Name of the Student:_____
Max. Marks : 21 Marks **Time : 21 Minutes**

Q1.

(a) The table gives information about the radioactive isotope, radon-222.

mass number	222
atomic number	86
radiation emitted	alpha particle

(i) Complete the following sentence.

The mass number is the total number of _____ and

_____ inside an atom.

(2)

(ii) Radon-222 is an isotope of radon.

How many protons are there in an atom of radon-222?

_____

(1)

(iii) When an atom of radon-222 emits an alpha particle, the radon-222 changes into an atom of polonium-218.

An alpha particle consists of 2 protons and 2 neutrons.

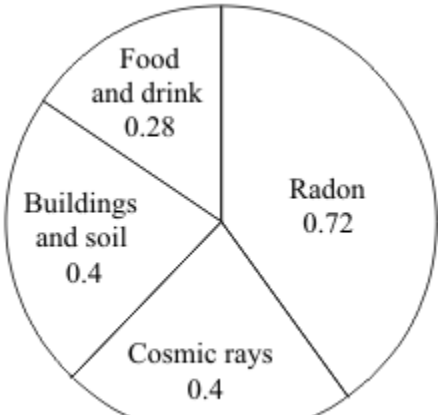
How is the structure of the nucleus of a polonium-218 atom different from the structure of the nucleus of a radon-222 atom?

_____

(1)

(b) The pie chart shows the average radiation dose that a person in the UK receives each year from natural background radiation.

The doses are measured in millisieverts (mSv).



(i) Calculate the proportion of natural background radiation that comes from radon. Show clearly how you work out your answer.

_____

_____

Proportion of radon = _____

(2)

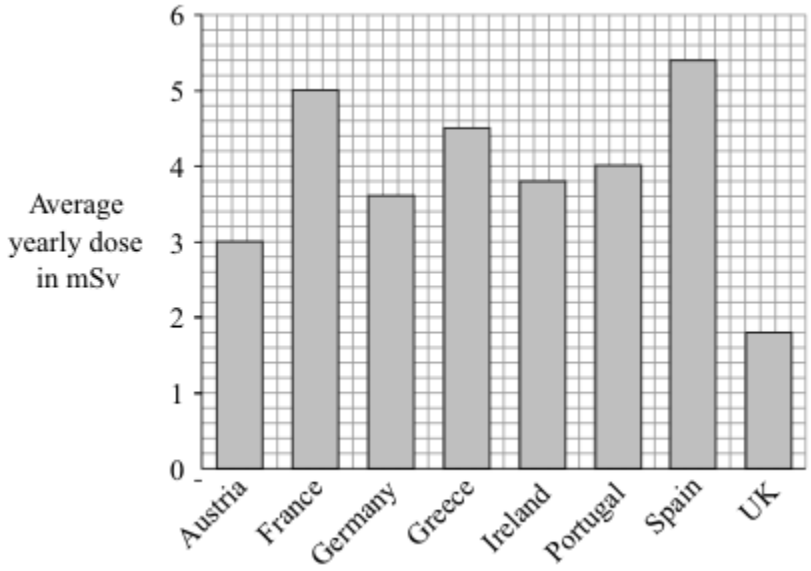
(ii) Not all background radiation is from natural sources.

Name **one** source of background radiation that is not natural.

_____

(1)

(c) The bar chart shows the average yearly dose from natural background radiation in different European countries.



(i) How many times bigger is the average annual background dose in Germany compared to the UK?

_____

(1)

(ii) The following table gives the effects of different radiation doses on the human body.

Radiation dose in mSv	Effects
10 000	Immediate illness; death within a few weeks
1 000	Radiation sickness; unlikely to cause death
50	Lowest dose with evidence of causing cancer

A family goes to Germany for a two-week holiday. Should they be concerned about the higher level of background radiation in Germany?

Draw a ring around your answer.

Yes **No**

Explain your answer.

_____

_____

_____

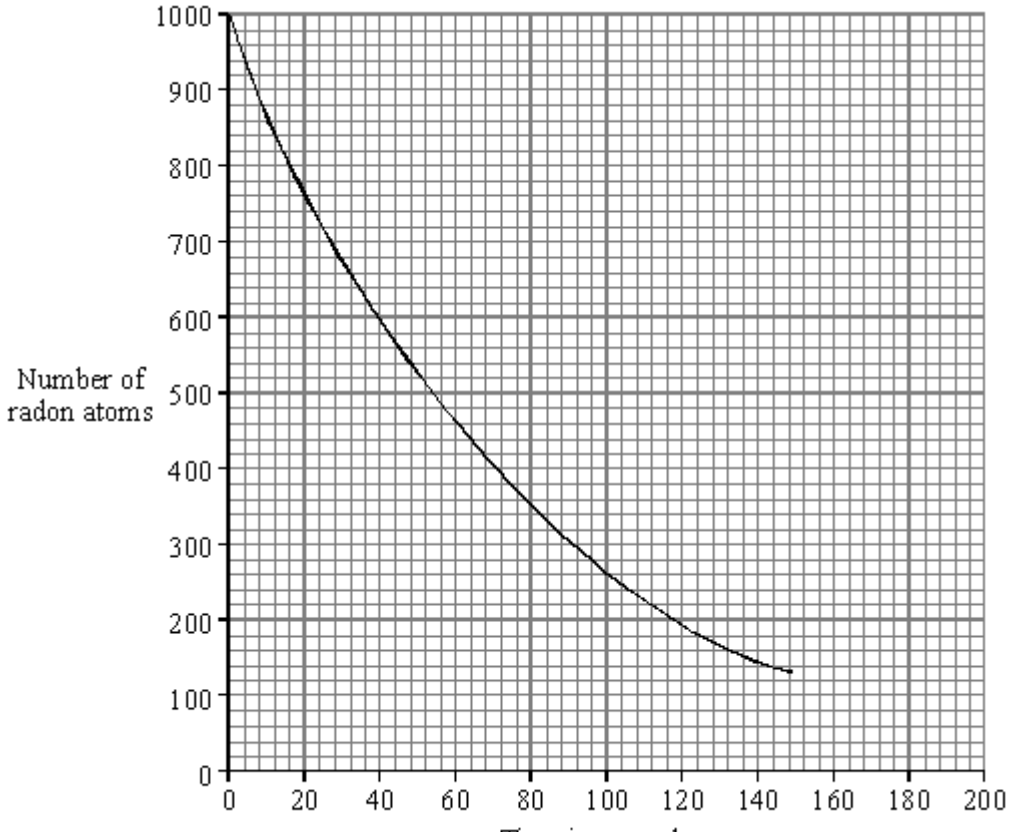
_____

(2)

(Total 10 marks)

Q2.

Radon is a radioactive element. The graph shows how the number of radon atoms in a sample of air changes with time.



(i) How long did it take the number of radon atoms in the sample of air to fall from 1000 to 500?

Time = _____ seconds

(1)

(ii) How long is the half-life of radon?

Half-life = _____ seconds

(1)

(iii) Complete this sentence by crossing out the **two** lines in the box that are wrong.

As a radioactive material gets older, it emits

less
a constant level of
more

radiation per second.

(1)

(Total 3 marks)

Q3.

Some types of food are treated with *gamma* radiation. Low doses of radiation slow down the ripening of fresh fruit and vegetables while higher doses of radiation kill the bacteria that make the food go off.

(a) (i) What is *gamma* radiation?

_____

(1)

(ii) Food packed in crates or boxes can be treated using this method.

Why must a source that emits *gamma* radiation be used?

_____

_____

(1)

(iii) A suitable source of gamma radiation is the isotope caesium 137.

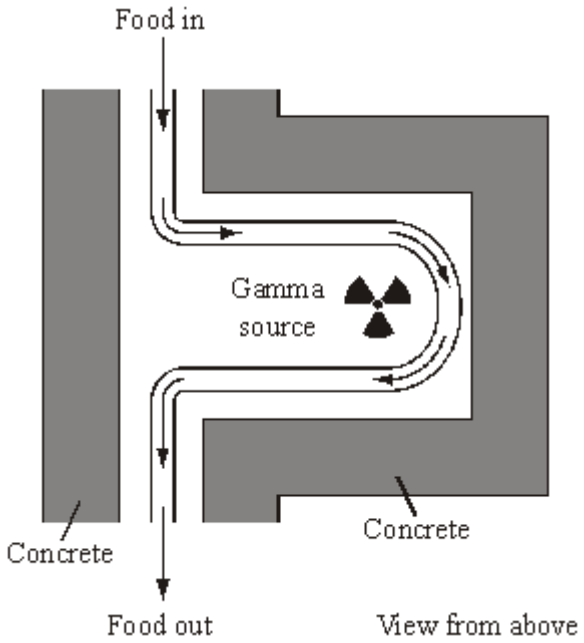
Complete the following sentence by choosing the correct word from the box.

electrons	**neutrons**	**protons**

An atom of caesium 137 has two more _____ than an atom of caesium 135.

(1)

(b) The diagram shows how a conveyor belt can be used to move food past the radioactive source.



(i) How do the concrete walls reduce the radiation hazard to workers outside the food treatment area?

_____

_____

(1)

(ii) Suggest **one** way that the dose of radiation received by the food could be increased other than by changing the radioactive source.

_____

_____

(1)

(c) Some people may not like the idea of eating food treated with radiation.

(i) What evidence could a food scientist produce to show that food treated with radiation is safe to eat?

_____

_____

_____

_____

(2)

(ii) The diagram shows the sign displayed on food treated with radiation.

Why is it important for people to know which foods have been treated with radiation?

_____

_____

(1)

(Total 8 marks)