T6 Radioactivity MIXED

Section A

1) Which of these is **NOT** part of an atom?
- ☐ **A:** proton
- ☐ **B:** isotope
- ☐ **C:** electron
- ☐ **D:** neutron

2) Roughly what size is a single atom?
- ☐ **A:** 1 x 10^{-6} m
- ☐ **B:** 1 x 10^{-8} m
- ☐ **C:** 1 x 10^{-10} m
- ☐ **D:** 1 x 10^{-12} m

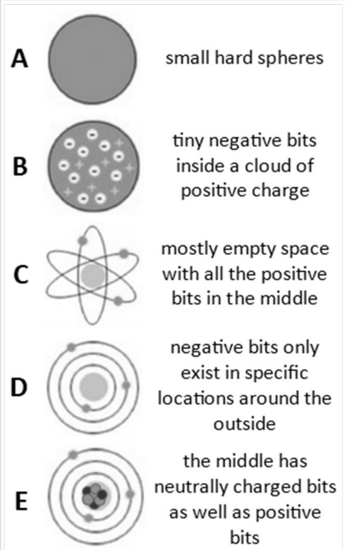
3) Compared with a proton, the mass of an electron is
- ☐ **A:** smaller
- ☐ **B:** larger
- ☐ **C:** equal
- ☐ **D:** opposite

4) How many neutrons are in an atom of Hydrogen-3?
- ☐ **A:** none
- ☐ **B:** one
- ☐ **C:** two
- ☐ **D:** three

5) Which of these forms of radiation is the most ionising?
- ☐ **A:** alpha
- ☐ **B:** beta minus
- ☐ **C:** beta plus
- ☐ **D:** gamma

6) What is the electrostatic charge on an alpha particle?
- ☐ **A:** +2
- ☐ **B:** +1
- ☐ **C:** zero
- ☐ **D:** -1

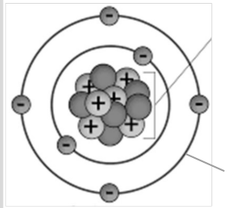
The diagrams lettered A to E represent how our understanding of the atomic model changed over time.



← Give the letter of the diagram that matches each of these statements:
You can use each letter once, more than once or not at all.

- ☐ electrons are discovered
- ☐ found by firing tiny positive particles at a sheet of gold foil and finding that some of the particles were scattered or even reflected back.
- ☐ neutrons are discovered
- ☐ the nucleus is discovered
- ☐ energy levels/orbitals are discovered
- ☐ this is the first example of the ***nuclear*** model of the atom

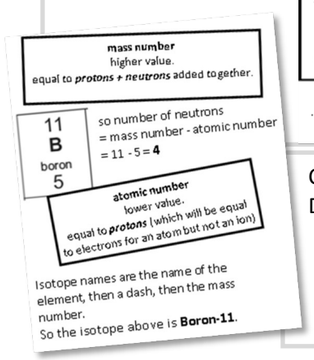
Fill the blanks in the key and add labels for the modern model of the atom ↓



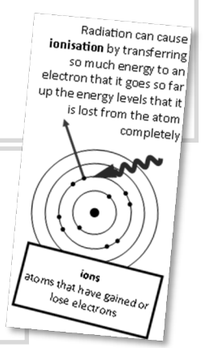
	Subatomic particle	Relative Charge	Relative Mass
+			
		zero	
−			

State the number of neutrons present in each of these isotopes ↓

23 11 Na sodium	9 Be beryllium 4	Carbon-14	Cobalt-60
.....	.....	.....	.....

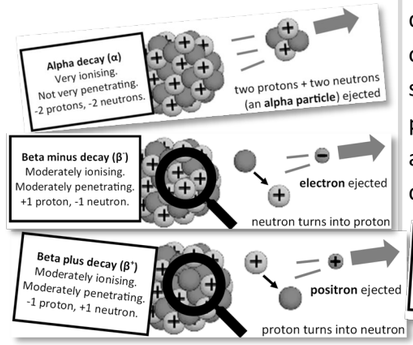


Some types of radiation are more dangerous than others. Suggest why.

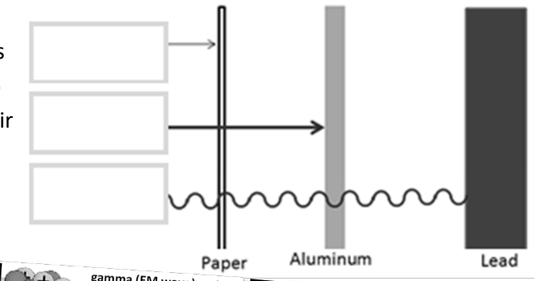


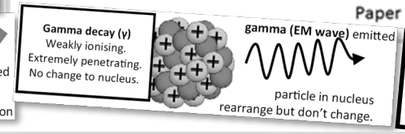
Carbon-14 and Carbon-12 are isotopes.
Define the word **isotope**.

Section B



Label the different types of radiation to show how their penetrating abilities compare →





Top tip:
Atomic numbers and mass numbers should both balance on each side of a nuclear equation

Complete the following nuclear equations

$^{239}_{94}Pu \rightarrow \ ^{\ldots\ldots}_{92}U + ^{4}_{2}\alpha$

$^{263}_{106}Sg \rightarrow \ ^{259}_{104}Rf + \ ^{\ldots\ldots}_{\ldots\ldots}\ldots\ldots$

$^{222}_{88}Ra \rightarrow \ ^{\ldots\ldots}_{\ldots\ldots}Rn + ^{4}_{2}He$

$^{22}_{11}Na \rightarrow \ ^{22}_{10}Ne + \ ^{\ldots\ldots}_{\ldots\ldots}\ldots\ldots$

$^{13}_{5}B \rightarrow \ ^{\ldots\ldots}_{6}C + ^{0}_{-1}\beta$

$^{131}_{53}I \rightarrow \ ^{131}_{54}Xe + \ ^{\ldots\ldots}_{\ldots\ldots}\ldots\ldots$

$^{18}_{9}F \rightarrow \ ^{18}_{\ldots\ldots}O + ^{0}_{+1}\beta$

$^{151}_{67}Ho \rightarrow \ ^{147}_{\ldots\ldots}Tb + \ ^{\ldots\ldots}_{\ldots\ldots}\ldots\ldots$

Fill the blanks in this summary table for the different types of radiation

Name	Description of the radiation that is emitted	Description of how a nucleus changes	How strongly ionising is the radiation?	What material and how thick to stop the radiation?
alpha				sheet of paper or few centimetres of air.
beta minus		one fewer neutrons. one more protons.		
beta plus	positron (+1 charge particle the size of an electron)			
gamma			weak	

combined sciences text book pages 353-370

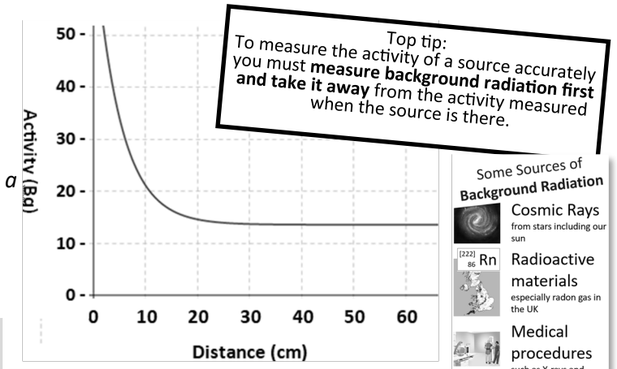
Link to BBC Bitesize

Section C

The sample being held in front of a GM tube connected to a counter.

A teacher demonstrates how to investigate how the intensity of the radiation from a radioactive source varies with distance from a detector.

Their results are shown in the graph to the right.



Top tip:
To measure the activity of a source accurately you must **measure background radiation first and take it away** from the activity measured when the source is there.

A student makes the following conclusion.

"When it was 20 cm from the GM tube the activity of the radioactive source was roughly 15 Bq"

Explain why the student's conclusion is inaccurate.

Describe the trend shown in the graph

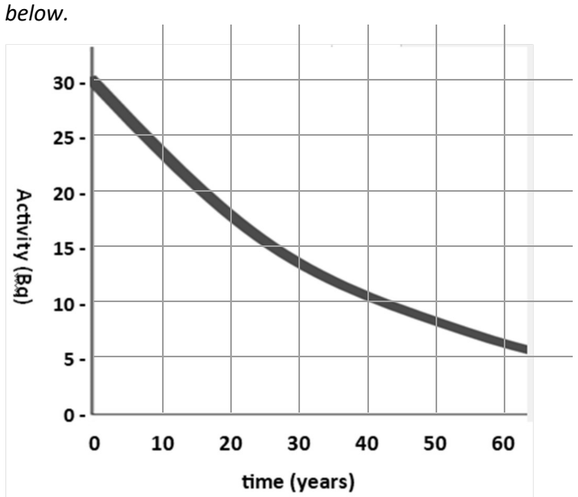
Use the graph to estimate the level of background radiation where the investigation was completed and suggest some sources for this radiation.

An investigation is performed into how the activity of a sample of strontium-90 changes over 60 years.

The results of this investigation are shown in the graph below.

Key Word: ***half-life***

The time taken for half of the undecayed radioactive nuclei in a sample to decay.



Use the graph to estimate the half life of strontium-90

A sample of a different isotope has an initial activity of 20 Bq and a half-life of 10 years.
Sketch, on the same axes, the activity of this sample for the first forty years.

Iodine-131 has a half-life of 8 days.
A samples of Iodine-131 is analysed and found to have 0.0500 g of undecayed nuclei.
(i) What mass of undecayed nuclei will there have been 8 days before the analysis?

(ii) What mass of undecayed nuclei will there be 8 days after the analysis?

(iii) How long after the analysis would you have to wait for the sample to have decreased to 0.0125 g?

Section D

ACROSS
1. the type of nuclear decay that results in a helium nucleus being ejected (5)
4. the centre of an atom (7)
7. the type of nuclear decay that results in an electron being ejected (4,5)
9. the type of nuclear decay that results in a positron being ejected (4,4)
12. where an electron is located around the outside of an atom (6,5)
15. word used to describe the radioactive decay of an unstable nucleus that explains why it is impossible to predict exactly when it will occur (6)
17. what an atom becomes if it gains or loses an electron (3)
18. what happened to a small number of alpha particles that were fired at thin gold foil (10)
19. atoms with the same number of protons but different numbers of neutrons (8)
21. word applied to radiation produced by stars including our own sun (6)
23. sub-atomic particle with zero charge found in the centre of atoms (7)
24. magnitude of the electrostatic charge on a neutron (4)

DOWN
2. alpha particles are the same as a nucleus of this element (6)
3. the time taken for the number of undecayed nuclei in a radioactive source to decrease by half (4-4)
5. the unit of activity of a radioactive isotope, unit symbol Bq (9)
6. positive sub-atomic particle in the centre of atoms that give them their identity (6)
8. type of tube used for detecting radiation, often shortened to GM (6,6)
10. damage caused by ionising radiation to living cells can lead to this (8)
11. the type of nuclear decay that results in a high-energy electromagnetic wave being ejected (5)
13. gas that is the largest source of background radiation in the UK (5)
14. the number of neutrons in an atom of carbon-14 (5)
16. sub-atomic particles with a negative charge (8)
20. the name of the particle emitted during beta plus decay (8)
22. a disease commonly associated with damage to living cells from ionising radiation (6)