total radiation dose that the average person in the UK receives?

Total radiation dose = _____ mSv

(1)

(ii) A student looked at the pie chart and then wrote down three statements.

Which **one** of the following statements is a correct conclusion from this data?

Put a tick (✓) in the box next to your answer.

In the future, more people will be exposed to a greater proportion of

radon gas.

People that have never had an X-ray get 50% of their radiation dose from

radon gas.

The radiation dose from natural sources is much greater than from artificial

sources.

(1)

- (b) The concentration of radon gas inside a home can vary from day to day. In some homes, the level can build up to produce a significant health risk. It is estimated that each year 1000 to 2000 people die because of the effects of radiation from radon gas.

- (i) It is not possible to give an exact figure for the number of deaths caused by the effects of radiation from radon gas. Why?

(1)

The table gives data for the radiation levels measured in homes in 4 different parts of the UK. The radiation levels were measured using two detectors, one in the living room and one in the bedroom. The measurements were taken over 3 months.

Area of the UK	Number of homes in the area	Number of homes in the sample	Average radiation level in Bq/m ³	Maximum radiation level in Bq/m ³
A	590 000	160	15	81
B	484 000	130	18	92
C	221 000	68 000	162	10 000
D	318 000	35 300	95	6 900

- (ii) Give **one** reason why the measurements were taken over 3 months using detectors in different rooms.

(1)

- (iii) Use information from the table to suggest why a much higher proportion of homes were sampled in areas **C** and **D** than in areas **A** and **B**.

(2)

(Total 6 marks)

Q2.

The table gives information about the three types of particle that make up an atom.

Particle	Relative mass	Relative charge
Proton		+1
Neutron	1	
Electron	very small	-1

- (a) Complete the table by adding the **two** missing values.

(2)

- (b) Use the information in the table to explain why an atom has no overall electrical charge.

(2)

- (c) Uranium has two natural isotopes, uranium-235 and uranium-238. Uranium-235 is used as a fuel inside a nuclear reactor. Inside the reactor, atoms of uranium-235 are split and energy is released.

- (i) How is the structure of an atom of uranium-235 different from the structure of an atom of uranium-238?

(1)

- (ii) The nucleus of a uranium-235 atom must absorb a particle before the atom is able to split.

What type of particle is absorbed?

(1)

(iii) The nucleus of an atom splits into smaller parts in a reactor.

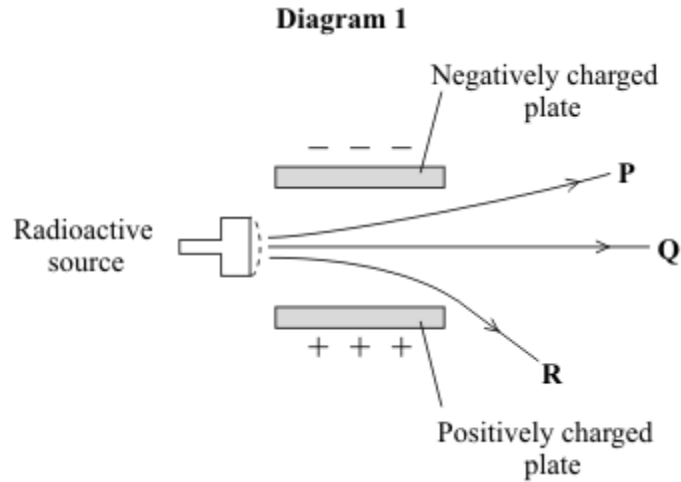
What name is given to this process?

(1)

(Total 7 marks)

Q3.

A radioactive source emits alpha (α), beta (β) and gamma (γ) radiation. The diagram shows what happens to the radiation as it passes between two charged metal plates.



(a) Which line **P**, **Q** or **R** shows the path taken by:

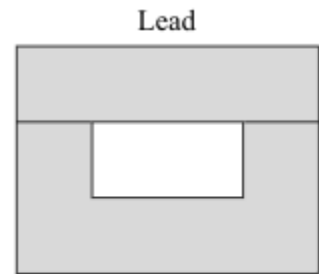
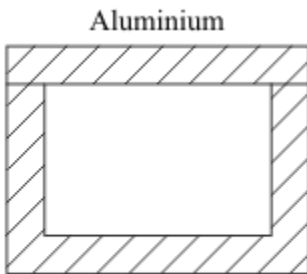
(i) alpha radiation _____

(1)

(ii) gamma radiation? _____

(1)

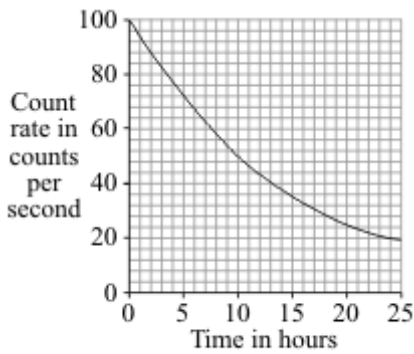
(b) The diagram shows three different boxes and three radioactive sources. Each source emits only one type of radiation and is stored in a different box. The box reduces the amount of radiation getting into the air.



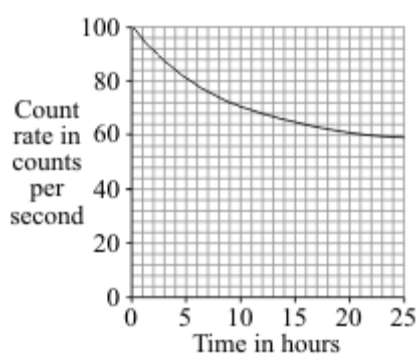
Draw **three** lines to show which source should be stored in which box so that the minimum amount of radiation gets into the air.

(2)

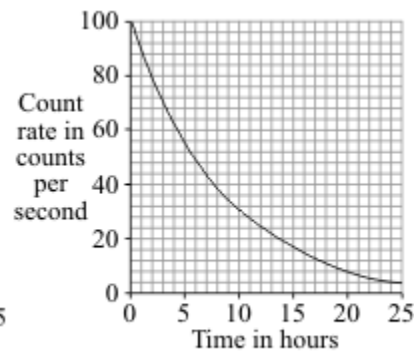
(c) The graphs show how the count rates from three different radioactive sources, **J**, **K**, and **L**, change with time.



J



K



L

(i) Which source, **J**, **K**, or **L**, has the highest count rate after 24 hours?

_____ (1)

(ii) For source **L**, what is the count rate after 5 hours?

_____ counts per second (1)

(iii) Which source, **J**, **K**, or **L**, has the longest half-life?

_____ (1)

(iv) A radioactive source has a half-life of 6 hours.

What might this source be used for?

Put a tick (✓) in the box next to your choice.

To monitor the thickness of paper as it is made in a factory

To inject into a person as a medical tracer

To make a smoke alarm work

(1)

(Total 8 marks)