

Radioactivity 4

Name & Set

1 We are surrounded by sources of ionising radiation. Some of these have are man-made, but the most occur naturally.

(a) Give *two* sources of natural radiation.

(i) _____ [1]

(ii) _____ [1]

(b) Give *one* source of artificial radiation.

_____ [1]

(c) Write down two ways in which radioactivity is harmful to humans.

(i) _____

_____ [2]

(ii) _____

_____ [2]

(d) Which type of radiation is least dangerous to the person? (Give a reason for your answer)

_____ [2]

(e) Give **two** precautions that you should take when handling radioactive sources.

_____ [2]

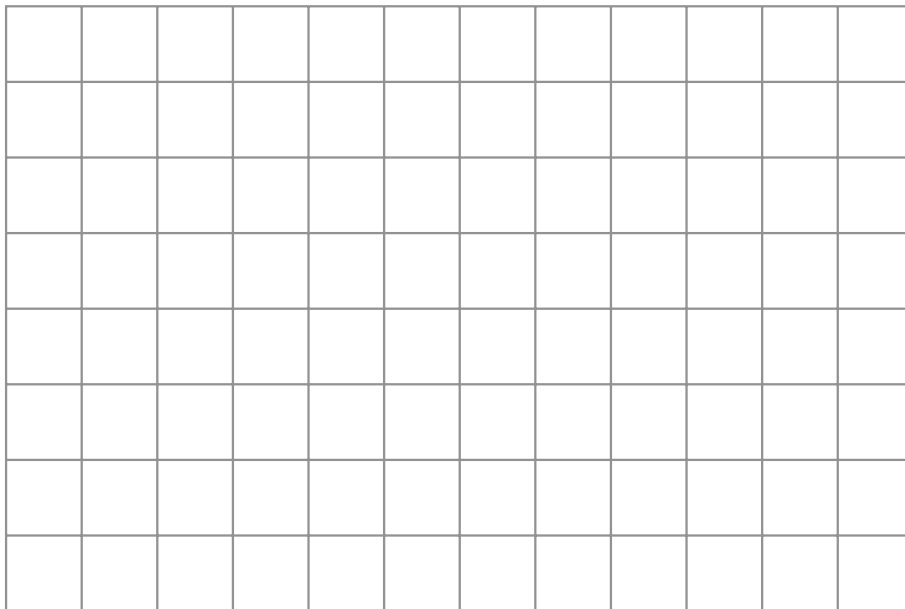
2 (a) Describe how radioactivity can be used to sterilise medical equipment.

_____ [2]

- 2 (b) The following table gives the average radiation levels from radon gas in air in different areas of the country.

<i>Location</i>	<i>Units of radiation dose per year</i>
Cornwall	60
Sussex	15
Derbyshire	65
Scottish Highlands	36
North Yorkshire	9

- (i) Display the data in a bar chart on the grid below. [3]



- (ii) Where would you obtain the lowest dose? _____ [1]
 (iii) Why is radon gas present in air? _____

_____ [2]

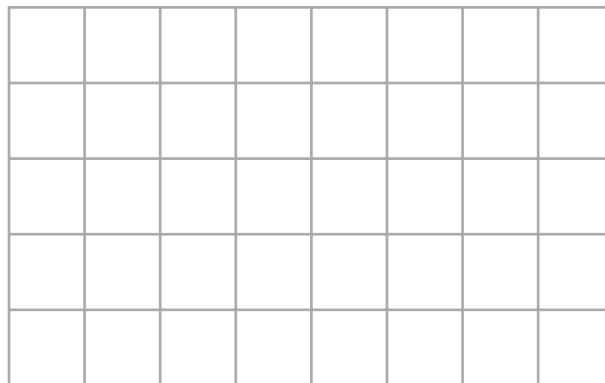
- (b) During a trans-Atlantic flight between UK and USA you will receive a radiation dose of 6 Units. How many return flights would you have to make to receive the equivalent of living in Cornwall for a year?

_____ [2]

3 People who do not work with radiation are allowed a certain dose per year. The table shows the percentage of that dose that each medical x-ray gives.

<i>X-ray source</i>	<i>% of background radiation dose</i>
dental	1
chest	5
skull	3
pelvis	24
spine	40
leg	3
arm	2

(a) (i) Draw a bar graph to display the data. [4]



(ii) Jack has a chest x-ray.

How many dental x-rays would he need to have the same dose? _____ [1]

(iii) Name **two** ways in which radiation can damage the body.

(i) _____
 _____ [2]

(ii) _____
 _____ [2]

(b) Mary is a radiographer who routinely works with x-rays.

Give **two** precautions she must take to keep her exposure as low as possible.

(i) _____
 _____ [2]

(ii) _____
 _____ [2]

4 (a) Complete the table about alpha, beta and gamma radiations.

[4]

Symbol	Name of radiation	What is it?	What charge does it carry?
	Alpha		
	Beta		
	Gamma		

(b) Technetium-99 m is a radioactive isotope that is often used by hospitals in the examination of patients. It emits only gamma rays and its half-life is 6 hours.

A doctor wishes to examine the action of a patient's heart. He injects a substance containing technetium-99m into the patient's bloodstream. It mixes with the blood. As the substance passes through the heart, the radiation from it is detected outside the patient's body. Measurements are made while 500 heartbeats take place.

(i) Why does the doctor choose a gamma emitter with a half-life of 6 hours rather than one with a half-life of 6 minutes or 6 days?

[5]

(ii) A sample of technetium-99m has a count-rate of 6400 counts per minute. After 24 hours the count-rate was calculated as 400 counts per minute.

Carry out a calculation to confirm this reduction in the count rate from the data given above.

[2]

(iii) In fact, after 24 hours the count rate was measurably less than predicted. Give a reason why this is to be expected.

[2]

9 Radioactive isotopes can be used to locate internal bleeding in the body. A commonly used radioactive isotope is ${}_{53}^{131}\text{I}$. This emits gamma radiation and has a half-life of 8 days.

(a) Describe what is meant by radioactive isotope

[2]

(b) Describe what is meant by half-life.

[2]

(c) The activity of a sample of ${}_{53}^{131}\text{I}$ was measured over a period of 20 minutes on three separate occasions. The readings obtained were:

A becquerel (Bq) is the unit of activity. 1 Bq = 1 count per second.

338 Bq	356 Bq	326 Bq
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(i) Explain why the readings were not all exactly the same.

[2]

(ii) Calculate the average count rate for the radioactive isotope.

[2]