

Name of the Student: _____

Max. Marks : 22 Marks

Time : 22 Minutes

Q1.

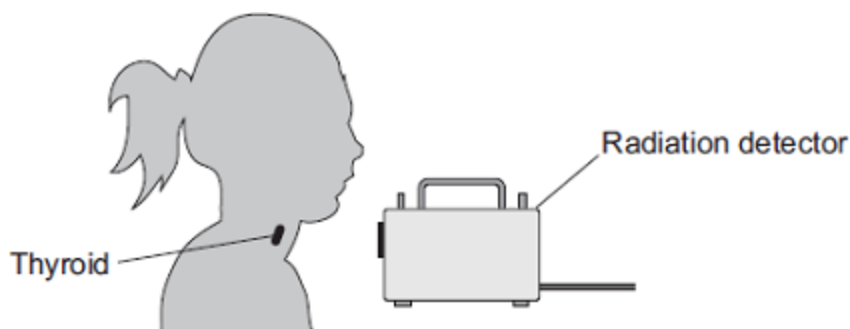
- (a) The names of three types of radiation are given in **List A**. Some properties of these three types of radiation are given in **List B**.

Draw **one** line from each type of radiation in **List A** to its correct property in **List B**.

| List A Type of radiation | List B Property of radiation |
|-----------------------------|--|
| alpha | will pass through paper but is stopped by thin metal |
| beta | has the shortest range in air |
| gamma | will not harm human cells |
| | is very weakly ionising |

(3)

- (b) The radioactive isotope iodine-123 can be used by a doctor to examine the thyroid gland of a patient. The iodine, taken as a tablet, is absorbed by the thyroid gland. The gamma radiation emitted as the iodine atoms decay is detected outside the body.



The doctor uses an isotope emitting gamma radiation to examine the thyroid gland rather than an isotope emitting alpha or beta radiation.

Which **one** of the following gives a reason why gamma radiation is used?

Tick (✓) **one** box.

Gamma radiation will pass through the body.

Gamma radiation is not deflected by a magnet.

Gamma radiation has a long range in air.

(1)

(c) Iodine-123 has a half-life of 13 hours.

Use a word from the box to complete the sentence.

all half most

After 13 hours _____ of the iodine-123 atoms the thyroid absorbed have decayed.

(1)

(d) Iodine-123 and iodine-131 are two of the isotopes of iodine.

Draw a ring around the correct answer to complete the sentence.

The nucleus of an iodine-123 atom has the same number of

electrons
neutrons
protons

as the

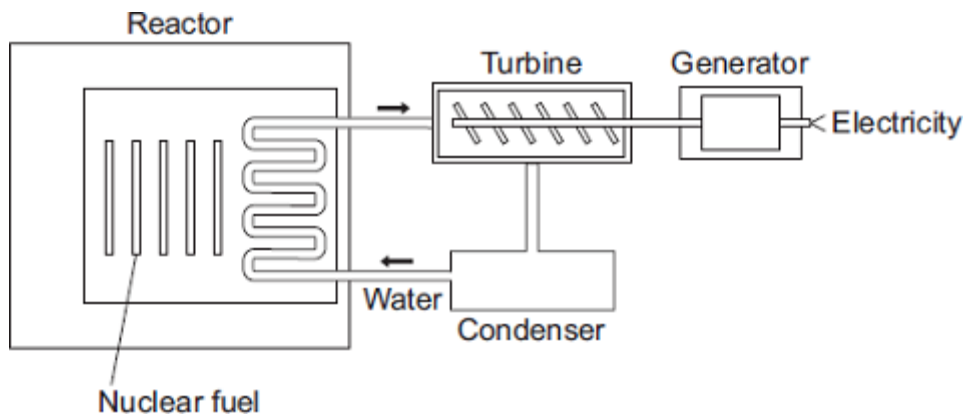
nucleus of an iodine-131 atom.

(1)

(Total 6 marks)

Q2.

Nuclear power stations use the energy released from nuclear fuels to generate electricity.



(a) Which substance do the majority of nuclear reactors use as fuel?

Draw a ring around your answer.

plutonium-239

thorium-232

uranium-235

(1)

- (b) Energy is released from nuclear fuels by the process of nuclear fission.

Describe what happens to the nucleus of an atom during nuclear fission.

(2)

- (c) Use words from the box to complete each sentence.

| | | | | | |
|------------------|------------|------------------|----------------|--------------|----------------|
| condenser | gas | generator | reactor | steam | turbine |
|------------------|------------|------------------|----------------|--------------|----------------|

The energy released from the nuclear fuel is used to heat water. The water turns into _____ and this is used to drive a _____.

This turns a _____ to produce electricity.

(3)

(Total 6 marks)

Q3.

- (a) Sources of background radiation are either natural or man-made.

Which **two** of the sources listed in the box are *natural* sources of background radiation?

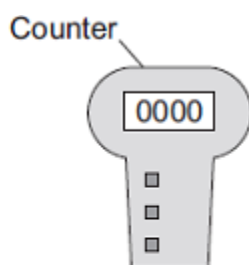
Draw a ring around each of your answers.

| | | | |
|--------------------|--------------------------|---------------|------------------|
| cosmic rays | nuclear accidents | X-rays | radon gas |
|--------------------|--------------------------|---------------|------------------|

(2)

- (b) A teacher used a Geiger-Müller (GM) tube and counter to measure the background radiation in her laboratory. The teacher reset the counter to zero, waited one minute and then took the count reading. The teacher repeated this two more times.

The three readings taken by the teacher are given in the table.



| Count |
|-------|
| 17 |
| 21 |
| 19 |

- (i) The three readings are different.

What is the most likely reason for this?

Tick (✓) **one** box.

The teacher did not reset the counter to zero.

Radioactive decay is a random process.

The temperature in the laboratory changed.

(1)

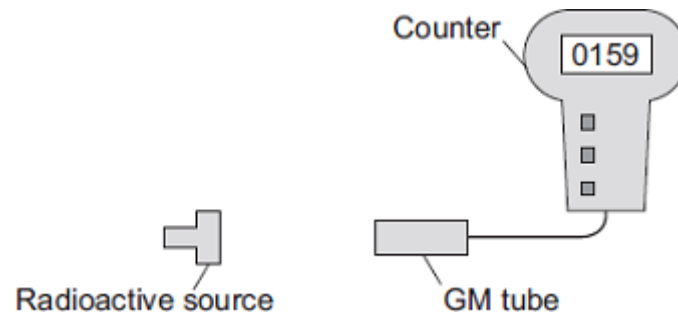
- (ii) Calculate the mean (average) value of the three readings given in the table.

Mean (average) value = _____ counts

(1)

- (iii) The diagram shows how the teacher used the GM tube and counter to measure the radiation emitted from a radioactive source.

The counter was reset to zero. The count after one minute was 159.



Calculate how many counts were due to the radiation from the radioactive source.

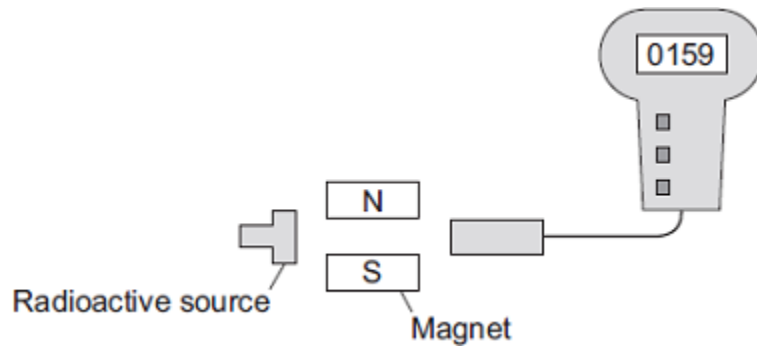
Counts due to the radiation from the radioactive source = _____

(1)

- (iv) The teacher then put a powerful magnet between the radioactive source and the GM tube.

The counter was reset to zero. The number on the counter shows the count after one

minute.



What type of radiation was being emitted from the radioactive source?

Draw a ring around your answer.

alpha

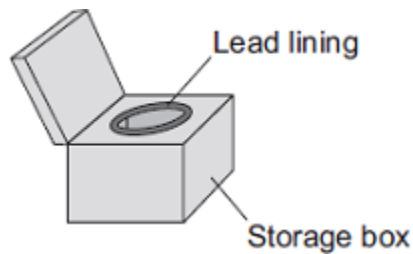
beta

gamma

Explain the reason for your answer.

(3)

- (c) At the end of the lesson the teacher put the radioactive source back inside its storage box.



Why is the inside of the box lined with lead?

(1)

- (d) Which **one** of the following questions **cannot** be answered by scientific study?

Tick (✓) **one** box.

Where does background radiation come from?

What is meant by the half-life of a radioactive source?

Should radioactive waste be dumped in the oceans?

(1)
(Total 10 marks)