GCSE
PHYSICS

Physics Test 3: Particle model of matter and Atom Structure
(Foundation)

Total number of marks: 36

0 5 Radioactive waste from nuclear power stations is a man-made source of background radiation.

0 5 . 1 Which of the following is also a man-made source of background radiation?

[1 mark]

Tick (✓) **one** box.

cosmic rays ☐

radiotherapy ☐

rocks ☐

stars ☐

0 5 . 2 Nuclear power stations use the process of nuclear fission.

Complete the sentences to describe the process of nuclear fission.

Choose answers from the box.

[3 marks]

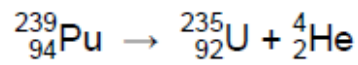| a neutron	a proton	an electron
cosmic rays	energy	gamma rays	x-rays

An unstable nucleus absorbs _____ and splits into two parts.

Two or three neutrons are released, as well as _____

and _____ .

| 0 | 5 | . | 3 | Plutonium-239 is one type of radioactive waste from nuclear power stations.

The following nuclear equation represents the decay of plutonium-239 (Pu-239).

$$^{239}_{94}\text{Pu} \rightarrow {}^{235}_{92}\text{U} + {}^{4}_{2}\text{He}$$

How does the nuclear equation show that alpha radiation is emitted when plutonium-239 decays?
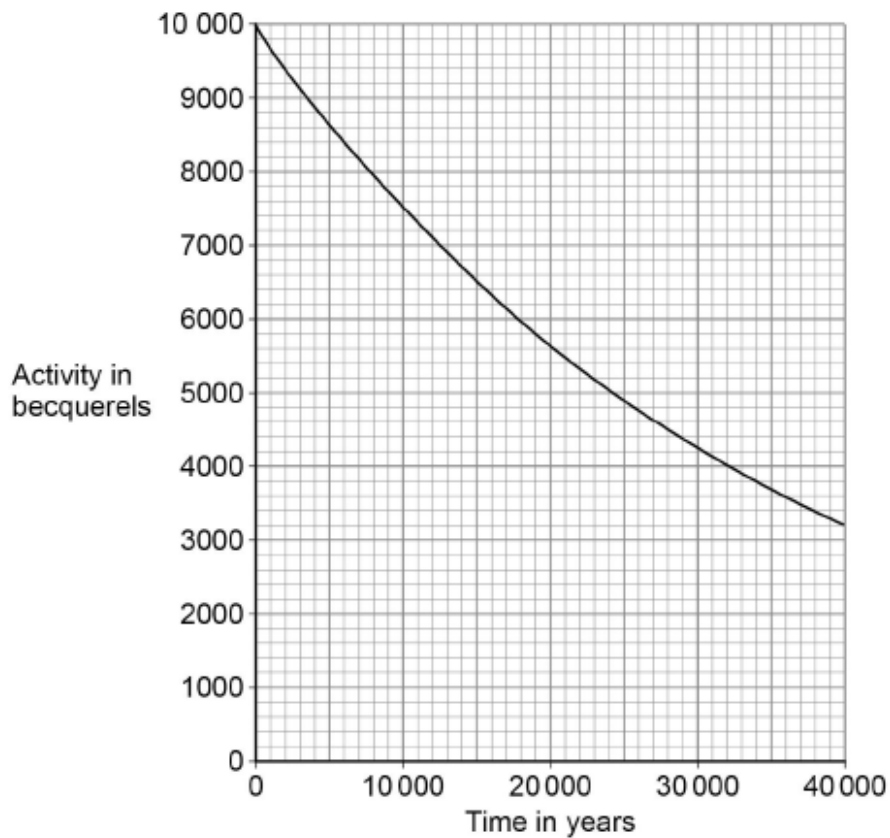
[1 mark]

Tick (✓) **one** box.

An alpha particle contains 92 protons. ☐

An alpha particle has a mass number of 235. ☐

An alpha particle is the same as a helium nucleus. ☐

Figure 8 shows how the activity of a sample of plutonium-239 varies with time.

Figure 8

0 5 . 4 How much time will it take for the activity of the sample of plutonium-239 to fall to half of its initial activity?

[1 mark]

Time = _____ years

0 5 . 5 What is the half-life of plutonium-239?
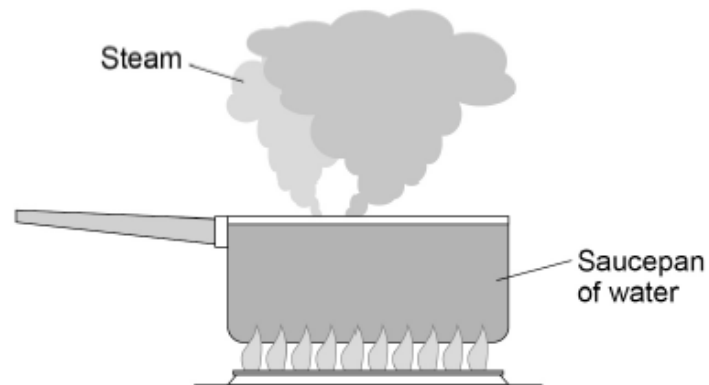
[1 mark]

Half-life = _____ years

0 5 . 6 The radioactive waste from a nuclear power station is buried underground.

People are warned to stay away from places where radioactive waste is buried.

Suggest **one** risk of going near the place where radioactive waste is buried.

[1 mark]

| 0 | 1 | | **Figure 1** shows water being heated. Eventually the water changed into steam.

Figure 1

| 0 | 1 |.| 1 | Complete the sentences.

Choose answers from the box.
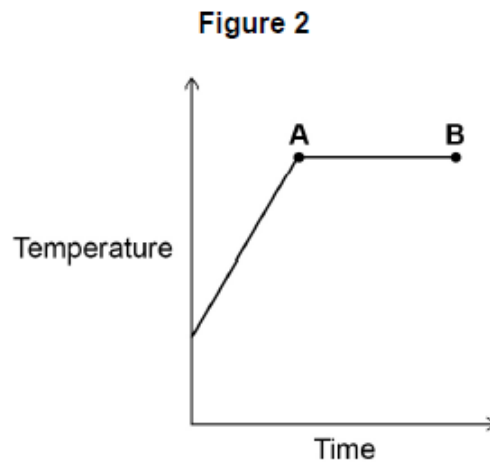
Each answer may be used once, more than once or not at all.

[2 marks]

greater than	less than	the same as

The distance between the particles in steam is _____ the

distance between the particles in liquid water.

The density of steam is _____ the density of liquid water.

Figure 2 shows how the temperature of the water varied with time.

Figure 2

0 1 . 2 What is the name of the process that is taking place between points **A** and **B**?

Give a reason for your answer.

[2 marks]

Process _____

Reason _____

_____

0 1 . 3 A mass of 0.063 kg of water was turned into steam.

The specific latent heat of vaporisation of water is 2 260 000 J/kg

Calculate the thermal energy transferred to the water to turn it into steam.

Use the equation:

thermal energy for a change of state = mass × specific latent heat

[2 marks]

Energy = _____ J

| 0 | 1 |. | 4 | The mass of the steam was 0.063 kg

The volume of the steam was 0.105 m³

Calculate the density of steam.

Use the equation:

$$density = \frac{mass}{volume}$$

Choose the unit from the box.

[3 marks]

kg	m³ / kg	kg / m³

Density = _____ Unit _____

| 0 | 4 | A student wanted to determine the density of a small piece of rock.

| 0 | 4 | . | 1 | Describe how the student could measure the volume of the piece of rock.

[4 marks]

| 0 | 4 | . | 2 | The volume of the piece of rock was 18.0 cm³.

The student measured the mass of the piece of rock as 48.6 g.

Calculate the density of the rock in g/cm³.

Use the equation:

$$density = \frac{mass}{volume}$$

[2 marks]

Density = _____ g/cm³

| 1 | 1 | | A teacher used a Geiger-Muller tube and counter to measure the number of counts in 60 seconds for a radioactive rock.

| 1 | 1 |.| 1 | The counter recorded 819 counts in 60 seconds. The background radiation count rate was 0.30 counts per second.

Calculate the count rate for the rock.

[3 marks]

Count rate = _____ per second

| 1 | 1 |.| 2 | A householder is worried about the radiation emitted by the granite worktop in his kitchen.

1 kg of granite has an activity of 1250 Bq. The kitchen worktop has a mass of 180 kg.

Calculate the activity of the kitchen worktop in Bq.

[2 marks]

Activity = _____ Bq

| 1 | 1 |.| 3 | The average total radiation dose per year in the UK is 2.0 millisieverts.

Table 2 shows the effects of radiation dose on the human body.

Table 2

Radiation dose in millisieverts	Effects
10 000	Immediate illness; death within a few weeks
1000	Radiation sickness; unlikely to cause death
100	Lowest dose with evidence of causing cancer

The average radiation dose from the granite worktop is 0.003 millisieverts per day.

Explain why the householder should **not** be concerned about his yearly radiation dose from the granite worktop.

One year is 365 days.

[2 marks]

| 1 | 1 | . | 4 |

Bananas are a source of background radiation. Some people think that the unit of radiation dose should be changed from sieverts to Banana Equivalent Dose.
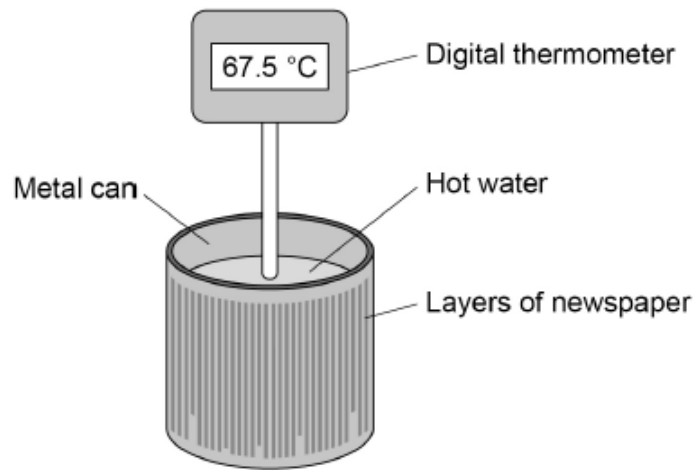
Suggest **one** reason why the Banana Equivalent Dose may help the public be more aware of radiation risks.

[1 mark]

| 1 | 0 |

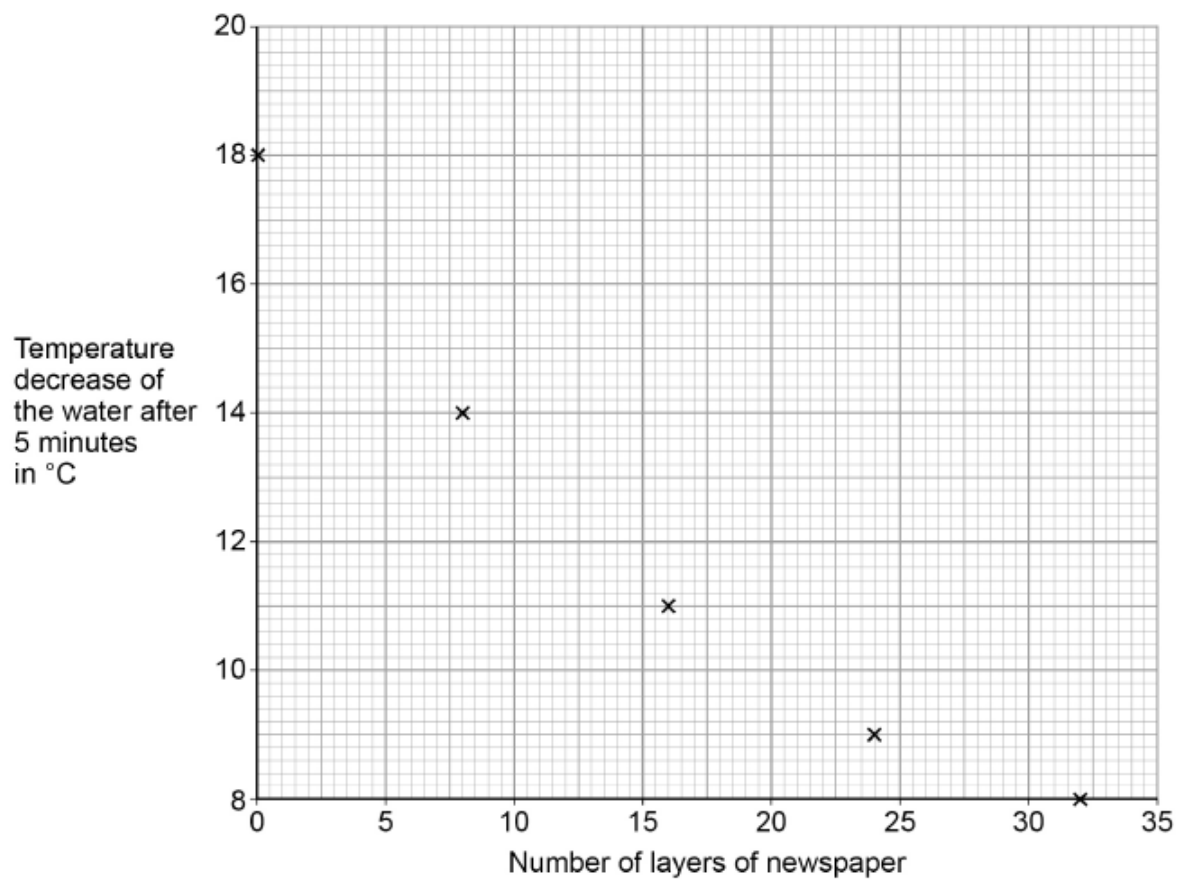A student investigated the insulating properties of newspaper.

Figure 15 shows the apparatus the student used.

Figure 15

The student's results are shown in **Figure 16**.

Figure 16

| 1 | 0 |.| 1 | Describe a method the student could have used to obtain the results shown in
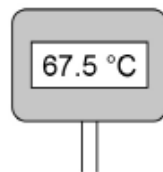**Figure 16**.

[6 marks]

| 1 | 0 |.| 2 | The student could have used a datalogger with a temperature probe instead of the
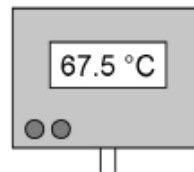digital thermometer.

Figure 17 shows the readings on the digital thermometer and the datalogger.

Figure 17

Digital thermometer   **Datalogger**

67.5 °C   67.5 °C

The datalogger records 10 readings every second.

The student considered using a temperature probe and datalogger.

Explain why it was **not** necessary to use a temperature probe and datalogger for
this investigation.

[2 marks]