

Radioactivity – 2019 June

1. 0625/11/M/J/19/No.38

Four nuclides are represented below.

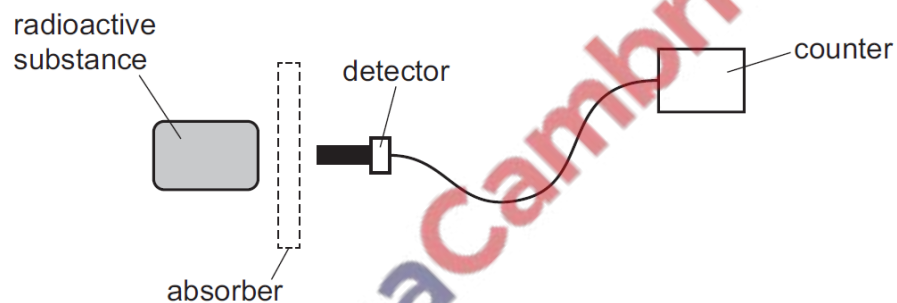


Which pair of nuclides are isotopes of the same element?

- A E and G B E and L C G and L D G and M

2. 0625/11/M/J/19/No.39

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	$\frac{\text{counter reading}}{\text{counts per minute}}$
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

3. 0625/11/M/J/19/No.40
The nuclei of the atoms in a substance are changing randomly and emitting radiation.

What is happening to the substance?

- A It is undergoing electromagnetic induction.
- B It is undergoing magnetisation.
- C It is undergoing solidification.
- D It is undergoing radioactive decay.

4. 0625/12/M/J/19/No.38
A simple model of the atom consists of small particles orbiting a central nucleus.

Which row is correct?

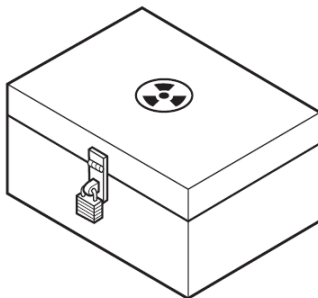
	charge on nucleus	charge on orbiting particles
A	negative	negative
B	negative	positive
C	positive	negative
D	positive	positive

5. 0625/12/M/J/19/No.39
Which statement explains the meaning of the half-life of a radioactive isotope?

- A half the time taken for one nucleus of the isotope to decay
- B half the time taken for the isotope to decay completely
- C the time taken for half of the nuclei of the isotope to decay
- D the time taken for one nucleus of the isotope to split in half

6. 0625/12/M/J/19/No.40

The diagram shows a lead-lined box used for storing radioactive sources.



Why is the inside of the box lined with lead?

- A It helps the sources to stay radioactive for longer.
- B It makes the box heavier.
- C It makes the radioactive sources more stable.
- D It reduces the amount of radiation that can escape from the box.

7. 0625/13/M/J/19/No.38

Which statement about the structure of an atom is correct?

- A It contains positively charged particles only.
- B It contains negatively charged particles only.
- C It contains no charged particles.
- D It contains positively charged particles and negatively charged particles.

8. 0625/13/M/J/19/No.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.

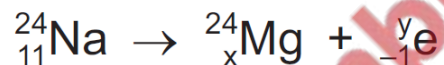
9. 0625/13/M/J/19/No.40
A radioactive element undergoes α -decay.

Which statement is **not** correct?

- A A different element is formed.
- B Radiation is emitted from the nucleus.
- C The decay is a random process.
- D The number of particles in the nucleus stays the same.

10. 0625/21/M/J/19/No.38

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



What are the numbers x and y ?

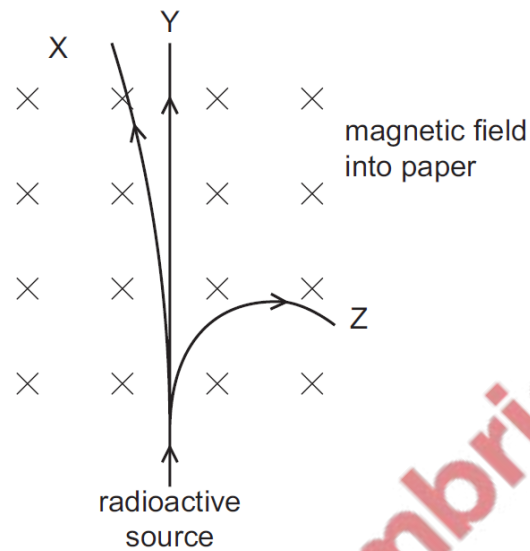
	x	y
A	10	0
B	10	1
C	12	0
D	12	1

11. 0625/21/M/J/19/No.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.

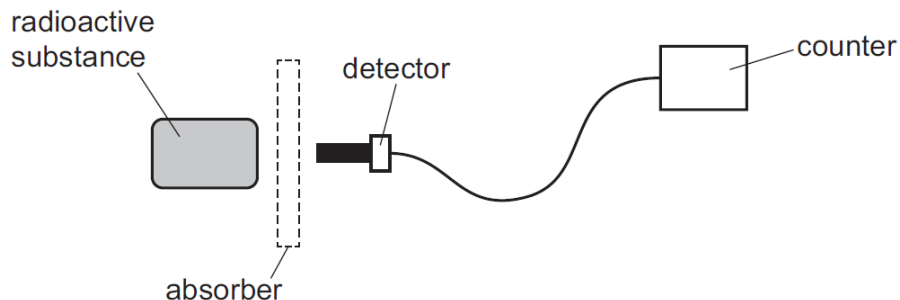


Which radiation follows path X, path Y and path Z?

	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

12. 0625/21/M/J/19/No.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
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- D α -particles, β -particles and γ -rays

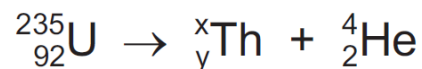
13. 0625/22/M/J/19/No.38

Which observation provides evidence for the nuclear atom?

- A attraction of opposite charges
- B emission of γ -rays during the decay of a radioactive nuclide
- C scattering of α -particles by thin metal foils
- D scattering of γ -rays by a thin metal foil

14. 0625/22/M/J/19/No.39

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



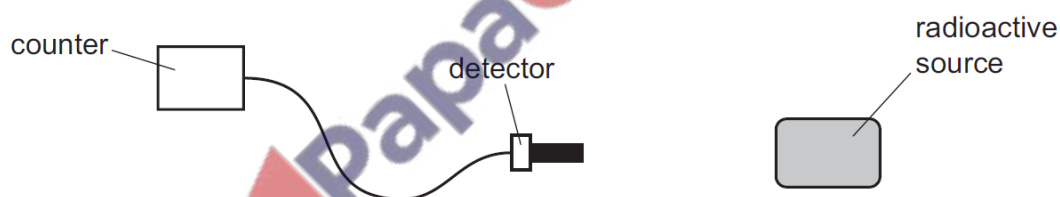
What are the numbers x and y?

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

15. 0625/22/M/J/19/No.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

16. 0625/23/M/J/19/No.36

α -particles are directed at a metal foil.

Most of the particles pass through the foil with little change in direction.

A small proportion of the particles are scattered back through large angles.

What does this evidence suggest about the structure of an atom?

- A It consists of a charged centre much smaller than the size of the atom and with little of the mass of the atom.
- B It consists of a negative charge the size of the atom containing small positive charges scattered through it.
- C It consists of a charged centre much smaller than the size of the atom but with most of the mass of the atom.
- D It consists of a positive charge the size of the atom containing small negative charges scattered through it.

17. 0625/23/M/J/19/No.38

What is nuclear fission?

- A the merging of two nuclei to create a heavier nucleus
- B the process by which electrons are removed from an atom
- C the process by which stars generate energy
- D the splitting of a nucleus to create two smaller nuclei

18. 0625/23/M/J/19/No.39

Which statement about γ -radiation is correct?

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- 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.

19. 0625/23/M/J/19/No.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

20. 0625/12/F/M/19/No.37

Which statement about the structure of an atom is correct?

- A** Negative electrons surround a neutral nucleus.
- B** Negative electrons surround a positive nucleus.
- C** Positive electrons surround a neutral nucleus.
- D** Positive electrons surround a negative nucleus.

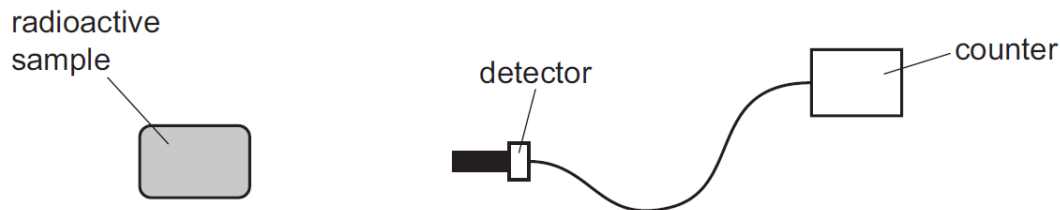
21. 0625/12/F/M/19/No.38

What are isotopes of an element?

- A** atoms of a different element with a different number of neutrons
- B** atoms of a different element with a different number of protons
- C** atoms of the same element with a different number of neutrons
- D** atoms of the same element with a different number of protons

22. 0625/12/F/M/19/No.39

A student measures the level of radiation emitted by a radioactive sample.



The table shows the readings she records on the counter over a short period of time.

counter reading / counts per minute	106	96	98	100
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The sample is removed and the counter then shows a background radiation reading of 4 counts per minute.

What is the best estimate for the average count rate due to the radioactive sample?

- A 96 counts per minute
- B 98 counts per minute
- C 100 counts per minute
- D 104 counts per minute

23. 0625/12/F/M/19/No.40

Four students are discussing ideas about radioactive decay.

Which student's statement is correct?

A

When a β -particle is emitted, the nucleus remains unchanged.

B

When an α -particle is emitted, the nucleus changes to that of a different element.

C

When a γ -ray is emitted, the nucleus changes to that of a different element.

D

Stable nuclei are dangerous because they emit high levels of γ -radiation.

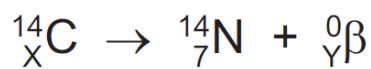
24. 0625/22/F/M/19/No.38

What are isotopes of an element?

- A atoms of a different element with a different number of neutrons
- B atoms of a different element with a different number of protons
- C atoms of the same element with a different number of neutrons
- D atoms of the same element with a different number of protons

25. 0625/22/F/M/19/No.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.



What is the value of X and of Y?

	X	Y
A	6	-1
B	6	1
C	8	-1
D	8	1

26. 0625/22/F/M/19/No.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.