Radioactivity – 2023 IGCSEPhysics 0625

1. Nov/2023/Paper_ 0625/11/No.34

Atom P has 6 electrons, 6 protons and 6 neutrons.

Atom Q has 6 electrons, 6 protons and 7 neutrons.

Which statement is correct?

A Atom P has atomic number 12.

B Atom P has nucleon number 6.

C Atom Q has nucleon number 13.

D Atoms P and Q are different chemical elements.

2. Nov/2023/Paper_ 0625/11/No.35

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, β-particles and γ-rays

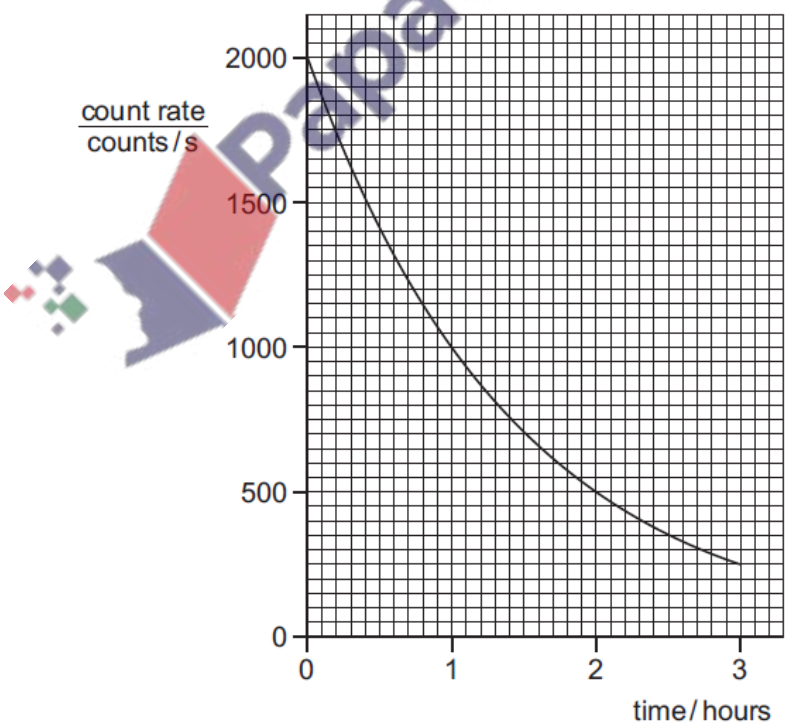
B α-particles and β-particles only

C β-particles and γ-rays only

D γ-rays and α-particles only

3. Nov/2023/Paper_ 0625/11/No.36

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

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4. Nov/2023/Paper_ 0625/11/No.37

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

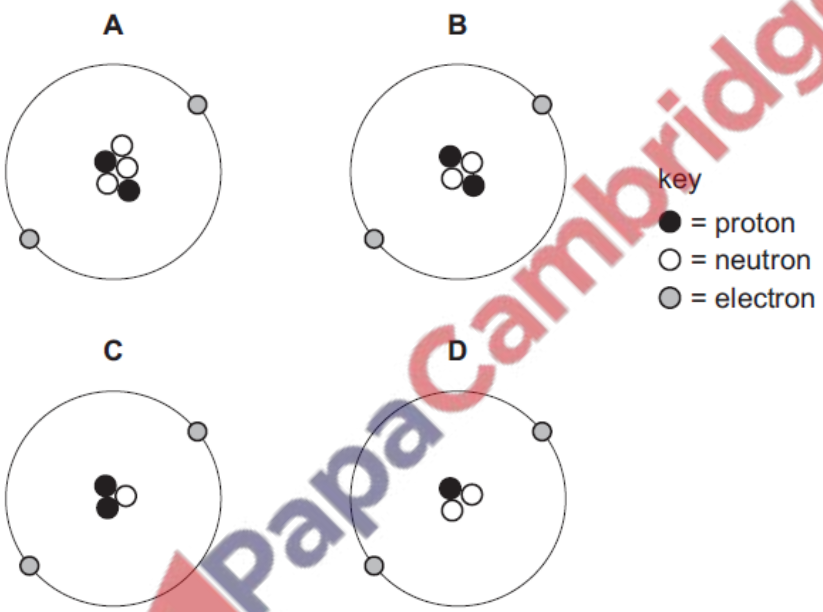
C opening all windows in the laboratory

D washing his hands before leaving the laboratory

5. Nov/2023/Paper_ 0625/12/No.34

The diagrams represent the protons, neutrons and electrons in different atoms and ions.

Which diagram shows a negatively charged ion?



6. Nov/2023/Paper_ 0625/12/No.35

Which row correctly describes an example of radioactive decay?

	original nucleus	emission	change or no change of element
A	stable	γ	change of element
B	unstable	α	change of element
C	unstable	α	no change of element
D	unstable	β	no change of element

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7. Nov/2023/Paper_ 0625/12/No.36

A detector is used to monitor the emissions from a radioactive source over several days.

The table shows the count rate from the source at different times.

time / days	count rate / counts / s
0	250
1	215
2	180
3	148
4	120
5	100

What is the half-life of the source?

A between 1 and 2 days

B between 2 and 3 days

C between 3 and 4 days

D between 4 and 5 days

8. Nov/2023/Paper_ 0625/12/No.37

What is the most effective precaution to reduce the risk when handling, storing or using a radioactive source that emits γ-rays?

A Handle the source for the least possible time.

B Have a fire extinguisher nearby when using the source.

C Store the source at a low temperature.

D Wear plastic safety goggles when handling the source.

9. Nov/2023/Paper_ 0625/13/No.34

What are the relative charges on a proton, a neutron and an electron?

	proton	neutron	electron
A	0	–1	+1
B	0	–1	–1
C	+1	0	–1
D	+1	0	+1

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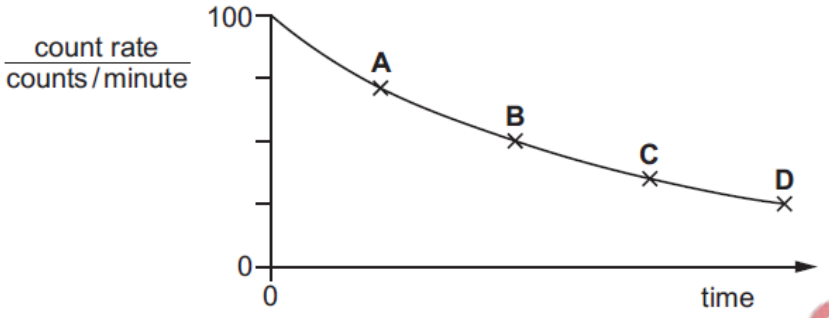
10. Nov/2023/Paper_ 0625/13/No.35

The half-life of carbon-14 is 5700 years.

An object containing carbon-14 has a count rate of 100 counts/minute when it is first formed. The graph shows how the count rate decreases over time.

Which point on the graph corresponds to a time 11 400 years after the formation of the object?



11. Nov/2023/Paper_ 0625/13/No.36

Which type of radioactive decay causes the nucleus of one element to change into the nucleus of another element?

	emission of an alpha-particle	emission of a beta-particle	emission of a gamma ray
A	✓	✓	✗
B	✓	✗	✗
C	✗	✓	✓
D	✗	✓	✗

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12. Nov/2023/Paper_ 0625/13/No.37

A scientist needs to use a source of γ-rays as safely as possible.

Which action will **not** reduce the total radiation that reaches the scientist?

A keeping the distance between the source and the scientist as large as possible

B keeping the temperature of the source as low as possible

C keeping the time for which the scientist uses the source as small as possible

D placing a lead screen between the scientist and the source

13. Nov/2023/Paper_ 0625/21/No.34

In α-particle scattering, α-particles are incident on a thin metal foil.

Which row describes results from the experiment and a conclusion that the results lead to?

	results	conclusion
A	most of the α-particles pass straight through the foil	most of the atom is empty space
B	most of the α-particles pass straight through the foil	the nucleus is very large
C	very few of the α-particles pass straight through the foil	most of the atom is empty space
D	very few of the α-particles pass straight through the foil	the nucleus is very large

14. Nov/2023/Paper_ 0625/21/No.35

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, β-particles and γ-rays

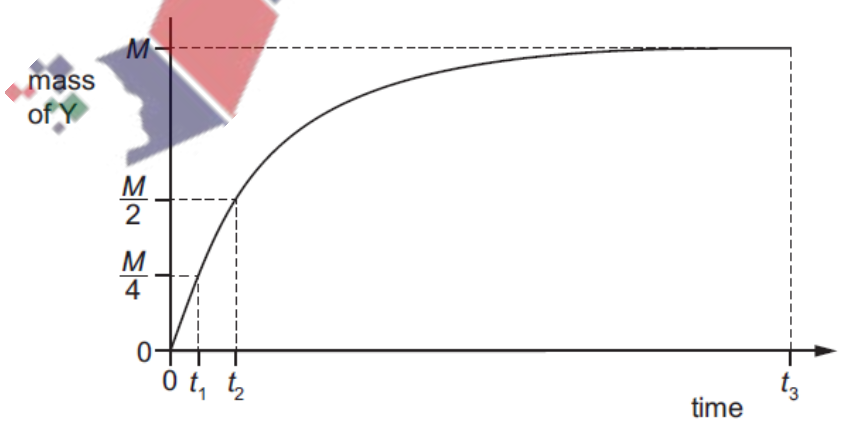
B α-particles and β-particles only

C β-particles and γ-rays only

D γ-rays and α-particles only

15. Nov/2023/Paper_ 0625/21/No.36

Radioisotope X decays to the stable isotope Y. The graph shows how the mass of Y present in a sample varies with time.



Which time interval gives the half-life of X?

A $t_2 - t_1$ **B** $t_3 - t_2$ **C** t_2 **D** $\frac{1}{2}t_3$

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16. Nov/2023/Paper_ 0625/21/No.37

Which particle is absorbed by a nucleus to cause nuclear fission?

A a neutron

B a proton

C an α-particle

D a β-particle

17. Nov/2023/Paper_ 0625/22/No.34

A magnesium ion has a double positive charge and a chloride ion has a single negative charge.

Which statement is correct?

A A chlorine atom gains an electron to form the chloride ion.

B A chlorine atom loses a proton to form the chloride ion.

C A magnesium atom loses an electron to form the magnesium ion.

D A magnesium atom gains two electrons to form the magnesium ion.

18. Nov/2023/Paper_ 0625/22/No.35

Which row correctly describes an example of radioactive decay?

	original nucleus	emission	change or no change of element
A	stable	γ	change of element
B	unstable	α	change of element
C	unstable	α	no change of element
D	unstable	β	no change of element

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19. Nov/2023/Paper_ 0625/22/No.36

A radioactive isotope of sodium has a half-life of 15 h.

The table gives data from an experiment to show how the rate of decay of the isotope varies with time.

The background count rate has not been subtracted from these data.

time / h	0	10	20	30
count rate / counts / s	400	260	170	115

What is the background radiation count rate?

A 12 counts / s

B 15 counts / s

C 20 counts / s

D 30 counts / s

20. Nov/2023/Paper_ 0625/22/No.37

What happens in the process of nuclear fission?

A Electrons are added to a nucleus.

B Electrons are removed from a nucleus.

C The nucleus of an atom splits.

D Two atomic nuclei join together.

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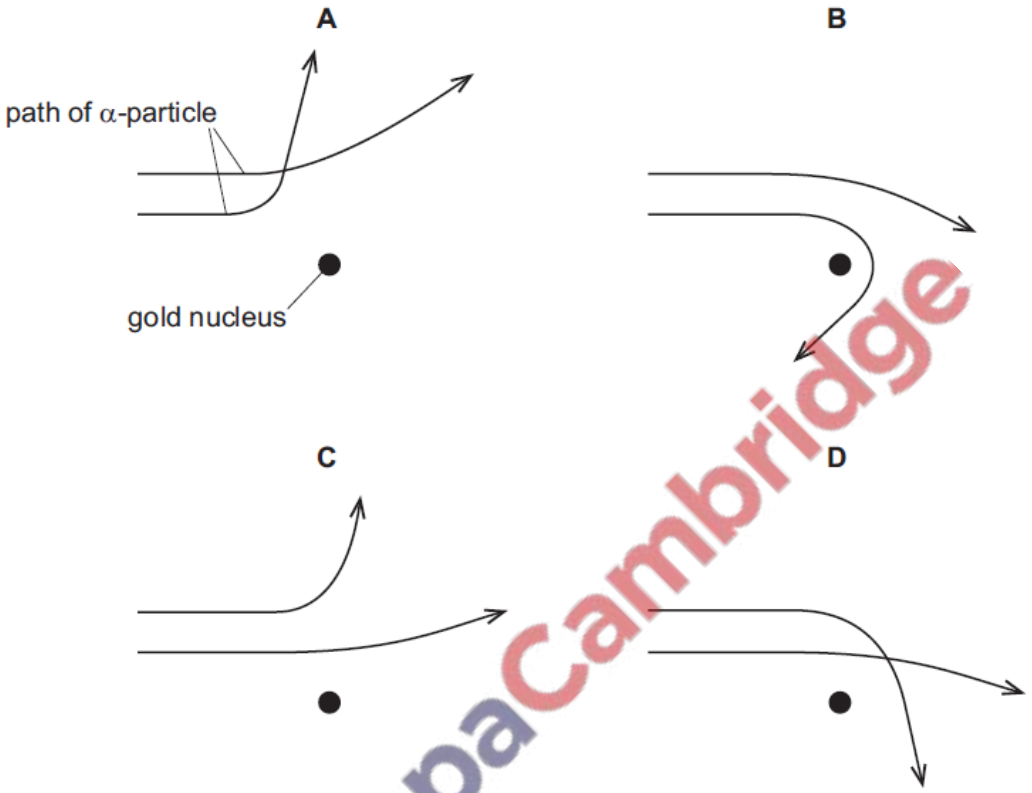
21. Nov/2023/Paper_ 0625/23/No.34

The scattering of α-particles by a thin gold foil provides evidence for the nuclear model of the atom.

Two α-particles of the same energy are incident on a nucleus of gold.

Which diagram shows the correct paths followed by the α-particles as they pass close to the nucleus?



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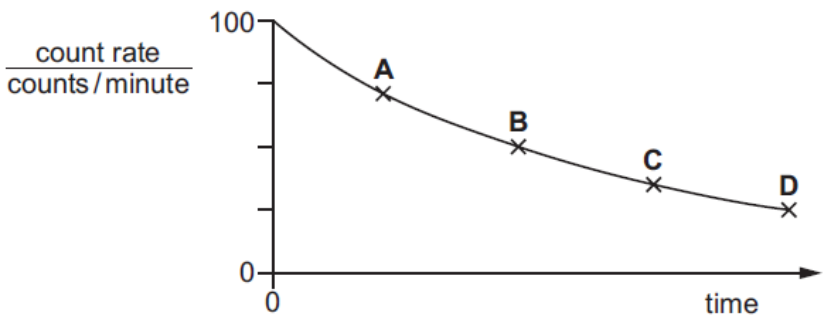
22. Nov/2023/Paper_ 0625/23/No.35

The half-life of carbon-14 is 5700 years.

An object containing carbon-14 has a count rate of 100 counts/minute when it is first formed. The graph shows how the count rate decreases over time.

Which point on the graph corresponds to a time 11 400 years after the formation of the object?



23. Nov/2023/Paper_ 0625/23/No.36

Why are beta-particles deflected more strongly than alpha-particles when they enter an electric field?

A Beta-particles have less mass than alpha-particles.

B Beta-particles are negatively charged.

C Beta-particles have lower velocities than alpha-particles.

D Beta-particles have more ionising power than alpha-particles.

24. Nov/2023/Paper_ 0625/23/No.37

Which statement describes how nuclear energy is released by fission in a nuclear power station?

A Atoms join together to make molecules.

B Heavy nuclei split into lighter nuclei.

C Light nuclei join together to form heavier nuclei.

D Molecules break down into atoms.

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25. Nov/2023/Paper_ 0625/31/No.10

A nucleus of an isotope of actinium contains 89 protons and 136 neutrons.
The chemical symbol for actinium is Ac.

(a) (i) Complete the nuclide notation for this isotope of actinium.

.....
Ac
.....

[1]

(ii) State the number of electrons orbiting the nucleus of a neutral atom of this isotope.

number of electrons = ... [1]

(b) A sample contains 8.0 mg of this isotope of actinium.

The isotope of actinium has a half-life of 10.0 days.

The graph in Fig. 10.1 shows the original mass of the actinium in the sample and its mass after 10 days.

On Fig. 10.1, plot **two** more points for the mass remaining after 20 days and 30 days. Draw the decay curve for the sample over 30 days.

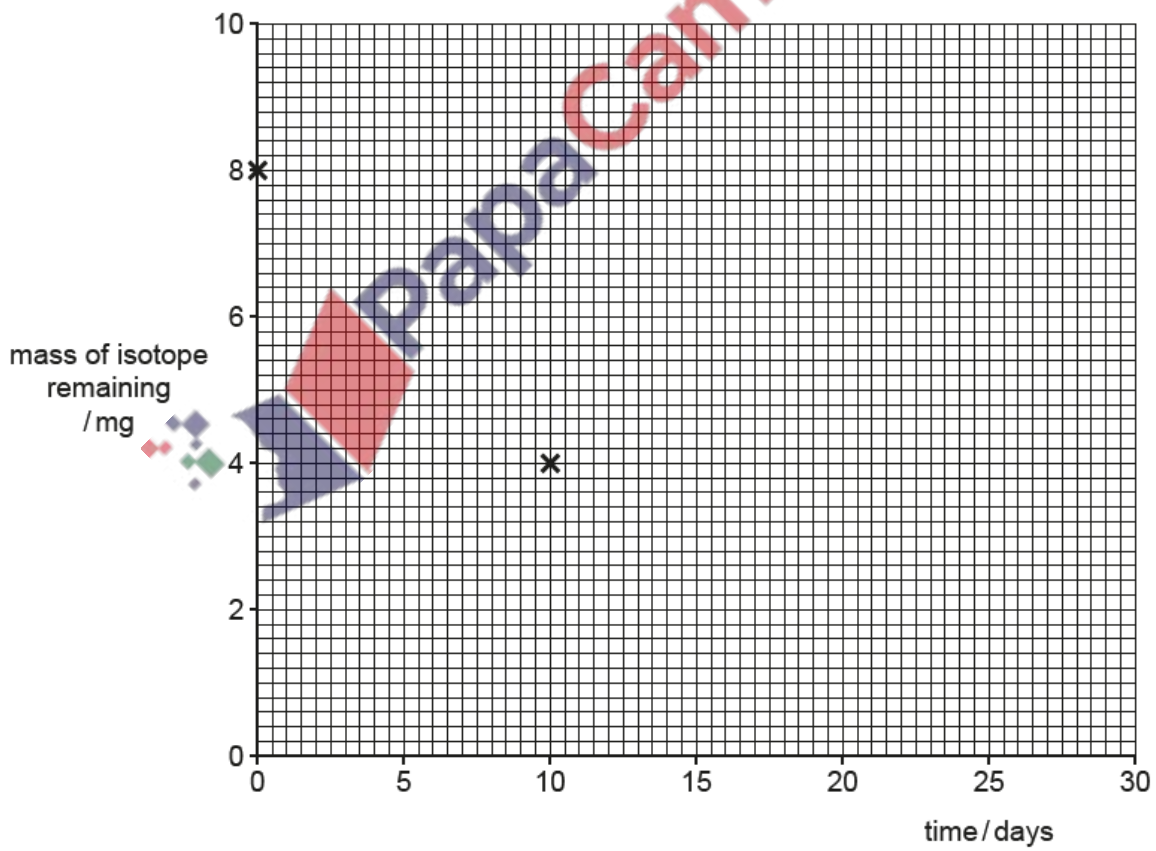

Fig. 10.1

[3]

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26. Nov/2023/Paper_ 0625/32/No.11

Fig. 11.1 represents all the particles in a beryllium atom.

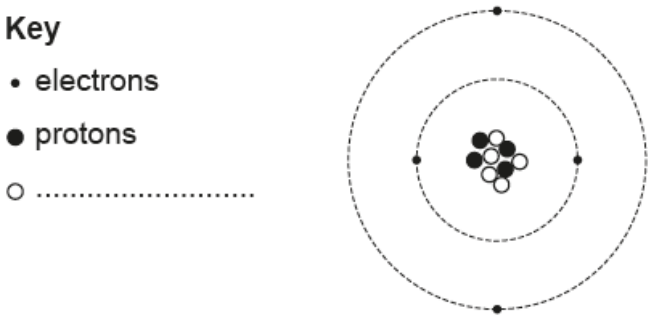

Fig. 11.1 (not to scale)

(a) **(i)** The symbol for the element beryllium is Be. Give the nuclide notation for the isotope shown in Fig. 11.1.

.....
Be
.....

[1]

(ii) The key for Fig. 11.1 gives the names of two types of particle. One label is missing.

Complete the key by adding the name of the third type of particle shown in Fig. 11.1. [1]

(b) Fig. 11.2 shows four different particle diagrams, A, B, C and D.

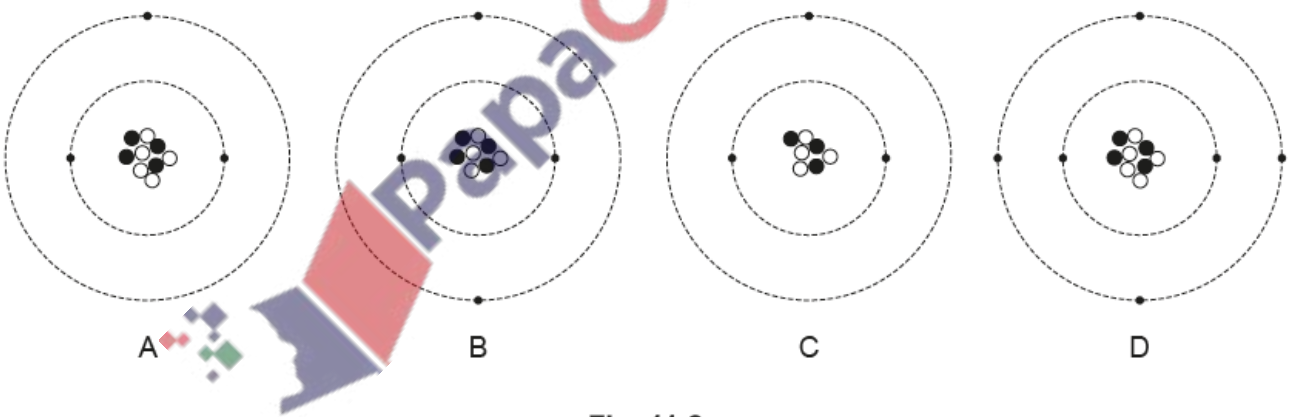

Fig. 11.2

(i) State which diagrams show an isotope of beryllium.

..... [1]

(ii) State which diagram shows a positive ion.

..... [1]

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(c) A scientist uses a detector and counter to measure the count rate due to radiation emitted from a radioactive source.

The first measurement is 400 counts / min.

The scientist takes another measurement 6 hours later. This measurement is 50 counts / min.

Calculate the half-life of the radioactive source.

half-life = ... h [2]

[Total: 6]

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27. Nov/2023/Paper_ 0625/33/No.10

(a) Fig. 10.1 represents all the particles in a lithium atom.

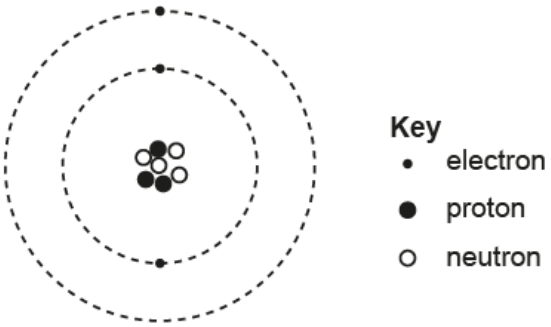

Fig. 10.1 (not to scale)

(i) State the proton number (atomic number) of the lithium atom in Fig. 10.1.

..... [1]

(ii) Determine the nucleon number (mass number) of the lithium atom in Fig. 10.1.

nucleon number = ... [1]

(iii) Describe how a lithium atom changes to form a positive ion.

..... [1]

(b) The half-life of iodine-131 is 8 days. A sample contains 80 mg of iodine-131.

Calculate the time taken to decay until 10 mg of iodine-131 remain in the sample.

time taken = ... days [2]

[Total: 5]

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28. Nov/2023/Paper_ 0625/41/No.9

Many household smoke alarms contain a sample of the radioactive isotope americium-241 (Am).

(a) Americium-241 is the isotope of the element americium that has the nucleon number (mass number) 241.

(i) State how the composition of a nucleus of americium-241 differs from that of a nucleus of americium-242.

.....

..... [1]

(ii) An atom of a different element has a nucleon number of 241.

State **two** differences between the composition of a nucleus of this atom and a nucleus of americium-241.

1 .....

2 .....

[2]

(b) Americium-241 decays to an isotope of neptunium (Np) by alpha-particle (α-particle) emission.

(i) Complete the equation for this decay.

$$^{241}_{.....}\text{Am} \longrightarrow {}^{.....}_{93}\text{Np} + {}^{.....}_{.....}\alpha$$

[3]

(ii) One reason for using an isotope that emits α-particles in a smoke detector is that α-particles are more strongly ionising than beta-particles (β-particles).

Explain why α-particles are more strongly ionising than β-particles.

.....

.....

..... [2]

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(iii) The isotope of neptunium produced by americium-241 is also radioactive.

The decay of this isotope of neptunium produces an isotope of protactinium which decays by β-emission. β-particles are more penetrating than α-particles.

The half-life of neptunium is longer than two million years.

Using this information, explain the advantage of this long half-life for the use and safe disposal of a household smoke alarm.

.....

.....

..... [2]

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29. Nov/2023/Paper_ 0625/42/No.8

The isotope uranium-235 is represented by

$$^{235}_{92}U.$$

(a) State what the numbers 92 and 235 represent in this symbol.

92 is .....

235 is .....

[2]

(b) Uranium-235 is a fuel used in nuclear reactors.

(i) State the process by which energy is released from uranium-235 in a nuclear reactor.

..... [1]

(ii) A nuclide equation for this process is

$$^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{140}_{54}Xe + {}^{94}_{38}Sr + 2\,{}^{1}_{0}n.$$

Describe the mass and energy changes that take place during this process in a nuclear reactor.

.....

.....

..... [2]

(c) **(i)** Describe how thermal energy from nuclear reactions is used to generate electricity in a power station.

.....

.....

.....

..... [3]

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(ii) State **one** advantage and **one** disadvantage of using nuclear fuels in a power station instead of using fossil fuels.

advantage .....

.....

disadvantage .....

.....

[2]

[Total: 10]

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30. Nov/2023/Paper_ 0625/43/No.9

(a) For each application of radioactive isotopes, state and explain which type of radioactive emission is suitable and suggest an appropriate half-life for the isotope.

(i) household smoke alarm

type of radioactive emission .....

explanation .....

.....

half-life .....

[3]

(ii) measuring the thickness of aluminium strips produced in a factory

type of radioactive emission .....

explanation .....

.....

half-life .....

[3]

(b) Lead-208 ($^{208}_{82}Pb$) has the highest nucleon number of the stable isotopes of lead.

Explain why lead-214 ($^{214}_{82}Pb$) is radioactive.

.....

.....

.....

..... [2]

(c) State **two** different sources of background radiation.

1 .....

2 .....

[2]

[Total: 10]

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31. June/2023/Paper_0625/11/No.34

How are positive and negative ions formed from atoms?

	positive ion	negative ion
A	add positive charge to the nucleus	add an electron to the atom
B	add positive charge to the nucleus	remove positive charge from the nucleus
C	remove an electron from the atom	add an electron to the atom
D	remove an electron from the atom	remove positive charge from the nucleus

32. June/2023/Paper_0625/11/No.35

A nucleus of element X is represented as $^{56}_{26}X$.

Which is an isotope of element X?

A $^{26}_{56}X$ **B** $^{54}_{26}X$ **C** $^{56}_{24}X$ **D** $^{54}_{28}X$

33. June/2023/Paper_0625/11/No.36

Which statement about the random decay of the nuclei in a sample of uranium-238 is correct?

A The probabilities of an alpha-particle, a beta-particle or a gamma ray being emitted from a nucleus in the sample are equal.

B The probability of a nucleus in the sample decaying decreases as time passes.

C The probability of a nucleus decaying in any ten minute interval is the same for all the nuclei in the sample.

D The probability of a nucleus in the sample decaying increases as time passes.

34. June/2023/Paper_0625/11/No.37

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

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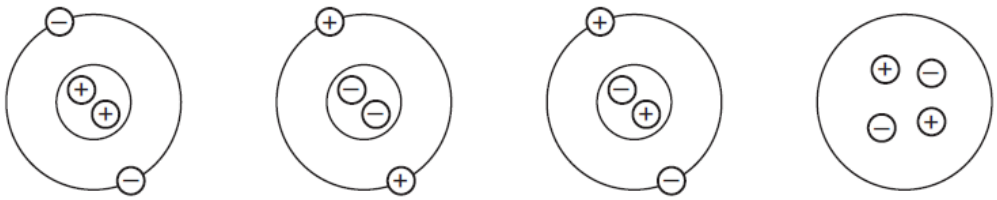
35. June/2023/Paper_0625/12/No.34

Which diagram represents the positions of the charged particles of an atom?

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



36. June/2023/Paper_0625/12/No.35

The table shows the composition of three different nuclei.

nucleus	number of protons	number of neutrons
X	3	3
Y	3	4
Z	4	3

Which nuclei are isotopes of the same element?

A X, Y and Z **B** X and Y only **C** X and Z only **D** Y and Z only

37. June/2023/Paper_0625/12/No.36

A sample of a radioactive isotope emits 9600 α-particles per second.

After 40 hours the rate of emission has fallen to 600 α-particles per second.

What is the half-life of this isotope?

A 4.0 hours **B** 8.0 hours **C** 10 hours **D** 20 hours

38. June/2023/Paper_0625/12/No.37

Which row states a harmful effect and a beneficial effect of ionising radiation on living things?

	harmful effect	beneficial effect
A	kills cancer cells	kills cancer cells
B	kills cancer cells	mutates living cells
C	mutates living cells	kills cancer cells
D	mutates living cells	mutates living cells

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39. June/2023/Paper_0625/13/No.34

An atom of an element contains electrons, neutrons and protons.

Which particles are found in the nucleus?

A electrons and neutrons only

B electrons and protons only

C neutrons and protons only

D electrons, neutrons and protons

40. June/2023/Paper_0625/13/No.35

A nuclide of chlorine has the symbol shown.

$$^{35}_{17}Cl$$

What is the nucleon number of this nuclide of chlorine?

A 17 **B** 18 **C** 35 **D** 52

41. June/2023/Paper_0625/13/No.36

What is a major source of background radiation?

A cosmic rays

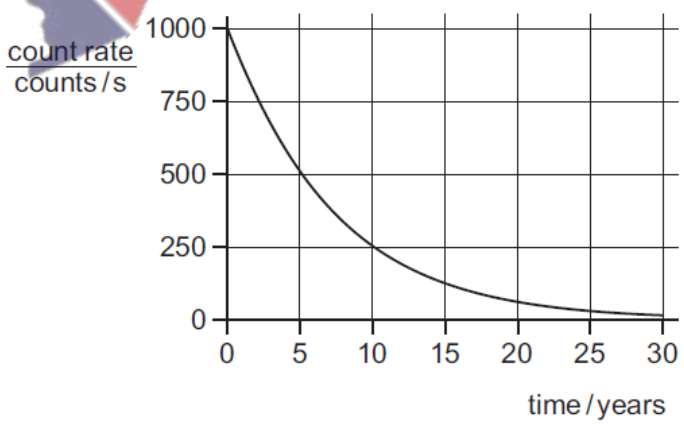
B microwaves from mobile (cell) phones

C nuclear power stations

D visible light from the Sun

42. June/2023/Paper_0625/13/No.37

The graph shows the radioactive decay curve of a substance.



What is the half-life of this substance?

A 0.5 years **B** 5 years **C** 15 years **D** 30 years

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43. June/2023/Paper_0625/21/No.34

A nucleus of element X is represented as $^{56}_{26}X$.

Which is an isotope of element X?

A $^{26}_{56}X$ **B** $^{54}_{26}X$ **C** $^{56}_{24}X$ **D** $^{54}_{28}X$

44. June/2023/Paper_0625/21/No.35

A radioactive source is placed near a detector connected to a counter.

210 counts are recorded by the counter in 3 minutes.

The background count rate is 20 counts per minute (cpm).

What is the corrected count rate for the radioactive source?

A 50 cpm **B** 70 cpm **C** 190 cpm **D** 270 cpm

45. June/2023/Paper_0625/21/No.36

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

With the counter close to a radioactive source, the counter reading is 960 cpm.

The half-life of the source is 20 minutes.

What is the counter reading one hour later?

A 115 cpm **B** 120 cpm **C** 155 cpm **D** 160 cpm

46. June/2023/Paper_0625/22/No.33

Fission and fusion are two types of nuclear process.

How does the total mass of the nuclides produced compare with the total mass of the original nuclide or nuclides in these nuclear processes?

	total mass of fission products compared to original nuclide	total mass of fusion products compared to original nuclides
A	same	same
B	more	less
C	less	more
D	less	less

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47. June/2023/Paper_0625/22/No.34

The table shows the composition of three different nuclei.

nucleus	number of protons	number of neutrons
X	3	3
Y	3	4
Z	4	3

Which nuclei are isotopes of the same element?

A X, Y and Z **B** X and Y only **C** X and Z only **D** Y and Z only

48. June/2023/Paper_0625/22/No.35

Which change occurs in the nucleus of a radioactive atom during β-emission?

A A neutron transforms into a proton and an electron.

B A neutron transforms into a proton only.

C A proton transforms into a neutron and an electron.

D A proton transforms into a neutron only.

49. June/2023/Paper_0625/22/No.36

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

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50. June/2023/Paper_0625/23/No.33

The scattering of alpha-particles from a thin gold foil produces the following observations.

- Most of the alpha-particles pass through the foil.
- Most of the alpha-particles are virtually undeflected.
- A small fraction of the alpha-particles are deflected through large angles.
- A very small fraction of the alpha-particles bounce back from the foil.

Which conclusion does **not** follow from these observations?

A Most of the mass of the gold atom is in its nucleus.

B Most of the atom is empty space.

C The nucleus consists of protons and neutrons.

D The nucleus must be charged.

51. June/2023/Paper_0625/23/No.34

A nuclide of chlorine has the symbol shown.

$$^{35}_{17}Cl$$

What is the nucleon number of this nuclide of chlorine?

A 17 **B** 18 **C** 35 **D** 52

52. June/2023/Paper_0625/23/No.35

Which change is occurring in a nucleus during β-emission?

A An electron and a neutron become one proton.

B An electron and a proton become one neutron.

C A neutron becomes one proton and one electron.

D A proton becomes one neutron and one electron.

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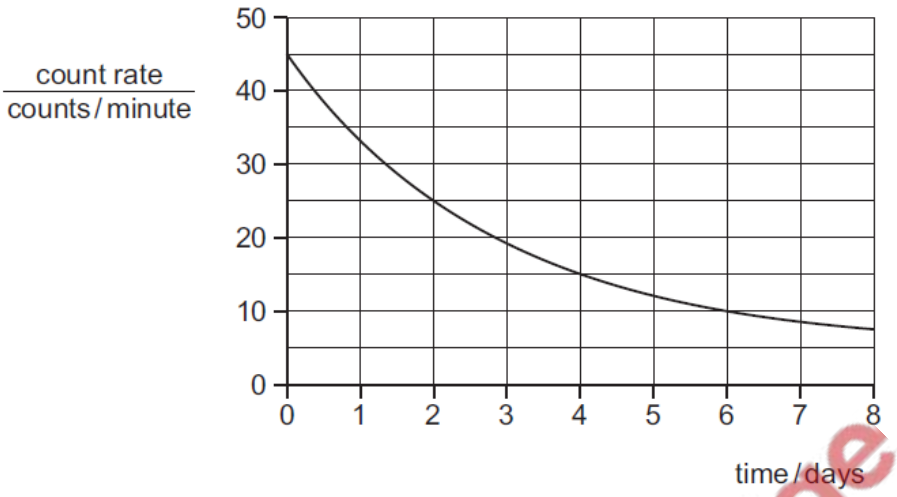
53. June/2023/Paper_0625/23/No.36

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

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54. June/2023/Paper_0625/31/No.11

Fig. 11.1 represents all the particles in an atom which is a radioactive isotope of carbon.

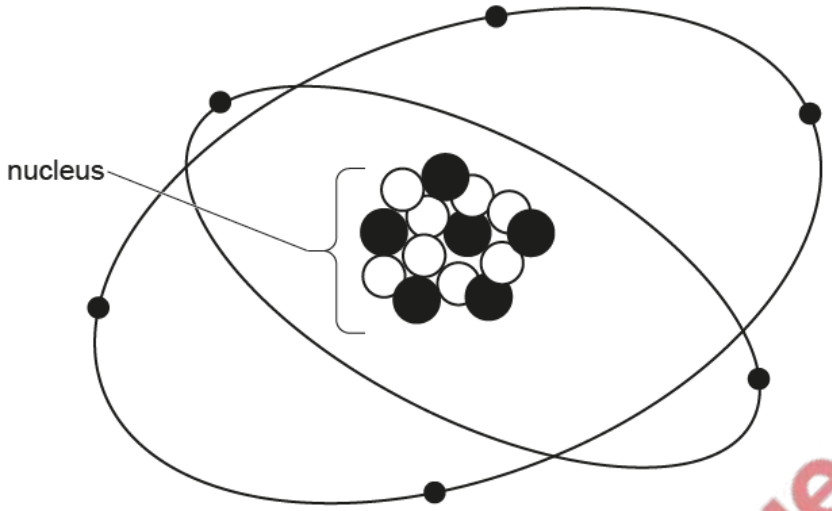

Fig. 11.1 (not to scale)

(a) Table 11.1 gives information about the particles shown in Fig. 11.1.

Using the information in Fig. 11.1, write in the empty boxes to complete Table 11.1.

Table 11.1

name of particle	number of particles	position of particle	relative charge of particle
electron			
neutron		in the nucleus	
	6		+1 (plus one)

[4]

(b) A museum displays an item made of ancient wood. When the wood was new, the item contained 8.00 mg of the isotope shown in Fig. 11.1. The item now contains 2.00 mg of the isotope. The half-life of the isotope is 5700 years.

Calculate the age of the wood in the item.

age of wood = ... years [3]

[Total: 7]

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55. June/2023/Paper_0625/32/No.10

Iodine-131 is a radioactive isotope of the element iodine. Fig. 10.1 shows the nuclide notation for a nucleus of iodine-131.

$$^{131}_{53}\mathrm{I}$$

Fig. 10.1

(a) (i) Determine the number of protons in one nucleus of iodine-131.

number of protons = ... [1]

(ii) Determine the number of neutrons in one nucleus of iodine-131.

number of neutrons = ... [1]

(b) When a nucleus of iodine-131 decays, it emits a beta (β)-particle and a gamma (γ) ray.

State the nature of a beta-particle and a gamma ray.

A beta-particle is .....

A gamma ray is .....

[2]

(c) A sample contains 1.6 mg of iodine-131.
The half-life of iodine-131 is 8.0 days.

Calculate the mass of iodine-131 remaining in the sample after 24.0 days.

mass of iodine-131 remaining = ... mg [3]

[Total: 7]

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56. June/2023/Paper_0625/33/No.9

Fig. 9.1 represents an atom of beryllium. The labels A, B and C indicate three types of particle.

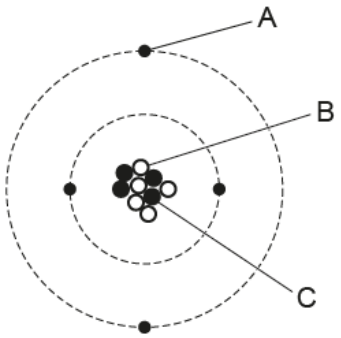

Fig. 9.1

(a) (i) Complete Table 9.1.

Name each type of particle and state the sign of its charge.

One row is done for you.

Table 9.1

type of particle	name	sign of charge
A		
B		
C	proton	positive (+)

[3]

(ii) There are several different isotopes of beryllium.

State what is meant by the term isotope.

.....

..... [2]

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(b) Fig. 9.2 shows sources of background radiation that affect people.

Fig. 9.2

Suggest the source of background radiation in region D.

..... [1]

(c) The nuclide notation for an atom of radon is:

$$^{222}_{86}Rn$$

(i) State the number of protons in this atom of radon. ..... [1]

(ii) State the number of particles in the nucleus of this atom of radon. ..... [1]

[Total: 8]

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57. June/2023/Paper_0625/41/No.9

Fig. 9.1 represents all the particles in a neutral atom of a radioactive isotope X1.

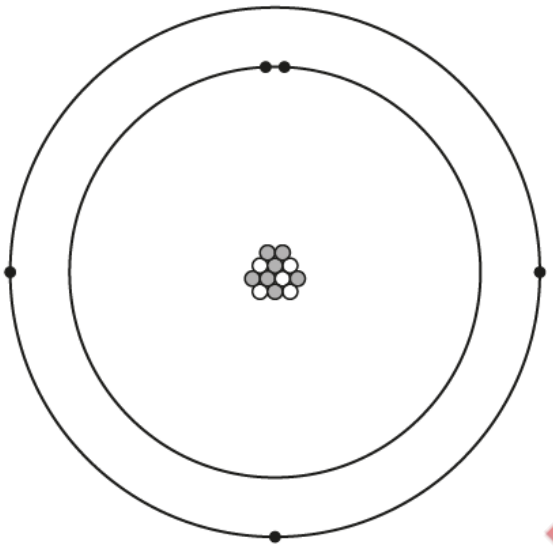

Fig. 9.1 (not to scale)

(a) Determine the number of neutrons in this atom and explain how the answer is obtained.

number of neutrons = ...

explanation

.....

.....

[2]

(b) The isotope X1 is a beta emitter that decays to the stable isotope X2.

(i) Describe how a nucleus of X2 differs from a nucleus of X1.

.....

..... [2]

(ii) Suggest why isotope X2 is stable whereas X1 is **not** stable.

.....

..... [1]

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(c) The half-life of X1 is approximately 20 ms.

(i) Define the term half-life.

.....

.....

..... [2]

(ii) Suggest **one** reason why isotopes with very short half-lives are especially hazardous.

.....

..... [1]

[Total: 8]

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58. June/2023/Paper_0625/42/No.9

(a) Table 9.1 shows some properties and values for α-particles, β-particles and γ-radiation.

Complete Table 9.1.

Table 9.1

type of radiation	number of protons	number of neutrons	charge / C	stopped by
α	2		$+ 3.2 \times 10^{-19}$	thin sheet of paper
β		0		thin sheet of aluminium
γ	0			

[3]

(b) State how β-decay changes the nucleus of an atom.

..... [1]

(c) A radiation detector used in a laboratory detects a background count rate of 30 counts / min. A radioactive source is placed in front of the radiation detector. The initial reading on the detector is 550 counts / min. The half-life of the source is 25 minutes.

Calculate the expected reading on the detector after 75 minutes.

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reading = ... counts / min [4]

(d) State **two** safety precautions taken when moving, using or storing radioactive sources in a laboratory.

1 .....

2 .....

[2]

[Total: 10]

59. June/2023/Paper_0625/43/No.8

(a) During β-decay, one of the neutrons in the nucleus changes.

(i) State what happens to this neutron.

..... [1]

(ii) Explain how charge is conserved during this change.

.....

.....

..... [2]

(b) Complete the nuclide equation for the α-decay of radon-212 to form an isotope of polonium, symbol Po.

$$^{212}_{86}Rn \rightarrow$$

[3]

[Total: 6]

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