1 Nuclear particles and nuclear radiation may cause ionisation as they pass through matter.

Which of the following is the most ionising?

☒ **A** α particles

☒ **B** β particles

☒ **C** γ rays

☒ **D** neutrons

(Total for Question = 1 mark)

2 An unstable nucleus recoils as it emits an alpha particle.

This is due to the conservation of

☒ **A** charge.

☒ **B** kinetic energy.

☒ **C** momentum.

☒ **D** total energy.

(Total for Question = 1 mark)

3 The table below gives the range and number of ion pairs per centimetre produced by β particles, compared to α particles of the same energy.

Select the row from the table which shows the correct comparison.

	Range of β particles	**Number of ion pairs per centimetre**
☒ **A**	greater	greater
☒ **B**	smaller	greater
☒ **C**	greater	smaller
☒ **D**	smaller	smaller

(Total for Question = 1 mark)

4 Radioactive decay is said to be a spontaneous process.

This means that

☒ **A** we cannot know when a nucleus will decay.

☒ **B** we cannot know which nucleus will decay next.

☒ **C** we cannot know how many nuclei will decay.

☒ **D** we cannot influence when a nucleus will decay.

(Total for Question = 1 mark)

5 In an experiment to measure the activity of a radioactive source the measured activity should always be corrected by

☒ **A** adding the background count.

☒ **B** adding the background count rate.

☒ **C** subtracting the background count.

☒ **D** subtracting the background count rate.

(Total for Question = 1 mark)

6 When measuring the count rate from a radioactive source it is usual to also measure the background count rate.

The background count rate must be

☒ **A** as large as possible for an accurate experiment.

☒ **B** measured when the source is in place.

☒ **C** recorded for the same time as the count rate.

☒ **D** subtracted from the count rate measured from the source.

(Total for Question = 1 mark)

7 Before carrying out an experiment to measure the activity from a radioactive source, it is usual to measure the background count. The background count obtained is **not** affected by the

☒ **A** location of the experiment.

☒ **B** temperature of the surroundings.

☒ **C** time interval used for the count.

☒ **D** type of detector being used.

(Total for Question 1 mark)

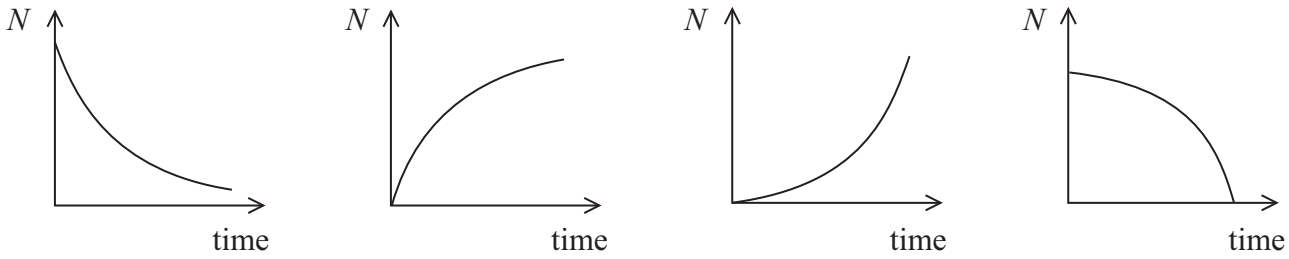
8 Health and safety guidelines state that radioactive sources suitable for school experiments should only be handled using long tongs, and only for restricted periods of time. Select the row in the table that gives the type of radiation that is most dangerous to the human body, in these circumstances, with the correct reason.

	Type of radiation	Reason
☒ **A**	α-radiation	it is the most ionising
☒ **B**	α-radiation	it is the most massive
☒ **C**	β-radiation	it can penetrate up to a metre of air
☒ **D**	β-radiation	it can penetrate the skin and enter the body

(Total for Question 1 mark)

9 Some rocks contain lead as a result of radioactive decay. In one such decay a fixed amount of polonium decays to a stable isotope of lead.

Which graph correctly shows the variation with time of the number of lead atoms, *N*, produced from the decay of polonium in the rock.



A **B** **C** **D**

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for Question 1 mark)

10 Which one of the following does **not** contribute to background radiation?

☒ **A** Dead matter

☒ **B** Living matter

☒ **C** Mobile phones

☒ **D** Rocks

(Total for Question = 1 mark)

11 A radioactive source is placed 2 cm from a detector. The count rate decreases slightly if a sheet of paper is placed between the source and the detector. It is reduced to background radiation level when the paper is replaced with a 1 cm thickness of aluminium.

The correct conclusion is that the source emits

☒ **A** alpha radiation only.

☒ **B** alpha and beta radiation.

☒ **C** beta and gamma radiation.

☒ **D** gamma radiation only.

(Total for Question = 1 mark)

12 Protactinium has a half-life of 70 s. A sample of protactinium is prepared and monitored over a period of time. Which of the following statements is correct?

☒ **A** The activity of the protactinium will be zero after 140 s.

☒ **B** The activity of the protactinium will be 25% of its initial value after 140 s.

☒ **C** The activity of the protactinium will be 12.5% of its initial value after 280 s.

☒ **D** The activity of the protactinium will never become zero.

(Total for Question = 1 mark)

13 The ionising properties of radiations determine their penetrating power.

Which of the following statements is correct?

☒ **A** α-particles are not very ionising so they are stopped by thin paper.

☒ **B** α-particles are very ionising so can only travel a few centimetres in air.

☒ **C** γ-radiation is very penetrating because it is very ionising.

☒ **D** γ-radiation is not very penetrating because it is very ionising.

(Total for Question 1 mark)

14 Radioactive decay is sometimes described as being spontaneous. In this context spontaneous means

☒ **A** nothing can influence the decay.

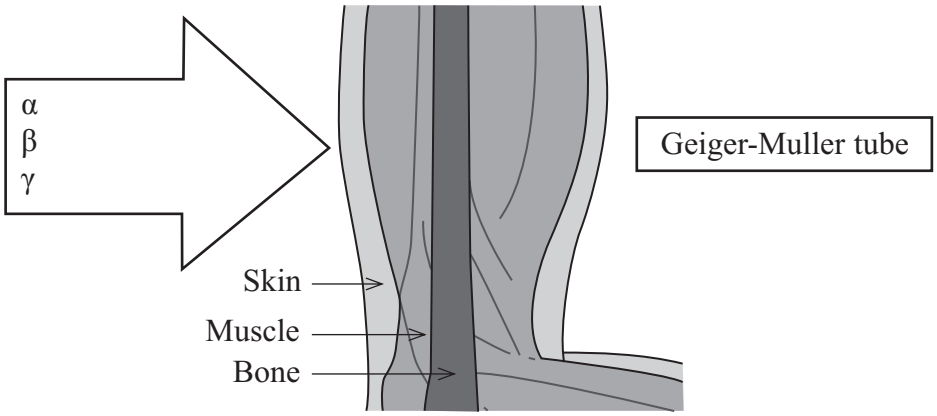
☒ **B** the decay is random.

☒ **C** the decay can be predicted.

☒ **D** the decay is exponential.

(Total for Question 1 mark)

15 The diagram shows radiation from a radium source approaching a person's arm. A Geiger-Muller tube on the other side of the arm detects radiation.



The radiation detected is substantially less than would be detected without the arm in position. This is because the

☒ **A** bone is absorbing α-radiation.

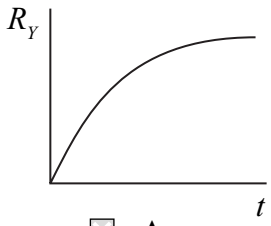
☒ **B** muscle is absorbing α-radiation.

☒ **C** muscle is absorbing β-radiation.

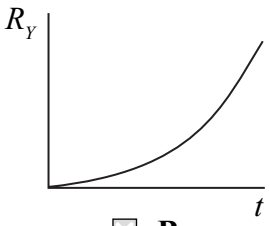
☒ **D** skin is absorbing γ-radiation.

(Total for Question 1 mark)

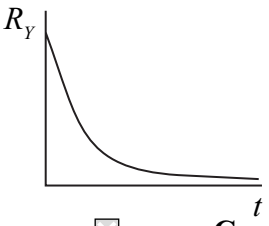
16 A sample of radioactive element X decays into a stable element Y. Which graph shows the rate of formation of element Y, R_Y with time, t?



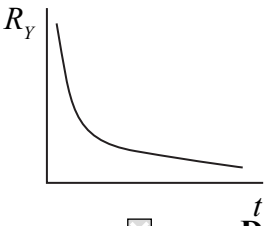
☒ **A**



☒ **B**



☒ **C**



☒ **D**

(Total for Question 1 mark)

17 In a famous thought experiment, Schrödinger imagined that a cat is locked in a box, along with a radioactive atom that is connected to a tube containing a deadly poison. If the atom decays, it causes the tube to smash and the cat to die.

The random nature of radioactive decay means that the radioactive atom will

☒ **A** decay after one half-life.

☒ **B** probably decay after one half-life.

☒ **C** have a fixed probability of decaying in a given time interval.

☒ **D** have a number of possible decay paths.

(Total for Question = 1 mark)

18 A radioactive source is placed a few cm away from a detector. There is no change in the count rate when a thin aluminium foil is placed between the source and the detector, but the count rate is reduced to the background rate when a 0.5 cm aluminium plate is introduced.

These observations show that the source must be emitting

☒ **A** alpha and beta radiation.

☒ **B** beta and gamma radiation.

☒ **C** beta radiation only.

☒ **D** gamma radiation only.

(Total for Question = 1 mark)