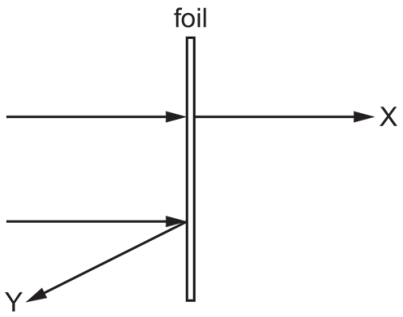
5.2 Radioactivity

01. 0625_m22_qp_22 Q: 38

When a beam of α-particles is incident on a thin metal foil, most of them follow a path represented by path X in the diagram. A small number of α-particles follow a path represented by path Y in the diagram.



Which row correctly describes a conclusion that can be drawn from each of these observations about the structure of the atom?

	most follow path X	some follow path Y
A	atom is mostly empty space	atom contains something that repels α-particles
B	atom is mostly empty space	nucleus contains protons and neutrons
C	atom is neutral	atom contains something that repels α-particles
D	atom is neutral	nucleus contains protons and neutrons

02. 0625_m22_qp_22 Q: 40

When a radioactive isotope is set up close to a counter, a count rate of 38 000 counts/s is obtained. The table shows the count rate from the isotope over a three-year period.

time / years	count rate / counts/s
0	38 000
1	26 000
2	17 000
3	12 000

What is the half-life of the isotope?

A less than 1 year

B more than 1 year but less than 2 years

C more than 2 years but less than 3 years

D more than 3 years

---

03. 0625_m21_qp_22 Q: 39

When alpha particles are incident on a thin metal foil, most of them pass through undeviated.

What does this observation reveal about the nature of the atom?

A The atom has a dense nucleus.

B The atom is mostly empty space.

C The atom is very small.

D The nucleus of the atom is positively charged.

---

04. 0625_m21_qp_22 Q: 40

A laboratory worker measures the count rate from a radioactive source. He records his results in a table.

time / minutes	count rate / counts / s
0	100
1.0	73
2.0	54
3.0	41
4.0	31

The average background radiation in the laboratory is 8 counts per second.

What is the half-life of the source?

A 1.5 minutes

B 2.0 minutes

C 3.0 minutes

D 4.0 minutes

---

05. 0625_s21_qp_21 Q: 39

Radon $^{219}_{86}Rn$ decays by emitting an α-particle.

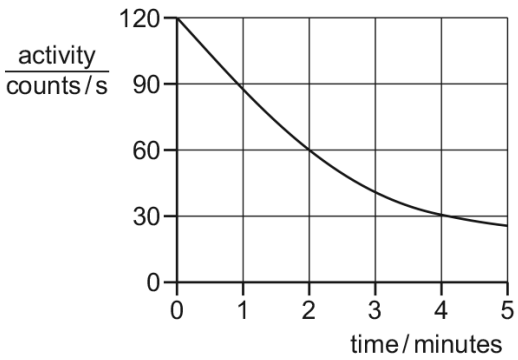
Which nuclide is formed in this decay?

A $^{215}_{84}Po$ **B** $^{223}_{88}Ra$ **C** $^{219}_{87}Fr$ **D** $^{219}_{85}At$

---

06. 0625_s21_qp_21 Q: 40

The graph shows the activity of a radioactive source over a period of time.



What is the half-life of the source?

A 1.0 minute **B** 2.0 minutes **C** 2.5 minutes **D** 4.0 minutes

---

07. 0625_s21_qp_22 Q: 39

Some radioactive nuclei decay to give new nuclei which are also radioactive. Part of a series of decays is shown.

$$^{238}_{92}U \rightarrow {}^{234}_{90}Th \rightarrow {}^{234}_{91}Pa \rightarrow {}^{234}_{92}U \rightarrow {}^{230}_{90}Th \rightarrow {}^{226}_{88}Ra$$

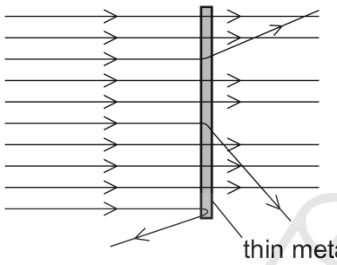
How many decays involve the emission of a β-particle?

A 1 **B** 2 **C** 3 **D** 5

---

08. 0625_s21_qp_23 Q: 38

The diagram shows α-particles incident on a thin metal foil.



How does the motion of these particles give evidence for the nuclear atom?

A Most particles passing through with minimal deflection shows that the atom is mostly empty space.

B Most particles passing through with minimal deflection shows that the mass of the atom is uniformly distributed.

C Large deflections of some particles shows that the atom is mostly empty space.

D Large deflections of some particles shows that the charge in the atom is uniformly distributed.

---

09. 0625_s21_qp_23 Q: 39

Radium-226, $^{226}_{88}Ra$, is an α-emitter.

It is implanted inside cancerous tumours.

It is safe to use as it kills the cancerous cells, but not the healthy ones surrounding the tumour.

Which properties of α-particles, compared to other emissions, enable this use of radium-226?

	ionising effect of α-particles	penetration of α-particles
A	high	high
B	high	low
C	low	high
D	low	low

---

10. 0625_w21_qp_21 Q: 37

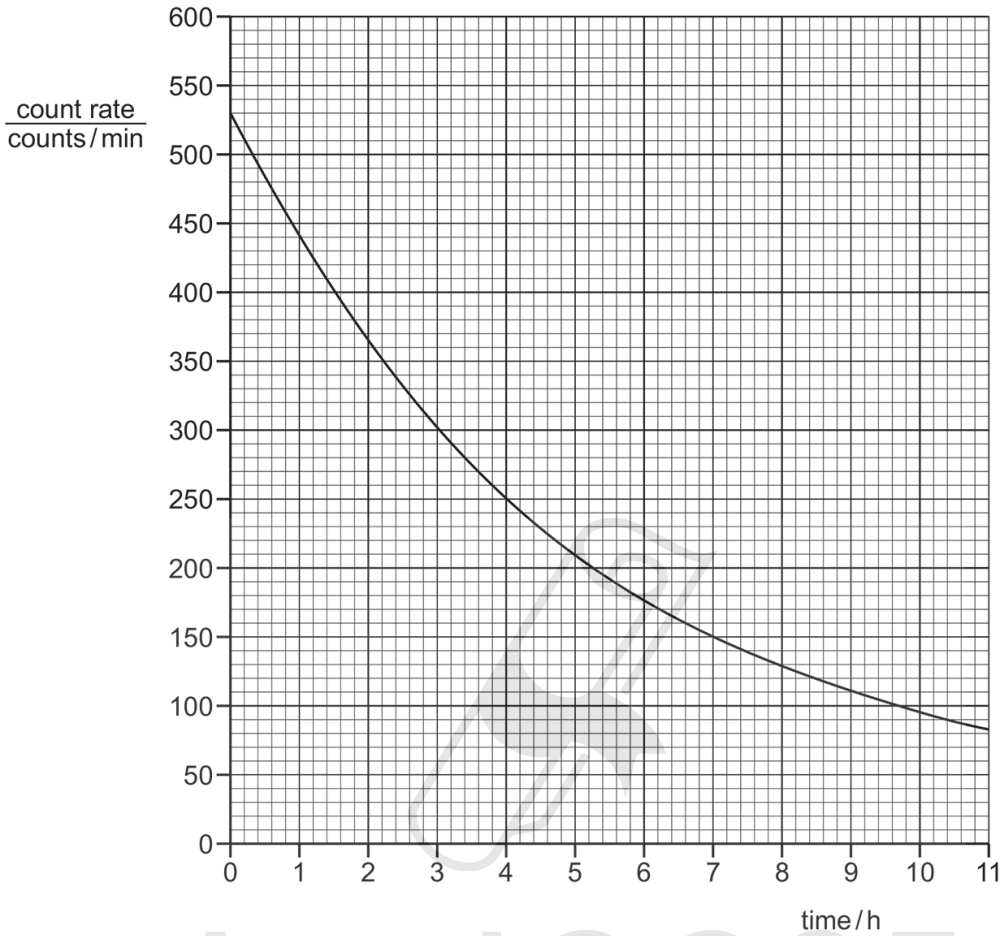
The nucleus of an americium atom contains 146 neutrons and 95 protons. It decays by emitting an α-particle.

How many neutrons and how many protons remain in the nucleus when this form of americium decays?

	number of neutrons remaining	number of protons remaining
A	142	93
B	142	95
C	144	93
D	144	95

11. 0625_w21_qp_21 Q: 38

The graph shows how the count rate measured by a radioactivity detector placed near a radioactive sample changed with time.



Given that the background count rate is 30 counts / min, what is the half-life of this sample?

A 3.4 h **B** 3.6 h **C** 4.0 h **D** 5.5 h

12. 0625_w21_qp_21 Q: 39

A teacher holds a radioactive source near a detector.

The reading on the detector is 320 counts / min.

The detector is switched on again after the source has been removed and it shows a reading of 20 counts / min.

What is the counts / min solely due to the source and why is there a reading on the detector when there is no radioactive source present?

	counts / min due to the source	reason for reading with no source
A	300	zero error on detector
B	300	background radiation
C	340	zero error on detector
D	340	background radiation

---

13. 0625_w21_qp_21 Q: 40

Which statement is **not** correct?

A α-particles are used to detect cracks in metallic structures.

B β-particles are used in the measurement of the thickness of paper.

C γ-rays may be used to treat cancer patients.

D Smoke alarms contain a weak source of α-particles.

---

14. 0625_w21_qp_22 Q: 37

The nucleus of an americium atom contains 146 neutrons and 95 protons. It decays by emitting an α-particle.

How many neutrons and how many protons remain in the nucleus when this form of americium decays?

	number of neutrons remaining	number of protons remaining
A	142	93
B	142	95
C	144	93
D	144	95

---

15. 0625_w21_qp_22 Q: 38

A sample of americium decays and changes into neptunium. The half-life of americium is 432 years.

Which fraction of the americium will remain after 1728 years?

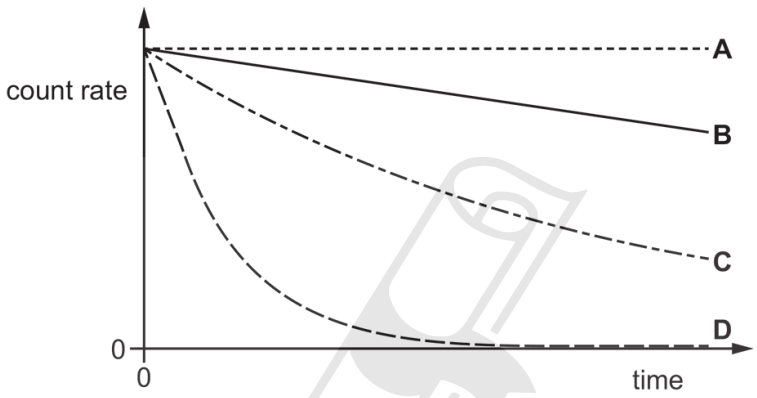
A 0 **B** $\frac{1}{16}$ **C** $\frac{1}{8}$ **D** $\frac{1}{4}$

---

16. 0625_w21_qp_22 Q: 39

The graph shows the decay curves of four different radioactive isotopes.

Which isotope has the largest half-life?



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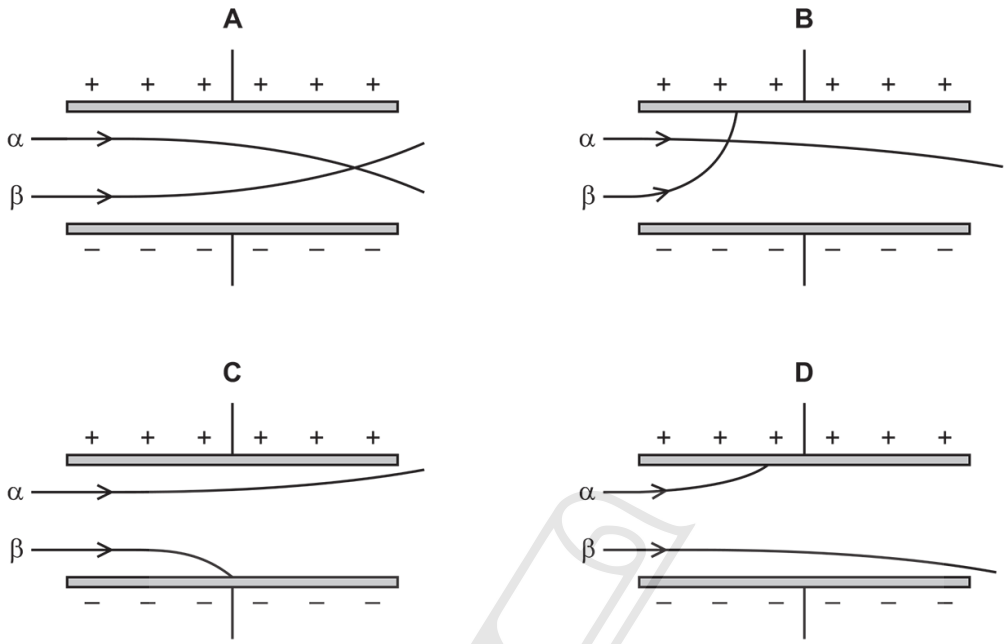
17. 0625_w21_qp_22 Q: 40

The diagrams show α-particles and β-particles passing through an electric field.

Which diagram shows the correct paths of the α-particles and β-particles?



18. 0625_w21_qp_23 Q: 37

The nucleus of an americium atom contains 146 neutrons and 95 protons. It decays by emitting an α-particle.

How many neutrons and how many protons remain in the nucleus when this form of americium decays?

	number of neutrons remaining	number of protons remaining
A	142	93
B	142	95
C	144	93
D	144	95

19. 0625_w21_qp_23 Q: 38

The half-life for lead-202 is 52 500 years.

A sample of lead-202 produces 800 counts / s.

How long will it take for the count rate to drop to 100 counts / s?

A 105 000 years

B 157 500 years

C 210 000 years

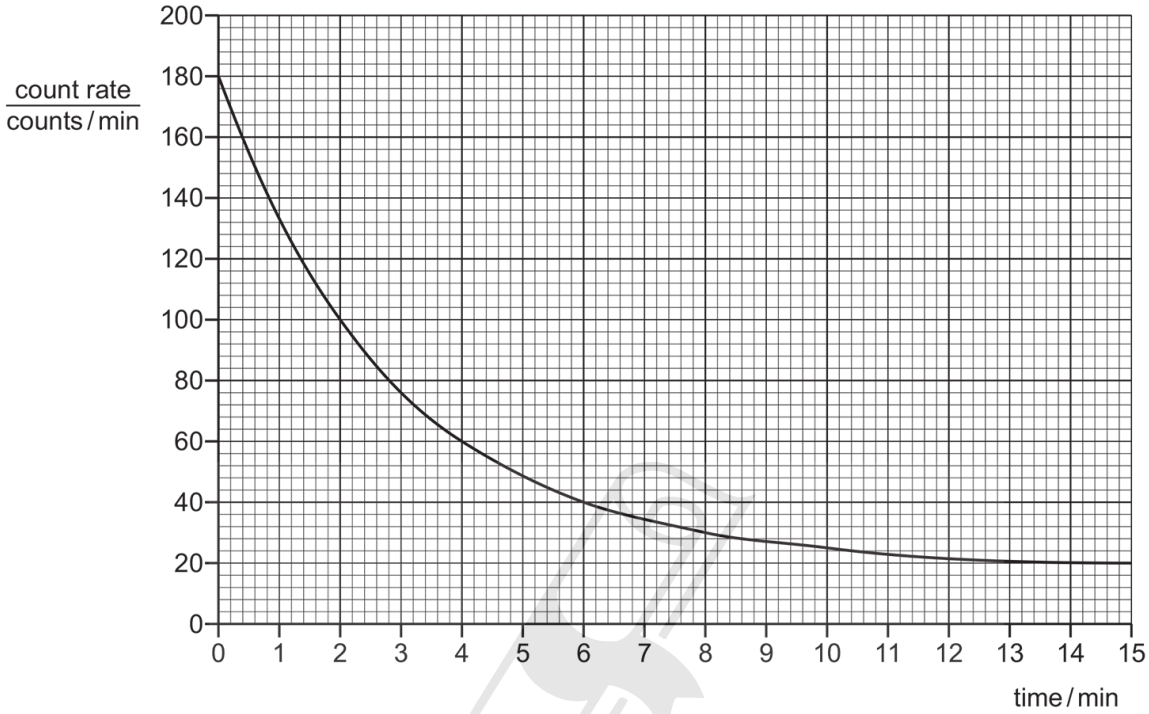
D 420 000 years

---

20. 0625_w21_qp_23 Q: 39

Oxygen-15 is used in hospitals.

The count rate from a detector placed close to a sample of oxygen-15 was recorded over a period of 15 min. The background count rate is 20 counts / min.



What is the half-life of this sample of oxygen-15?

A 2.0 min **B** 2.4 min **C** 2.8 min **D** 7.5 min

---

21. 0625_w21_qp_23 Q: 40

Of the three types of ionising radiation, α, β and γ, why does α-emission cause the most ionisation?

A α-particles have the smallest mass.

B α-particles have the greatest mass.

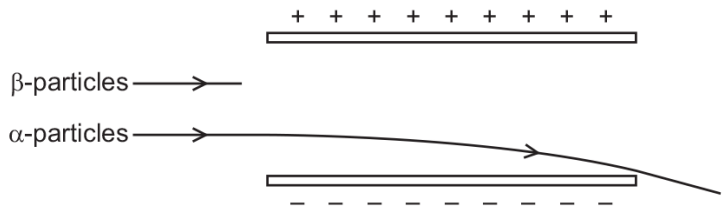
C α-particles move with the greatest speed.

D α-particles travel the greatest distance in matter.

---

22. 0625_m20_qp_22 Q: 39

The diagram shows the path followed by α-particles as they pass between two charged plates. They are deflected downwards.



What happens to β-particles passing through the same electric field?

A They are deflected downwards more than the α-particles.

B They are deflected upwards.

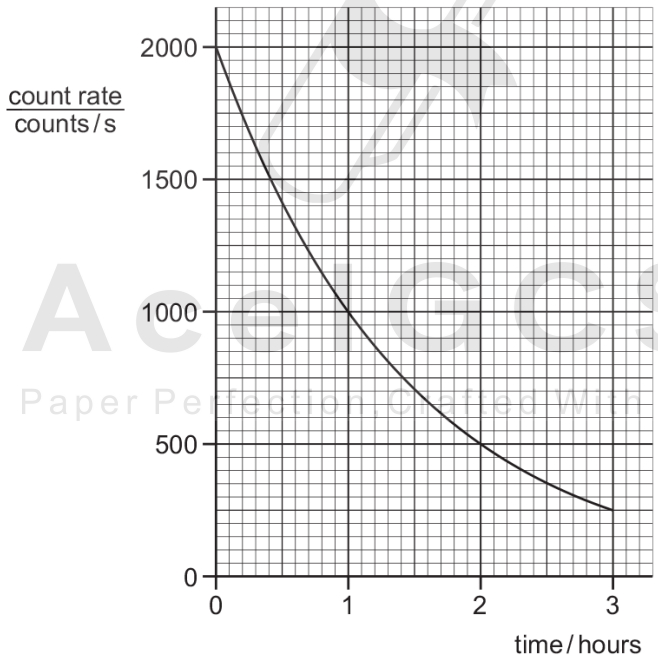
C They are not deflected at all.

D They are deflected downwards by the same amount as the α-particles.

---

23. 0625_m20_qp_22 Q: 40

The graph shows the count rate from a radioactive source over a period of time.



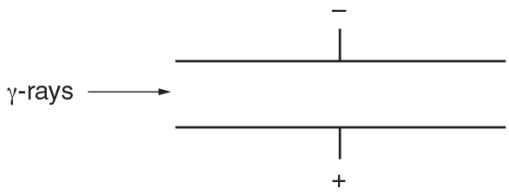
What is the half-life of the source?

A 0.5 hour **B** 1.0 hour **C** 1.5 hours **D** 3.0 hours

---

24. 0625_p20_qp_20 Q: 39

A beam of γ-rays passes between two charged metal plates as shown in the diagram.



How do the γ-rays pass between the two charged plates?

A The rays are deflected in a direction perpendicular to the page

B The rays are deflected towards the negative plate.

C The rays are deflected towards the positive plate.

D The rays will continue in the same direction.

---

25. 0625_p20_qp_20 Q: 40

A powder contains 400 mg of a radioactive isotope that emits α-particles.

The half-life of the isotope is 5 days.

What mass of this isotope remains after 10 days?

A 0 mg **B** 40 mg **C** 100 mg **D** 200 mg

---

26. 0625_s20_qp_21 Q: 38

A radioactive material has a half-life of 20 days.

A sample of the material contains 8.0×10^{10} atoms.

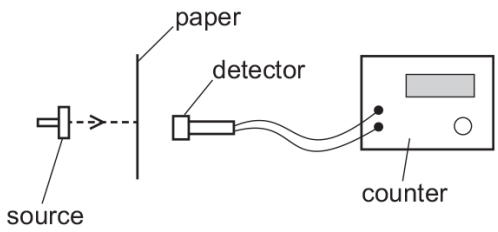
How many atomic nuclei have decayed after 60 days?

A 1.0×10^{10} **B** 4.0×10^{10} **C** 6.0×10^{10} **D** 7.0×10^{10}

---

27. 0625_s20_qp_21 Q: 39

A thin sheet of paper is placed between a radioactive source and a radiation detector. The count rate falls to a very low reading.



From this result, which type of radiation is the source emitting?

A α-particles

B β-particles

C γ-rays

D X-rays

---

28. 0625_s20_qp_21 Q: 40

α-particles, β-particles and γ-rays are emitted by radioactive nuclei when they decay.

Which emissions can be deflected by an electric field?

A α-particles and β-particles only

B β-particles and γ-rays only

C γ-rays and α-particles only

D α-particles, β-particles and γ-rays

---

29. 0625_s20_qp_22 Q: 38

A radioactive material has a half-life of 20 days.

A sample of the material contains 8.0×10^{10} atoms.

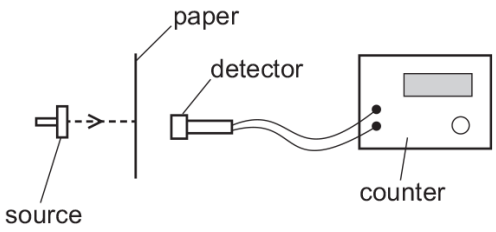
How many atomic nuclei have decayed after 60 days?

A 1.0×10^{10} **B** 4.0×10^{10} **C** 6.0×10^{10} **D** 7.0×10^{10}

---

30. 0625_s20_qp_22 Q: 39

A thin sheet of paper is placed between a radioactive source and a radiation detector. The count rate falls to a very low reading.



From this result, which type of radiation is the source emitting?

A α-particles

B β-particles

C γ-rays

D X-rays

---

31. 0625_s20_qp_22 Q: 40

α-particles, β-particles and γ-rays are emitted by radioactive nuclei when they decay.

Which emissions can be deflected by an electric field?

A α-particles and β-particles only

B β-particles and γ-rays only

C γ-rays and α-particles only

D α-particles, β-particles and γ-rays

---

32. 0625_s20_qp_23 Q: 38

A radioactive material has a half-life of 20 days.

A sample of the material contains 8.0×10^{10} atoms.

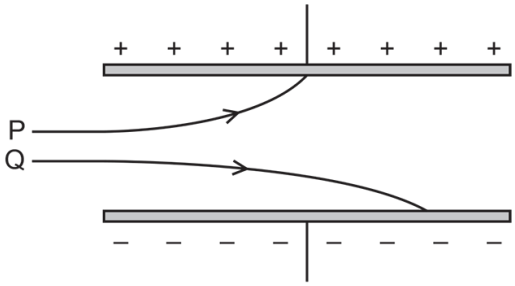
How many atomic nuclei have decayed after 60 days?

A 1.0×10^{10} **B** 4.0×10^{10} **C** 6.0×10^{10} **D** 7.0×10^{10}

---

33. 0625_w20_qp_21 Q: 39

Two beams of radiation, P and Q, enter an electric field as shown.



Which type of radiations are P and Q?

	P	Q
A	beta (β)	alpha (α)
B	beta (β)	gamma (γ)
C	gamma (γ)	alpha (α)
D	gamma (γ)	gamma (γ)

---

34. 0625_w20_qp_21 Q: 40

Which equation represents the β-decay of lead-209?

A $^{209}_{82}Pb + {}^{0}_{-1}e \rightarrow {}^{209}_{83}Bi$

B $^{209}_{82}Pb + {}^{0}_{-1}e \rightarrow {}^{209}_{81}Tl$

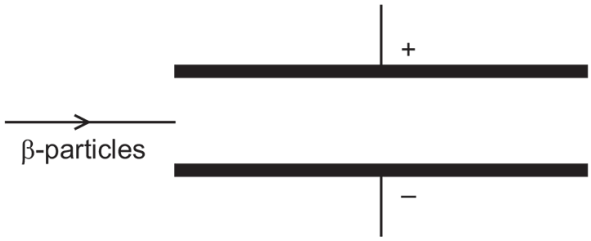
C $^{209}_{82}Pb \rightarrow {}^{209}_{83}Bi + {}^{0}_{-1}e$

D $^{209}_{82}Pb \rightarrow {}^{209}_{81}Tl + {}^{0}_{-1}e$

---

35. 0625_w20_qp_22 Q: 39

The diagram shows a beam of β-particles passing through a strong electric field.



In which direction will the β-particles be deflected?

A upwards towards the top of the page

B downwards towards the bottom of the page

C into the plane of the page

D out of the plane of the page

---

36. 0625_w20_qp_22 Q: 40

Which equation represents the β-decay of lead-209?

A $^{209}_{82}Pb + {}^{0}_{-1}e \rightarrow {}^{209}_{83}Bi$

B $^{209}_{82}Pb + {}^{0}_{-1}e \rightarrow {}^{209}_{81}Tl$

C $^{209}_{82}Pb \rightarrow {}^{209}_{83}Bi + {}^{0}_{-1}e$

D $^{209}_{82}Pb \rightarrow {}^{209}_{81}Tl + {}^{0}_{-1}e$

---

37. 0625_w20_qp_23 Q: 39

Which statement about γ-rays is correct?

A They are deflected by both electric and magnetic fields.

B They are deflected by magnetic fields but not by electric fields.

C They are deflected by electric fields but not by magnetic fields.

D They are not deflected either by electric fields or by magnetic fields.

---

38. 0625_w20_qp_23 Q: 40

Which equation represents the β-decay of lead-209?

A $^{209}_{82}Pb + {}^{0}_{-1}e \rightarrow {}^{209}_{83}Bi$

B $^{209}_{82}Pb + {}^{0}_{-1}e \rightarrow {}^{209}_{81}Tl$

C $^{209}_{82}Pb \rightarrow {}^{209}_{83}Bi + {}^{0}_{-1}e$

D $^{209}_{82}Pb \rightarrow {}^{209}_{81}Tl + {}^{0}_{-1}e$

---

39. 0625_m19_qp_22 Q: 39

A radioactive isotope of carbon ^{14}C decays by beta emission to give an isotope of nitrogen ^{14}N and a beta particle. The equation for the reaction is shown.

$$^{14}_{X}C \rightarrow {}^{14}_{7}N + {}^{0}_{Y}\beta$$

What is the value of X and of Y?

	X	Y
A	6	–1
B	6	1
C	8	–1
D	8	1

---

40. 0625_m19_qp_22 Q: 40

A beta particle is a fast moving electron.

Which statement explains how beta particles are emitted from an atom?

A An electron is emitted as a beta particle from an inner electron shell of the atom.

B An electron is emitted as a beta particle from an outer electron shell of the atom.

C A neutron changes into a proton and a beta particle is emitted from the nucleus.

D A proton changes into a neutron and a beta particle is emitted from the nucleus.

---

41. 0625_s19_qp_21 Q: 38

The chemical symbol for sodium is Na. The equation represents the radioactive decay of sodium-24.

$$^{24}_{11}\text{Na} \rightarrow {}^{24}_{x}\text{Mg} + {}^{y}_{-1}\text{e}$$

What are the numbers x and y?

	x	y
A	10	0
B	10	1
C	12	0
D	12	1

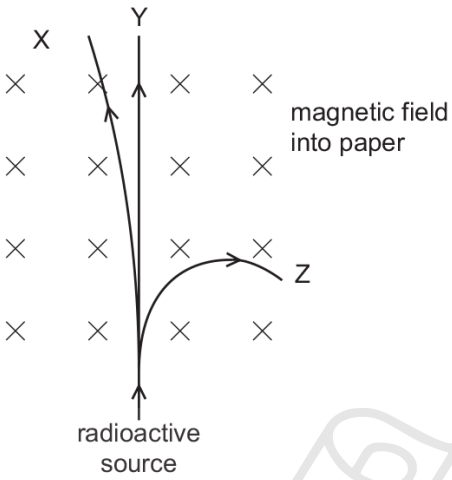
---

42. 0625_s19_qp_21 Q: 39

A radioactive source emits α-particles, β-particles and γ-rays into a vacuum where there is a magnetic field.

The magnetic field acts perpendicularly into the plane of the paper.

The paths X, Y and Z of the three types of radiation through the magnetic field are shown.

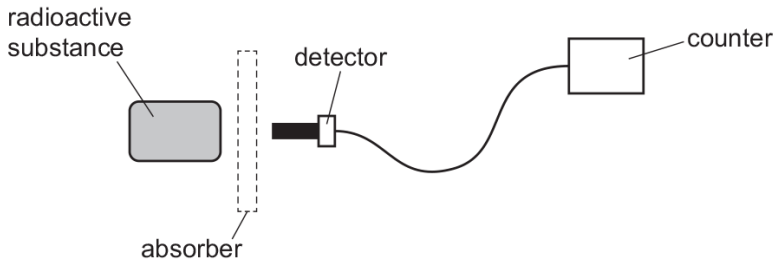


Which radiation follows path X, path Y and path Z?

	X	Y	Z
A	α-particles	β-particles	γ-rays
B	α-particles	γ-rays	β-particles
C	β-particles	α-particles	γ-rays
D	β-particles	γ-rays	α-particles

43. 0625_s19_qp_21 Q: 40

A student measures the level of radiation emitted from a radioactive substance. He places a detector very close to the substance. He puts different absorbers between the radioactive substance and the detector.



The student's results are shown. These results are corrected for background radiation.

absorber	counter reading / counts per minute
none	95
thin paper	52
few mm of aluminium	52
several cm of lead	12

Which types of radiation are being emitted by the substance?

A α-particles and β-particles only

B α-particles and γ-rays only

C β-particles and γ-rays only

D α-particles, β-particles and γ-rays

---

44. 0625_s19_qp_22 Q: 39

The chemical symbol for uranium is U. The equation represents the radioactive decay of uranium-235.

$$^{235}_{92}U \rightarrow {}^{x}_{y}Th + {}^{4}_{2}He$$

What are the numbers x and y?

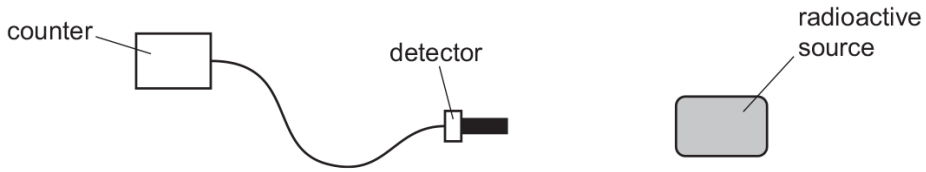
	x	y
A	231	94
B	231	90
C	239	94
D	239	90

---

45. 0625_s19_qp_22 Q: 40

An experiment is done to measure the radiation from a radioactive source that has a half-life of 10 minutes.

The source is placed close to a detector that is connected to a counter, as shown.



The average background count-rate is 20 counts / minute.

At the start of the experiment, the count-rate recorded by the counter is 1000 counts / minute.

What is the count-rate 10 minutes later?

A 490 counts / minute

B 500 counts / minute

C 510 counts / minute

D 530 counts / minute

---

46. 0625_s19_qp_23 Q: 39

Which statement about γ-radiation is correct?

A It consists of very small charged particles.

B It is a form of electromagnetic radiation.

C It is less penetrating than β-radiation.

D It is more highly ionising than α-radiation.

---

47. 0625_s19_qp_23 Q: 40

A radium nucleus with nucleon number 226 decays by emitting an α-particle.

The proton number of radium is 88.

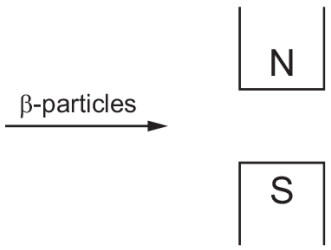
What are the nucleon number and proton number for the nucleus produced by this decay?

	nucleon number	proton number
A	222	86
B	222	87
C	226	86
D	226	87

---

48. 0625_w19_qp_21 Q: 39

The diagram shows β-particles being directed between the poles of a magnet.



In which direction will the particles be deflected?

A into the page

B out of the page

C towards the bottom of the page

D towards the top of the page

---

49. 0625_w19_qp_21 Q: 40

Why are some radioactive sources stored in boxes made from lead?

A Lead absorbs emissions from the radioactive sources.

B Lead decreases the half-life of radioactive sources.

C Lead increases the half-life of radioactive sources.

D Lead repels emissions from the radioactive sources.

---

50. 0625_w19_qp_22 Q: 38

Plutonium-238 decays by the emission of an α-particle.

Which equation represents the decay of a plutonium-238 nucleus?

A $^{238}_{94}Pu \rightarrow {}^{238}_{95}U + {}^{0}_{-1}\alpha$

B $^{238}_{94}Pu \rightarrow {}^{234}_{92}U + {}^{4}_{2}\alpha$

C $^{238}_{94}Pu \rightarrow {}^{234}_{92}U + {}^{2}_{4}\alpha$

D $^{238}_{94}Pu \rightarrow {}^{242}_{96}U + {}^{4}_{2}\alpha$

---

51. 0625_w19_qp_22 Q: 39

A radioactive isotope has a half-life of 8 days.

A detector close to a sample of this isotope gives a count rate of 200 counts per minute.
Without the source, the background count is 20 counts per minute.

What is the count rate due to the source after 8 days?

A 80 counts per minute

B 90 counts per minute

C 100 counts per minute

D 110 counts per minute

---

52. 0625_w19_qp_23 Q: 40

The background count rate measured by a radiation counter is 40 counts per minute.

With the counter close to a radioactive source, the counter reading is 960 counts per minute.

The half-life of the source is 20 minutes.

What is the counter reading one hour later?

A 115 counts per minute

B 120 counts per minute

C 155 counts per minute

D 160 counts per minute

---

53. 0625_m18_qp_22 Q: 38

The radioactive isotope of hydrogen undergoes beta decay to the isotope $^{3}_{2}\mathrm{He}$.

What is the nuclide notation for the hydrogen isotope?

A $^{1}_{1}\mathrm{H}$ **B** $^{2}_{1}\mathrm{H}$ **C** $^{3}_{1}\mathrm{H}$ **D** $^{4}_{2}\mathrm{H}$

---

54. 0625_m18_qp_22 Q: 39

When measuring the emissions from a radioactive rock brought into the laboratory, a teacher mentions that background radiation must be taken into account.

What is this background radiation?

A infra-red radiation from warm objects in the laboratory

B infra-red radiation from the Sun

C ionising radiation from the radioactive rock brought into the laboratory

D ionising radiation in the laboratory when the radioactive rock is not present

---

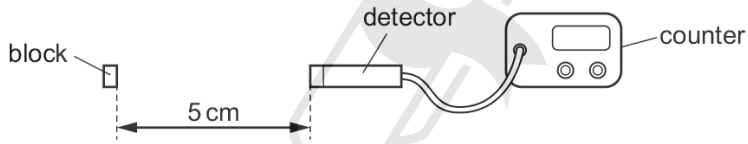
55. 0625_m18_qp_22 Q: 40

Solid caesium-137 decays by the emission of a β-particle to form solid barium-137, which emits a γ-ray.

The barium-137 undergoes no further decay. The half-life of caesium-137 is 33 years.

A block of pure caesium-137 has a mass of 2.0 μg.

The diagram shows a radiation detector a distance of 5 cm from the block. The detector registers a count rate of 2000 counts / second.



Which statement is **not** correct?

A After 33 years, the mass of the block is 1.0 μg.

B After 66 years, the sample contains 1.5 μg of barium.

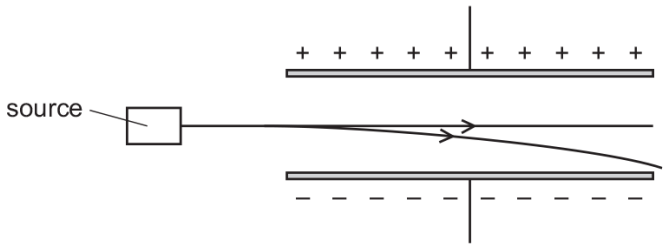
C With 5 cm of lead between the block and the detector, the count rate is just above background level.

D With 2 mm of aluminium between the block and the detector, the count rate is reduced significantly.

---

56. 0625_s18_qp_21 Q: 39

The diagram shows emissions from a source passing into the electric field between two charged plates.



What is emitted by this source?

A neutrons and γ-rays only

B α-particles and β-particles only

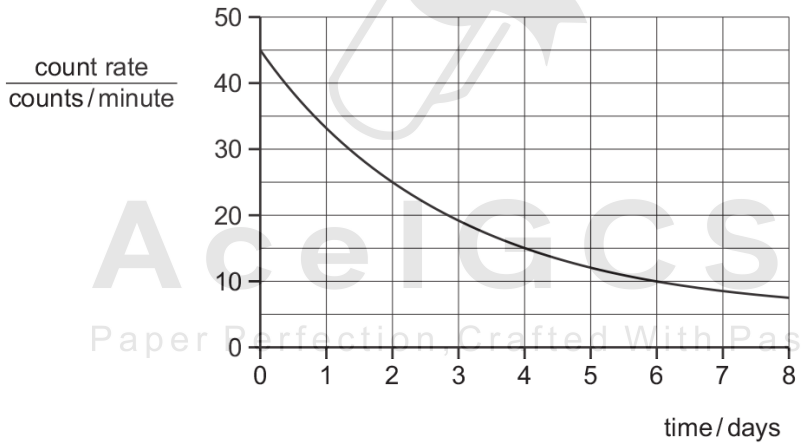
C α-particles and γ-rays only

D β-particles and γ-rays only

---

57. 0625_s18_qp_21 Q: 40

The graph shows how the count rate registered by a counter near to a sample of a radioactive isotope changes over a period of a few days. The background count rate is 5 counts per minute.



What is the half-life of the isotope?

A 2.0 days **B** 2.5 days **C** 3.0 days **D** 4.0 days

---

58. 0625_s18_qp_22 Q: 38

An isotope of polonium has the nuclide notation $^{218}_{84}\text{Po}$.

A nucleus of this isotope decays by emitting an α-particle. A β-particle is then emitted to form nuclide X.

What is the notation for nuclide X?

A $^{214}_{81}\text{X}$ **B** $^{213}_{82}\text{X}$ **C** $^{213}_{83}\text{X}$ **D** $^{214}_{83}\text{X}$

---

59. 0625_s18_qp_22 Q: 39

The table compares the penetrating abilities and ionising effects of α-radiation and of γ-radiation.

Which row is correct?

	least penetrating	most ionising
A	α	α
B	α	γ
C	γ	α
D	γ	γ

---

60. 0625_s18_qp_23 Q: 38

The radiation from a radioactive source passes between two metal plates, and is deflected as shown in the diagram. Between the plates there is a magnetic field directed into the plane of the paper, as indicated by the crosses.

Only one type of radiation is present.

Which situation is possible?

A The source emits alpha particles and there is an upwards electric field between the plates.

B The source emits alpha particles and there is no electric field between the plates.

C The source emits beta particles and there is an upwards electric field between the plates.

D The source emits gamma radiation and there is a downwards electric field between the plates.

---

61. 0625_s18_qp_23 Q: 39

The nucleus of an isotope of nitrogen (N) absorbs a neutron. It then decays into an isotope of carbon (C) and emits x.

$$^{1}_{0}n + {}^{14}_{7}N \rightarrow {}^{14}_{6}C + x$$

What is x?

A α-particle

B β-particle

C γ-radiation

D proton

---

62. 0625_w18_qp_21 Q: 38

When a uranium-235 nucleus absorbs a neutron, it becomes unstable and undergoes fission.

The fission process produces a barium (Ba) nucleus, a krypton (Kr) nucleus and 3 neutrons.

The fission process is represented by the nuclear equation shown.

$$^{1}_{0}n + {}^{235}_{92}U \rightarrow {}^{144}_{56}Ba + {}^{\cdots}_{\cdots}Kr + 3\,{}^{1}_{0}n$$

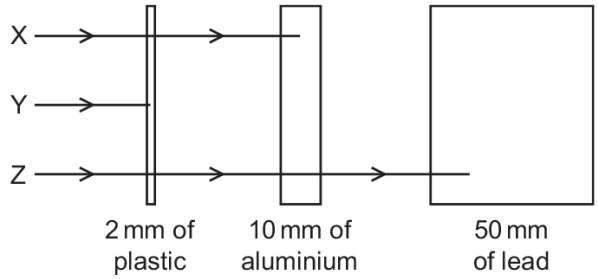
Which symbol represents the resulting krypton nucleus?

A $^{89}_{36}Kr$ **B** $^{91}_{34}Kr$ **C** $^{91}_{35}Kr$ **D** $^{91}_{36}Kr$

---

63. 0625_w18_qp_21 Q: 39

The diagram shows the paths of three different types of radiation X, Y and Z.



Which row correctly identifies X, Y and Z?

	X	Y	Z
A	α-particles	β-particles	γ-rays
B	β-particles	α-particles	γ-rays
C	β-particles	γ-rays	α-particles
D	γ-rays	α-particles	β-particles

64. 0625_w18_qp_21 Q: 40

A scientist measures the count rate of a radioactive sample in a laboratory over a period of 12 weeks.

The background radiation count rate in the laboratory remains constant at 20 counts per minute.

The table shows the scientist's results before the background radiation count rate is taken into account.

time / weeks	count rate / counts per minute
0	100
2	80
4	65
6	54
8	45
10	39
12	34

In which range does the half-life of the radioactive isotope lie?

A between 4 and 6 weeks

B between 6 and 8 weeks

C between 8 and 10 weeks

D more than 12 weeks

---

65. 0625_w18_qp_22 Q: 38

A radioactive nucleus $^{220}_{86}Rn$ decays in two stages to produce $^{212}_{82}Pb$.

Which two particles are emitted in this process?

A an α-particle and a β-particle

B an α-particle and a proton

C two α-particles

D two β-particles

---

66. 0625_w18_qp_22 Q: 40

The count rate measured when near a radioactive source drops from 542 counts per minute to 94 counts per minute in 12 hours. The background count remains constant at 30 counts per minute.

What is the half-life of the source?

A 2 hours **B** 3 hours **C** 4 hours **D** 8 hours

---

67. 0625_w18_qp_23 Q: 38

A nucleus of $^{228}_{88}Ra$ decays into an isotope of actinium, which then decays into a nucleus of $^{228}_{90}Th$.

What types of radiation have been emitted during this process?

A one alpha particle only

B one alpha particle and one beta particle

C two alpha particles

D two beta particles

---

68. 0625_w18_qp_23 Q: 40

The count rate due to a sample of a radioactive isotope is measured for 80 minutes.

time / minutes	count rate / counts / second
0	480
20	380
40	300
60	240
80	190

What is the half-life of the isotope?

A 20 minutes **B** 40 minutes **C** 60 minutes **D** 80 minutes

---

69. 0625_m17_qp_22 Q: 37

A radioactive substance emits radiation at a rate of 600 emissions per second. Four hours later, it emits radiation at a rate of 300 emissions per second.

What is the half-life of the substance and what is the rate of emission after a further four hours?

	half-life / hours	rate of emission after a further four hours / emissions per second
A	2	0
B	2	150
C	4	0
D	4	150

---

70. 0625_m17_qp_22 Q: 39

The equation represents an isotope of radium Ra decaying to an isotope of radon Rn with the emission of particle X.

$$^{226}_{88}\text{Ra} \rightarrow {}^{222}_{86}\text{Rn} + \text{X}$$

What is particle X?

A $^{0}_{-1}\text{e}$ **B** $^{1}_{1}\text{H}$ **C** $^{4}_{2}\text{He}$ **D** $^{1}_{0}\text{n}$

---

71. 0625_m17_qp_22 Q: 40

An atomic nucleus decays by one or more radioactive decay processes.

What causes the proton number to **decrease** by 1?

A α-decay followed by β-decay

B α-decay only

C β-decay followed by γ-decay

D β-decay only

---

72. 0625_s17_qp_21 Q: 38

A nuclide of element X undergoes β-decay.

Which statement is correct?

A The nucleon number increases by 1.

B The nucleon number stays the same.

C The product is another nuclide of an isotope of X.

D The proton number decreases by 1.

---

73. 0625_s17_qp_21 Q: 40

A detector of ionising radiation gives a background reading of 20 counts / minute.

A radioactive isotope with a half-life of 2.0 days is brought near to the detector. The reading on the detector increases to 100 counts / minute.

How long does it take for the reading on the detector to decrease to 40 counts / minute?

A 2.0 days **B** 4.0 days **C** 5.0 days **D** 10 days

---

74. 0625_s17_qp_22 Q: 40

A sample of a radioactive isotope emits particles at a rate of 240 per minute.

After 48 hours the rate of emission has decreased to 15 per minute.

What is the half-life of the radioactive material?

A 4.0 hours **B** 8.0 hours **C** 12 hours **D** 16 hours

---

75. 0625_s17_qp_23 Q: 39

A sample of radioactive isotope is decaying.

The nuclei of which atoms will decay first?

A It is impossible to know because radioactive decay is random.

B It is impossible to know unless the age of the material is known.

C The atoms near the centre will decay first because they are surrounded by more atoms.

D The atoms near the surface will decay first because the radiation can escape more easily.

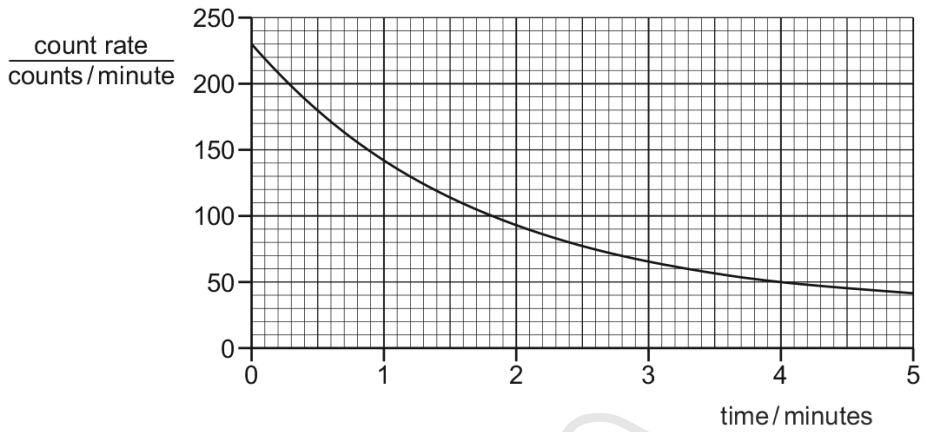
---

76. 0625_s17_qp_23 Q: 40

A student determines the half-life of a radioactive isotope.

The student uses a detector over five minutes and plots a graph showing how the count rate shown on the detector varies with time.

The count rate due to background radiation is 30 counts per minute.



What is the half-life of this isotope?

A 0.30 minutes

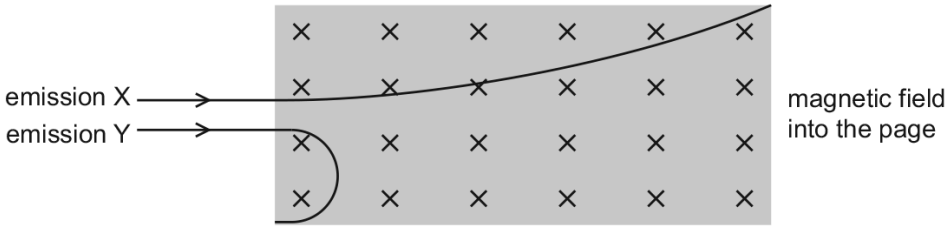
B 1.2 minutes

C 1.5 minutes

D 5.0 minutes

77. 0625_w17_qp_21 Q: 38

Emissions X and Y from radioactive material are passed through a magnetic field. The diagram shows the direction of the emissions, the direction of the magnetic field and the effect on the emissions.



Which type of emission is X, and which type of emission is Y?

	emission X	emission Y
A	α-particles	β-particles
B	α-particles	γ-rays
C	β-particles	α-particles
D	β-particles	γ-rays

---

78. 0625_w17_qp_21 Q: 39

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

A half of the time taken for all of the original nuclei to decay

B the time taken for half of the original nuclei to decay

C the time taken for the charges on all the nuclei to halve

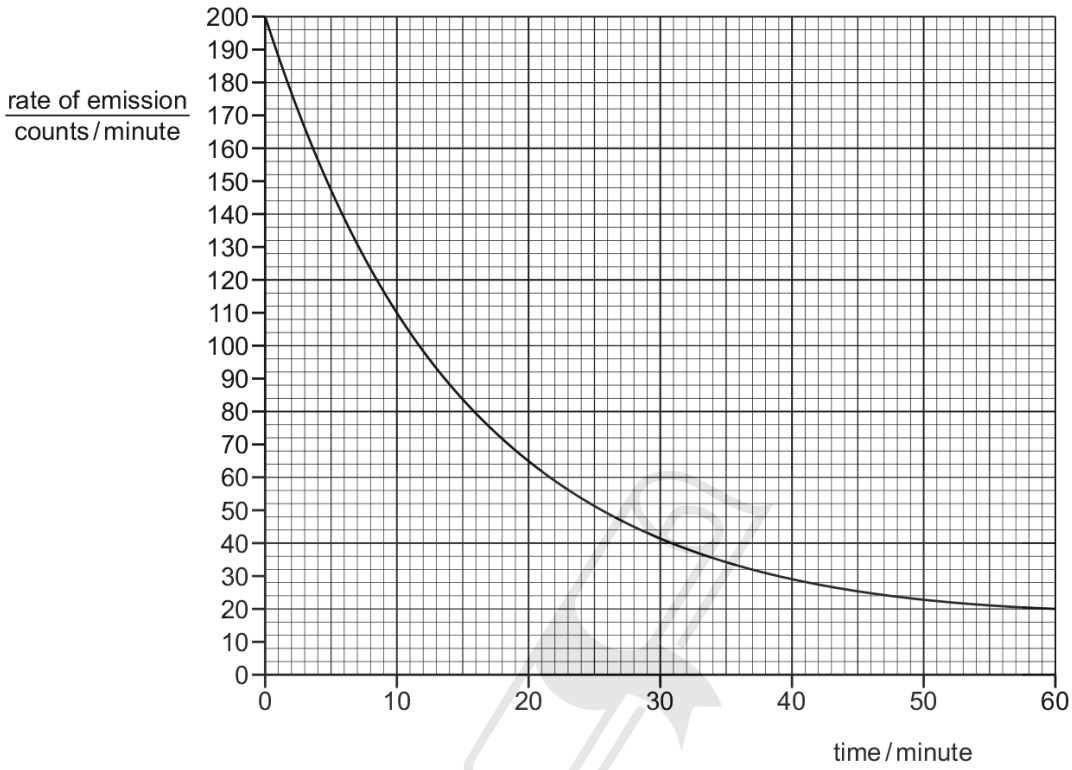
D the time taken for the mass of each nucleus to halve

---

79. 0625_w17_qp_21 Q: 40

The rate of emission of a radioactive source is measured until the reading reaches the background rate of 20 counts per minute.

The results are shown.



What is the best estimate of the half-life of the source?

A 10 minutes

B 12 minutes

C 14 minutes

D 30 minutes

---

80. 0625_w17_qp_22 Q: 39

Which row describes the behaviour of γ-rays in an electric field and in a magnetic field?

	electric field	magnetic field
A	deflected	deflected
B	deflected	undeflected
C	undeflected	deflected
D	undeflected	undeflected

---

81. 0625_w17_qp_22 Q: 40

A radioactive source has a half-life of 0.5 hours.

A detector near the source shows a reading of 6000 counts per second.

Background radiation can be ignored.

What is the reading on the detector 1.5 hours later?

A 750 counts per second

B 1500 counts per second

C 2000 counts per second

D 3000 counts per second

---

82. 0625_w17_qp_23 Q: 38

Radioactive carbon-14 decays to nitrogen-14 by the emission of a particle.

$$^{14}_{6}C \rightarrow {}^{14}_{7}N + \text{particle}$$

Which particle has been emitted in this process?

A a β-particle

B an α-particle

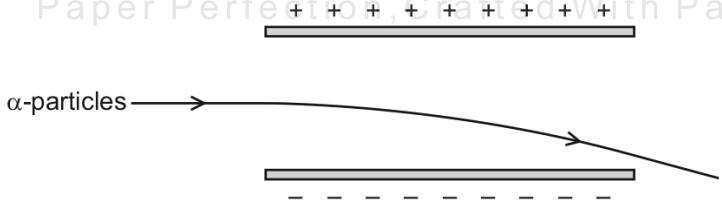
C a neutron

D a proton

---

83. 0625_w17_qp_23 Q: 39

As α-particles pass through the electric field between two charged plates, they are deflected downwards.



What happens to γ-rays passing through the same electric field?

A They are deflected downwards more than the α-particles.

B They are deflected upwards.

C They are not deflected at all.

D They follow the same path as the α-particles.

---

84. 0625_w17_qp_23 Q: 40

Radioactive iodine-131 emits β-particles and has a half-life of 8 days. It decays to produce xenon-131.

Which statement about this decay is correct?

A After 8 days no more β-particles are emitted.

B After 8 days the number of xenon-131 atoms has halved.

C After 16 days the iodine-131 has decayed completely.

D After 16 days the number of iodine-131 atoms has reduced to one quarter.

---

85. 0625_m16_qp_22 Q: 38

A nucleus of a radioactive substance $^{218}_{84}$Po undergoes an α-decay followed by a β-decay.

What are the nucleon (mass) number and proton (atomic) number of the nuclide formed after both decays have happened?

	nucleon number	proton number
A	214	85
B	216	85
C	214	83
D	216	83

---

86. 0625_m16_qp_22 Q: 39

A scientist carries out an experiment using a sealed source which emits β-particles. The range of the β-particles in the air is about 30 cm.

Which precaution is the most effective to protect the scientist from the radiation?

A handling the source with long tongs

B keeping the temperature of the source low

C opening all windows in the laboratory

D washing his hands before leaving the laboratory

---

87. 0625_m16_qp_22 Q: 40

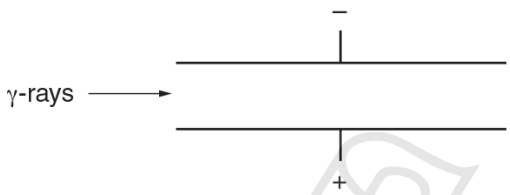
Which row describes the nature of α-particles and of γ-rays?

	α-particles	γ-rays
A	helium nuclei	electromagnetic radiation
B	helium nuclei	electrons
C	protons	electromagnetic radiation
D	protons	electrons

---

88. 0625_p16_qp_20 Q: 39

A beam of γ-rays passes between two charged metal plates as shown in the diagram.



How do the γ-rays pass between the two charged plates?

A The rays are deflected in a direction perpendicular to the page

B The rays are deflected towards the negative plate.

C The rays are deflected towards the positive plate.

D The rays will continue in the same direction.

---

89. 0625_p16_qp_20 Q: 40

A powder contains 400 mg of a radioactive isotope that emits α-particles.

The half-life of the isotope is 5 days.

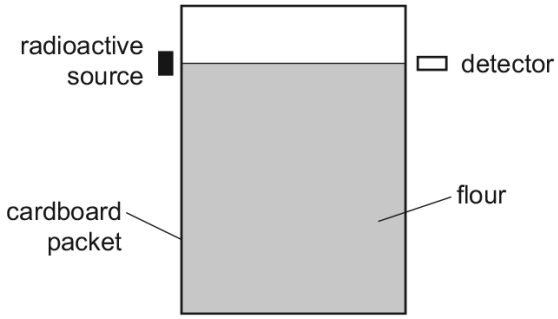
What mass of this isotope remains after 10 days?

A 0 mg **B** 40 mg **C** 100 mg **D** 200 mg

---

90. 0625_s16_qp_21 Q: 37

The arrangement shown is used to check whether the flour inside a cardboard packet is above a certain level. If it is above this level, the flour absorbs the radiation from the source so that it doesn't reach the detector.



Which type of radiation is suitable to use?

A α-particles only

B β-particles only

C either α-particles or β-particles

D γ-rays only

---

91. 0625_s16_qp_21 Q: 38

A nucleus of americium $^{243}_{95}Am$ emits an α-particle to form a nucleus of neptunium (Np).

Which equation represents this decay?

A $^{243}_{95}Am \rightarrow {}^{247}_{97}Np + {}^{4}_{2}\alpha$

B $^{243}_{95}Am \rightarrow {}^{243}_{96}Np + {}^{0}_{-1}\alpha$

C $^{243}_{95}Am \rightarrow {}^{243}_{94}Np + {}^{0}_{-1}\alpha$

D $^{243}_{95}Am \rightarrow {}^{239}_{93}Np + {}^{4}_{2}\alpha$

---

92. 0625_s16_qp_21 Q: 40

A reading is taken every 10 minutes of the number of emissions per second from a radioactive source. The table shows the readings.

time / min	number of emissions per second
0	800
10	560
20	400
30	280
40	200
50	140
60	100

What is the half-life of the source?

A 10 min **B** 20 min **C** 40 min **D** 60 min

---

93. 0625_s16_qp_22 Q: 39

A radioactive decay can be represented as shown.

$$^{233}_{91}\text{Pa} \rightarrow {}^{233}_{92}\text{U}$$

The equation is incomplete.

In this decay, the nucleus changes by

A absorbing a neutron.

B absorbing a proton.

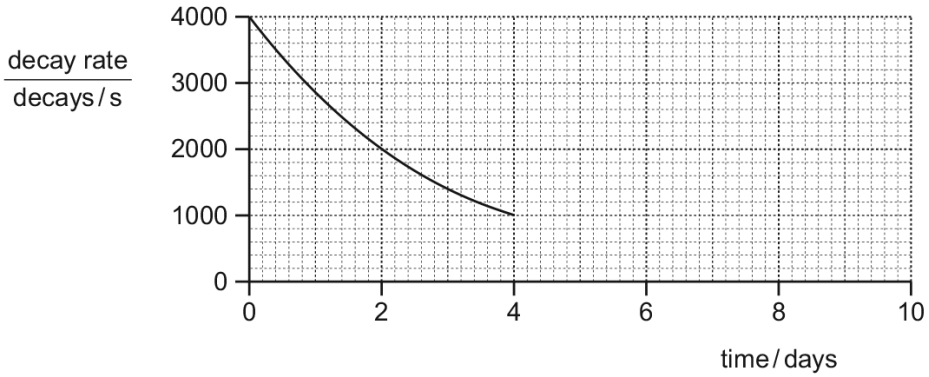
C emitting an α-particle.

D emitting a β-particle.

---

94. 0625_s16_qp_22 Q: 40

The graph shows how the decay rate of a radioactive source changes with time.



What will be the decay rate at 8 days?

A 0 decays / s

B 125 decays / s

C 250 decays / s

D 500 decays / s

---

95. 0625_s16_qp_23 Q: 36

The diagram shows a shaded area where the direction of a magnetic field is into the page.

A beam of β-particles enters the field as shown.

In which direction is the beam of β-particles deflected as they enter the magnetic field?

A into the page

B out of the page

C down the page

D up the page

---

96. 0625_s16_qp_23 Q: 39

Sodium-24 decays to magnesium-24 according to the following equation.

$$^{24}_{11}\text{Na} \rightarrow {}^{24}_{12}\text{Mg} + \text{emitted particle}$$

What is the emitted particle?

A α-particle

B β-particle

C neutron

D proton

---

97. 0625_s16_qp_23 Q: 40

The reading on a detector placed near a radioactive material is 536 counts per second.

The background count rate is 44 counts per second.

The half-life of the radioactive material is 34 hours.

What is the reading on the detector after 68 hours?

A 44 counts per second

B 123 counts per second

C 134 counts per second

D 167 counts per second

---

98. 0625_w16_qp_21 Q: 39

A nucleus undergoes radioactive decay. The proton number increases by one. The nucleon number does not change.

Which particle has been emitted in this decay?

A a neutron

B a proton

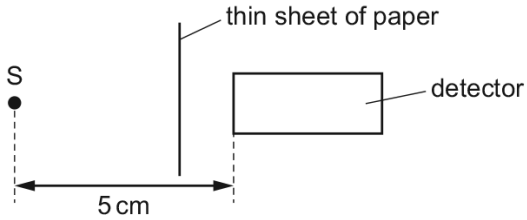
C an α-particle

D a β-particle

---

99. 0625_w16_qp_21 Q: 40

Radioactive source S emits α-particles, β-particles and γ-rays. A detector is placed 5 cm away from S. A thin sheet of paper is placed as shown in the diagram.



Which emissions from the source can be detected?

A α-particles and β-particles only

B α-particles and γ-rays only

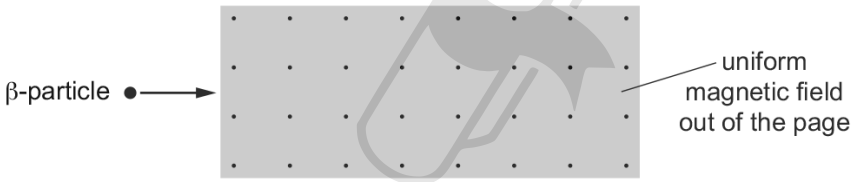
C β-particles and γ-rays only

D α-particles, β-particles and γ-rays

---

100. 0625_w16_qp_22 Q: 38

A β-particle enters a uniform magnetic field directed out of the page.



In which direction is the β-particle deflected by the field?

A towards the top of the page

B into the page

C out of the page

D towards the bottom of the page

---

101. 0625_w16_qp_22 Q: 39

The radioactive nucleus $^{214}_{83}Bi$ decays to another nucleus by the emission of a β-particle.

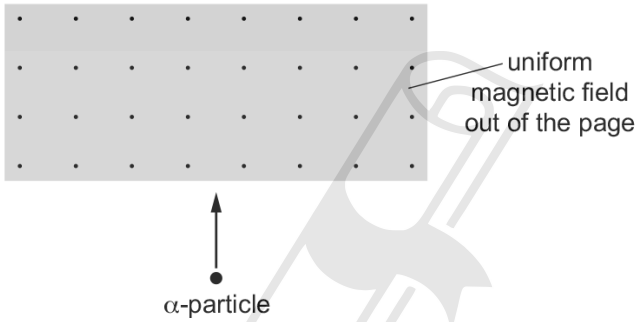
What is the proton number and what is the nucleon number of the nucleus formed by this decay?

	proton number	nucleon number
A	81	210
B	81	212
C	84	213
D	84	214

---

102. 0625_w16_qp_23 Q: 38

An α-particle enters a uniform magnetic field directed out of the page.



In which direction is the α-particle deflected by the field?

A into the page

B out of the page

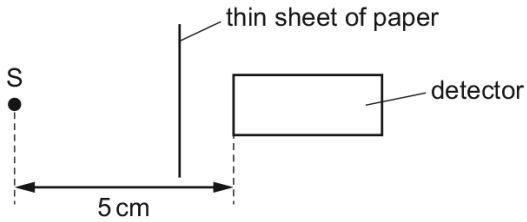
C to the left

D to the right

---

103. 0625_w16_qp_23 Q: 39

Radioactive source S emits α-particles, β-particles and γ-rays. A detector is placed 5 cm away from S. A thin sheet of paper is placed as shown in the diagram.



Which emissions from the source can be detected?

A α-particles and β-particles only

B α-particles and γ-rays only

C β-particles and γ-rays only

D α-particles, β-particles and γ-rays

---

104. 0625_w16_qp_23 Q: 40

Uranium-238 is radioactive and decays to thorium-234 by the emission of a particle.

$$^{238}_{92}U \rightarrow {}^{234}_{90}Th + \text{particle}$$

Which particle is emitted in this process?

A an α-particle

B a β-particle

C a neutron

D a proton

---

105. 0625_m15_qp_12 Q: 38

Which row shows the relative ionising effects and penetrating abilities of α-particles and β-particles?

	ionising effect	penetrating ability
A	α greater than β	α greater than β
B	α greater than β	α less than β
C	α less than β	α greater than β
D	α less than β	α less than β

---

106. 0625_m15_qp_12 Q: 39

A radioactive substance has a half-life of 2 weeks. At the beginning of an investigation, a sample of the substance emits 3000 β-particles per minute.

How many β-particles will it emit per minute after 6 weeks?

A 0 **B** 375 **C** 500 **D** 1500

---

107. 0625_s15_qp_11 Q: 38

Which row gives the properties of the radiation from radioactive materials?

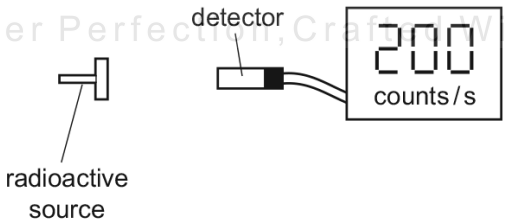
	most penetrating radiation	most highly ionising radiation
A	α	β
B	β	γ
C	γ	α
D	γ	γ

---

108. 0625_s15_qp_11 Q: 39

In a laboratory, a detector of ionising radiation records an average background count rate of 8 counts per second.

A radioactive source is now placed close to the detector. The count rate on the detector rises to 200 counts per second.



What is the count rate due to radiation from the radioactive source?

A 25 counts / s

B 192 counts / s

C 200 counts / s

D 208 counts / s

---

109. 0625_s15_qp_12 Q: 38

Which statement about α-radiation is correct?

A It is a stream of fast-moving electrons.

B It is a form of electromagnetic radiation.

C It is more highly ionising than γ-radiation.

D It is more penetrating than β-radiation.

---

110. 0625_s15_qp_12 Q: 39

A radioactive source produces a count rate on a detector of 1600 counts/s.

After 32 hours the count rate has fallen to 100 counts/s.

Both count rates have been corrected for background radiation.

What is the half-life of the source?

A 2.0 hours **B** 6.4 hours **C** 8.0 hours **D** 16 hours

---

111. 0625_s15_qp_13 Q: 38

α, β and γ-radiations are emitted by radioactive substances.

Which statement is correct?

A α-radiation consists of charged particles and is the most highly ionising radiation.

B β-radiation consists of charged particles and is the most penetrating radiation.

C β-radiation consists of uncharged particles and is the least highly ionising radiation.

D γ-radiation consists of uncharged particles and is the least penetrating radiation.

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112. 0625_s15_qp_13 Q: 39

The nucleus of an americium atom contains 146 neutrons and 95 protons. It decays by emitting an α-particle.

How many neutrons and how many protons remain in the nucleus when this form of americium decays?

	number of neutrons remaining	number of protons remaining
A	142	93
B	142	95
C	144	93
D	144	95

---

113. 0625_w15_qp_11 Q: 38

The nuclide symbol for radioactive polonium is $^{210}_{84}Po$.

A nucleus of this type of polonium emits an α-particle.

What is the proton number (atomic number) of the nucleus after it has emitted the α-particle?

A 82 **B** 83 **C** 84 **D** 85

---

114. 0625_w15_qp_11 Q: 39

A student investigates how the radiation from a radioactive source changes with time.

The table shows the results from the detector used by the student.

time / minutes	count rate / counts per minute
0	340
2.0	180
4.0	100
6.0	60
8.0	40

The experiment is repeated by many other students, who also measure the count rate every two minutes.

The half-life of the source is known to be exactly 2.0 minutes.

Why is the measured count rate **always greater** than half the previous value?

A Radioactive emissions occur randomly with time.

B The detector used is very close to the source.

C There is background radiation present.

D The radioactive source is decaying.

---

115. 0625_w15_qp_12 Q: 38

Radioactive carbon-14 decays into nitrogen by emitting a β-particle. The equation below represents the decay.

$$^{14}_{P}C \rightarrow {}^{14}_{7}N + {}^{0}_{Q}\beta$$

What are the values of P and Q?

	P	Q
A	6	1
B	6	–1
C	8	1
D	8	–1

---

116. 0625_w15_qp_13 Q: 38

A radioactive nucleus contains 128 nucleons. It emits a β-particle.

How many nucleons are now in the nucleus?

A 124 **B** 127 **C** 128 **D** 129

---

117. 0625_s14_qp_11 Q: 38

The table shows the results of an experiment to find the half-life of a radioactive substance.

time / s	count rate from substance / counts / second
0	150
60	120
120	95
180	75
240	60

What is the half-life of the substance?

A 60 seconds

B 120 seconds

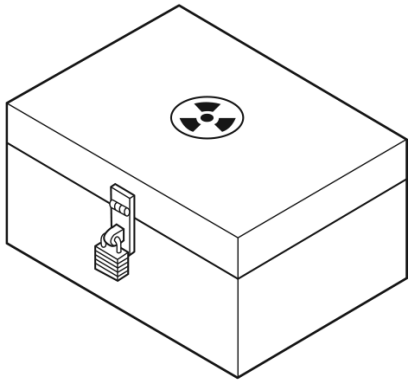
C 180 seconds

D 240 seconds

---

118. 0625_s14_qp_11 Q: 39

The diagram shows a box used for storing radioactive sources.



Which material is best for lining the box to prevent the escape of most radioactive emissions?

A aluminium

B copper

C lead

D steel

---

119. 0625_s14_qp_12 Q: 38

Compared with β-particles and γ-rays, α-particles

A are the only type of radiation to carry a charge.

B have the greatest ionising effect.

C have the greatest penetrating effect.

D have the smallest mass.

---

120. 0625_s14_qp_13 Q: 39

The table shows the results of an experiment to find the half-life of a radioactive substance.

time / s	count rate from substance / counts / second
0	150
60	120
120	95
180	75
240	60

What is the half-life of the substance?

A 60 seconds

B 120 seconds

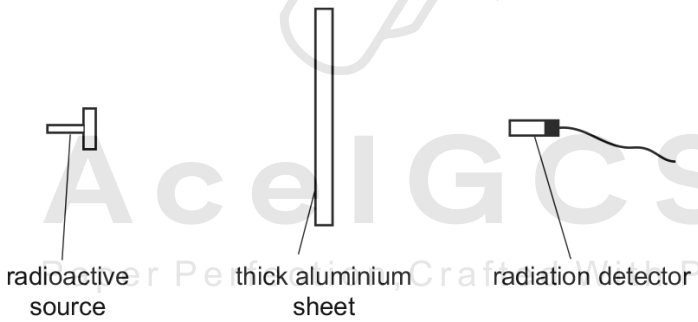
C 180 seconds

D 240 seconds

---

121. 0625_w14_qp_11 Q: 38

The diagram shows a radioactive source, a thick aluminium sheet and a radiation detector.



The radiation detector shows a reading greater than the background reading.

Which type of radiation is being emitted by the source and detected by the detector?

A α-radiation

B β-radiation

C γ-radiation

D infra-red radiation

---

122. 0625_w14_qp_11 Q: 39

The count rate from a radioactive isotope is recorded every hour. The count rate is corrected for background radiation.

The table shows the readings.

time / hours	0	1	2	3	4	5
corrected count rate / counts / s	800	620	480	370	290	220

What estimate of the half-life of the isotope can be obtained from the readings in the table?

A between 1 and 2 hours

B between 2 and 3 hours

C between 3 and 4 hours

D between 4 and 5 hours

---

123. 0625_w14_qp_13 Q: 39

The half-life of a radioactive substance is 10 minutes. A sample of the radioactive substance contains 2000 nuclei.

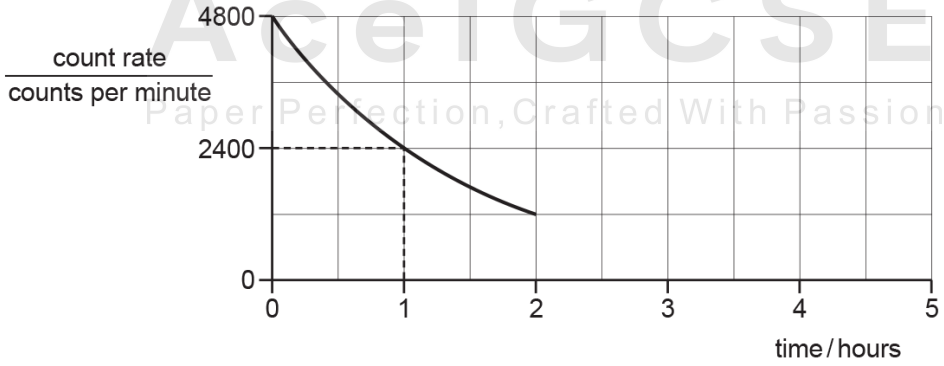
How many radioactive nuclei were in the sample half an hour earlier?

A 250 **B** 4000 **C** 6000 **D** 16 000

---

124. 0625_s13_qp_11 Q: 39

The graph shows how the count rate on a detector due to a radioactive source changes with time.



What is the count rate at 5.0 hours?

A 960 counts per minute

B 600 counts per minute

C 150 counts per minute

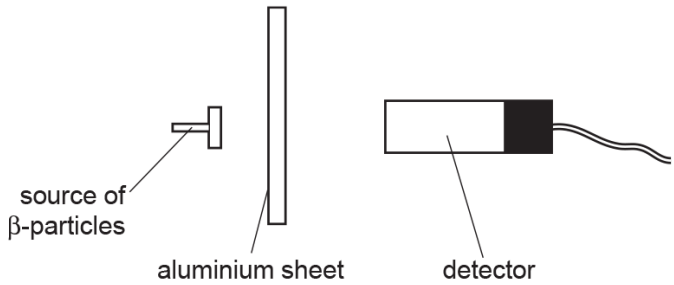
D 0 counts per minute

---

125. 0625_s13_qp_12 Q: 39

A radiation detector is placed close to a source of β-particles.

Aluminium sheets of increasing thickness are placed between the source and the detector.



Eventually a sheet which is 2.0 cm thick is used. The reading on the detector decreases, but does not fall to zero.

Why does the reading not fall to zero?

A Some of the β-particles go round the edges of the sheet.

B The detector is too close to the source.

C There is always some background radiation.

D The sheet can never be thick enough to absorb all the β-particles.

---

126. 0625_w13_qp_11 Q: 39

A radioactive substance emits a particle from the nucleus of one of its atoms. The particle consists of two protons and two neutrons.

What is the name of this process?

A α-emission

B β-emission

C γ-emission

D nuclear fission

---

127. 0625_w13_qp_13 Q: 39

Why are some radioactive sources stored in boxes made from lead?

A Lead absorbs emissions from the radioactive sources.

B Lead decreases the half-life of radioactive sources.

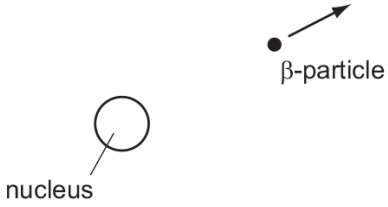
C Lead increases the half-life of radioactive sources.

D Lead repels emissions from the radioactive sources.

---

128. 0625_s12_qp_11 Q: 38

A radioactive nucleus emits a β-particle.



What happens to the proton number (atomic number) of the nucleus?

A It stays the same.

B It increases by 1.

C It decreases by 2.

D It decreases by 4.

---

129. 0625_s12_qp_12 Q: 38

When measuring the emissions from a radioactive rock brought into the laboratory, a teacher mentions that background radiation must be taken into account.

What is this background radiation?

A infra-red radiation from warm objects in the laboratory

B infra-red radiation from the Sun

C ionising radiation from the radioactive rock brought into the laboratory

D ionising radiation in the laboratory when the radioactive rock is not present

---

130. 0625_w12_qp_11 Q: 38

How does the ionising effect of α-particles compare with that of β-particles and γ-rays?

	compared with β-particles	compared with γ-rays
A	α-particles are less strongly ionising	α-particles are less strongly ionising
B	α-particles are less strongly ionising	α-particles are more strongly ionising
C	α-particles are more strongly ionising	α-particles are less strongly ionising
D	α-particles are more strongly ionising	α-particles are more strongly ionising

---

131. 0625_w12_qp_11 Q: 39

The table shows the count rates obtained from four radioactive sources. The measurements were taken at noon on four consecutive days.

Which source has the longest half-life?

	count rate/counts per second			
	day 1	day 2	day 3	day 4
A	100	48	27	11
B	200	142	99	69
C	300	297	292	290
D	400	202	99	48

---

132. 0625_w12_qp_13 Q: 38

How do the ionising effect and the penetrating ability of α-particles compare with those of β-particles and γ-rays?

	ionising effect	penetrating ability
A	higher	higher
B	higher	lower
C	lower	higher
D	lower	lower

---

133. 0625_w12_qp_13 Q: 39

A student is investigating how the radiation from a radioactive source changes with time.

The table shows the results from the detector.

time / min	count-rate / counts per min
0	340
2	180
4	100
6	60
8	40

The experiment is repeated by other students, who also measure the count-rate every two minutes.

The half-life of the source is known to be exactly two minutes.

Why is the measured count-rate **always** higher than half the previous value?

A Radioactive emissions occur randomly with time.

B The detector used is very close to the source.

C There is background radiation present.

D The radioactive source is decaying.

SN	Paper	Q. No.	Answer
01	0625_m22_qp_22	38	A
02	0625_m22_qp_22	40	B
03	0625_m21_qp_22	39	B
04	0625_m21_qp_22	40	B
05	0625_s21_qp_21	39	A
06	0625_s21_qp_21	40	B
07	0625_s21_qp_22	39	B
08	0625_s21_qp_23	38	A
09	0625_s21_qp_23	39	B
10	0625_w21_qp_21	37	C
11	0625_w21_qp_21	38	A
12	0625_w21_qp_21	39	B
13	0625_w21_qp_21	40	A
14	0625_w21_qp_22	37	C
15	0625_w21_qp_22	38	B
16	0625_w21_qp_22	39	A
17	0625_w21_qp_22	40	B
18	0625_w21_qp_23	37	C
19	0625_w21_qp_23	38	B
20	0625_w21_qp_23	39	A
21	0625_w21_qp_23	40	B
22	0625_m20_qp_22	39	B
23	0625_m20_qp_22	40	B
24	0625_p20_qp_20	39	D
25	0625_p20_qp_20	40	C
26	0625_s20_qp_21	38	D
27	0625_s20_qp_21	39	A
28	0625_s20_qp_21	40	A
29	0625_s20_qp_22	38	D
30	0625_s20_qp_22	39	A
31	0625_s20_qp_22	40	A
32	0625_s20_qp_23	38	D
33	0625_w20_qp_21	39	A
34	0625_w20_qp_21	40	C
35	0625_w20_qp_22	39	A
36	0625_w20_qp_22	40	C
37	0625_w20_qp_23	39	D
38	0625_w20_qp_23	40	C
39	0625_m19_qp_22	39	A
40	0625_m19_qp_22	40	C
41	0625_s19_qp_21	38	C
42	0625_s19_qp_21	39	A
43	0625_s19_qp_21	40	C
44	0625_s19_qp_22	39	B
45	0625_s19_qp_22	40	C
46	0625_s19_qp_23	39	B
47	0625_s19_qp_23	40	A
48	0625_w19_qp_21	39	B
49	0625_w19_qp_21	40	A

SN	Paper	Q. No.	Answer
50	0625_w19_qp_22	38	B
51	0625_w19_qp_22	39	B
22	0625_w19_qp_23	40	C
53	0625_m18_qp_22	38	C
54	0625_m18_qp_22	39	D
55	0625_m18_qp_22	40	A
56	0625_s18_qp_21	39	C
57	0625_s18_qp_21	40	A
58	0625_s18_qp_22	38	D
59	0625_s18_qp_22	39	A
60	0625_s18_qp_23	38	C
61	0625_s18_qp_23	39	D
62	0625_w18_qp_21	38	A
63	0625_w18_qp_21	39	B
64	0625_w18_qp_21	40	A
65	0625_w18_qp_22	38	C
66	0625_w18_qp_22	40	C
67	0625_w18_qp_23	38	D
68	0625_w18_qp_23	40	C
69	0625_m17_qp_22	37	D
70	0625_m17_qp_22	39	C
71	0625_m17_qp_22	40	A
72	0625_s17_qp_21	38	B
73	0625_s17_qp_21	40	B
74	0625_s17_qp_22	40	C
75	0625_s17_qp_23	39	A
76	0625_s17_qp_23	40	B
77	0625_w17_qp_21	38	A
78	0625_w17_qp_21	39	B
79	0625_w17_qp_21	40	A
80	0625_w17_qp_22	39	D
81	0625_w17_qp_22	40	A
82	0625_w17_qp_23	38	A
83	0625_w17_qp_23	39	C
84	0625_w17_qp_23	40	D
85	0625_m16_qp_22	38	C
86	0625_m16_qp_22	39	A
87	0625_m16_qp_22	40	A
88	0625_p16_qp_20	39	D
89	0625_p16_qp_20	40	C
90	0625_s16_qp_21	37	B
91	0625_s16_qp_21	38	D
92	0625_s16_qp_21	40	B
93	0625_s16_qp_22	39	D
94	0625_s16_qp_22	40	C
95	0625_s16_qp_23	36	C
96	0625_s16_qp_23	39	B
97	0625_s16_qp_23	40	D
98	0625_w16_qp_21	39	D

SN	Paper	Q. No.	Answer
99	0625_w16_qp_21	40	C
100	0625_w16_qp_22	38	A
101	0625_w16_qp_22	39	D
102	0625_w16_qp_23	38	D
103	0625_w16_qp_23	39	C
104	0625_w16_qp_23	40	A
105	0625_m15_qp_12	38	B
106	0625_m15_qp_12	39	B
107	0625_s15_qp_11	38	C
108	0625_s15_qp_11	39	B
109	0625_s15_qp_12	38	C
110	0625_s15_qp_12	39	C
111	0625_s15_qp_13	38	A
112	0625_s15_qp_13	39	C
113	0625_w15_qp_11	38	A
114	0625_w15_qp_11	39	C
115	0625_w15_qp_12	38	B
116	0625_w15_qp_13	38	C
117	0625_s14_qp_11	38	C
118	0625_s14_qp_11	39	C
119	0625_s14_qp_12	38	B
120	0625_s14_qp_13	39	C
121	0625_w14_qp_11	38	C
122	0625_w14_qp_11	39	B
123	0625_w14_qp_13	39	D
124	0625_s13_qp_11	39	C
125	0625_s13_qp_12	39	C
126	0625_w13_qp_11	39	A
127	0625_w13_qp_13	39	A
128	0625_s12_qp_11	38	B
129	0625_s12_qp_12	38	D
130	0625_w12_qp_11	38	D
131	0625_w12_qp_11	39	C
132	0625_w12_qp_13	38	B
133	0625_w12_qp_13	39	C