1 How many neutrons are in a nucleus of the nuclide $^{37}_{17}Cl$?

A 17 **B** 20 **C** 37 **D** 54

2 A certain element has several isotopes.

Which statement about these isotopes is correct?

A They must have different numbers of electrons orbiting their nuclei.

B They must have the same number of neutrons in their nuclei.

C They must have the same number of nucleons in their nuclei.

D They must have the same number of protons in their nuclei.

3 A neutral atom consists of electrons orbiting a nucleus. The nucleus contains protons and neutrons.

Which statement about the atom **must** be correct?

A The number of electrons is equal to the number of neutrons.

B The number of electrons is equal to the number of protons.

C The number of neutrons is equal to the number of protons.

D The number of electrons, neutrons and protons are all different.

4 Below are the symbols for five different nuclides.

$^{35}_{17}X$	$^{37}_{17}X$	$^{38}_{18}X$	$^{81}_{35}X$	$^{81}_{37}X$
nuclide 1	nuclide 2	nuclide 3	nuclide 4	nuclide 5

Which two nuclides are isotopes of the same element?

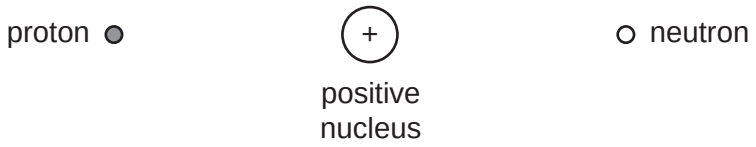
A nuclide 1 and nuclide 2

B nuclide 2 and nuclide 3

C nuclide 2 and nuclide 5

D nuclide 4 and nuclide 5

5 A proton and a neutron are each close to a positive nucleus.



How does the charge on the nucleus affect the proton and the neutron, if at all?

A The neutron is attracted; the proton is repelled.

B The neutron is not affected; the proton is repelled.

C The proton is attracted; the neutron is repelled.

D The proton is not affected; the neutron is repelled.

6 Below are four statements about isotopes of a certain element.

Which statement about the isotopes **must** be correct?

A They are radioactive.

B They are unstable.

C They have the same number of neutrons.

D They have the same number of protons.

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

Which is an isotope of element X?

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

8 The charge on a proton is *e*.

What is the charge on an electron and what is the charge on a neutron?

	electron	neutron
A	*e*	*e*
B	*e*	0
C	–*e*	–*e*
D	–*e*	0

9 A particular nuclide has the symbol $^{37}_{17}Cl$.

What is true for atoms of this nuclide?

A There are 17 nucleons in the nucleus.

B There are 17 protons in the nucleus.

C There are 37 electrons in the nucleus.

D There are 37 neutrons in the nucleus.

10 $^{14}_{6}C$ is a nuclide of carbon.

What is the composition of one nucleus of this nuclide?

	neutrons	protons
A	6	8
B	6	14
C	8	6
D	14	6

11 A nuclide has the symbol $^{32}_{10}Ne$.

What is the proton number of a nucleus of this nuclide?

A 10 **B** 12 **C** 22 **D** 32

12 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

13 Which statement is correct for the nucleus of **any** atom?

A The nucleus contains electrons, neutrons and protons.

B The nucleus contains the same number of protons as neutrons.

C The nucleus has a total charge of zero.

D The nucleus is very small compared with the size of the atom.

14 Which particles are emitted during thermionic emission?

A atoms

B electrons

C neutrons

D protons

15 A uranium U^{238}_{92} nucleus emits an α-particle.

What are the new nucleon and proton numbers?

	nucleon number	proton number
A	238	88
B	236	90
C	234	92
D	234	90

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

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

17 The nuclide notation for radium-226 is $^{226}_{88}Ra$.

How many electrons orbit the nucleus of a neutral atom of radium-226?

A 0 **B** 88 **C** 138 **D** 226

18 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	–
C	8	1
D	8	–

19 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

20 The nuclide notation for radium-226 is $^{226}_{88}Ra$.

How many electrons orbit the nucleus of a neutral atom of radium-226?

A 0 **B** 88 **C** 138 **D** 226

21 A nuclide has the symbol $^{14}_{6}C$.

How many protons are there in one nucleus of this nuclide?

A 6 **B** 8 **C** 14 **D** 20

22 A lithium nucleus contains 3 protons and 4 neutrons.

What is its nuclide notation?

A $^{3}_{4}Li$ **B** $^{4}_{3}Li$ **C** $^{7}_{3}Li$ **D** $^{7}_{4}Li$

23 A particular nuclide of chlorine can be represented by the symbol shown.

$$^{37}_{17}Cl$$

How many electrons are there in a neutral atom of this nuclide?

A 17 **B** 20 **C** 37 **D** 54

24 A nuclide is represented by the symbol ${}^{P}_{Q}X$.

How many neutrons are in one nucleus of the nuclide?

A P **B** Q **C** P + Q **D** P – Q

25 Which statement about the nuclei of all atoms is correct?

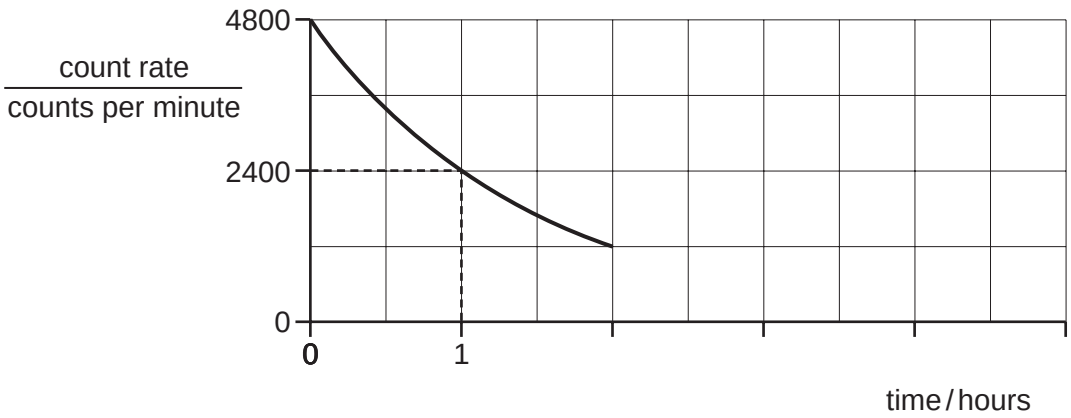
A They are very small compared with the size of the atoms.

B They always contain the same number of protons as neutrons.

C They contain electrons, neutrons and protons.

D They have a total charge of zero.

26 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?

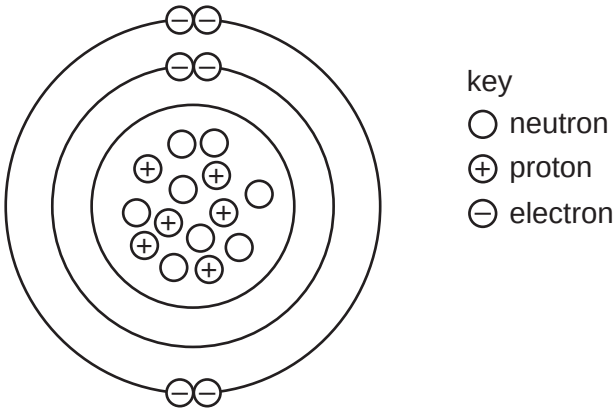
A 960 counts per minute

B 600 counts per minute

C 150 counts per minute

D 0 counts per minute

27 The diagram represents a carbon atom.



What is the nucleon number (mass number) for this atom?

A 6 **B** 8 **C** 14 **D** 20

28 A nuclide is represented by the notation shown.

$$^{P}_{Q}X$$

How many nucleons are there in one atom of this nuclide?

A P **B** Q **C** P + Q **D** P – Q

29 A nucleus X has 17 protons and 18 neutrons.

Which notation is correct for this nucleus?

A $^{17}_{18}X$ **B** $^{17}_{35}X$ **C** $^{18}_{17}X$ **D** $^{35}_{17}X$

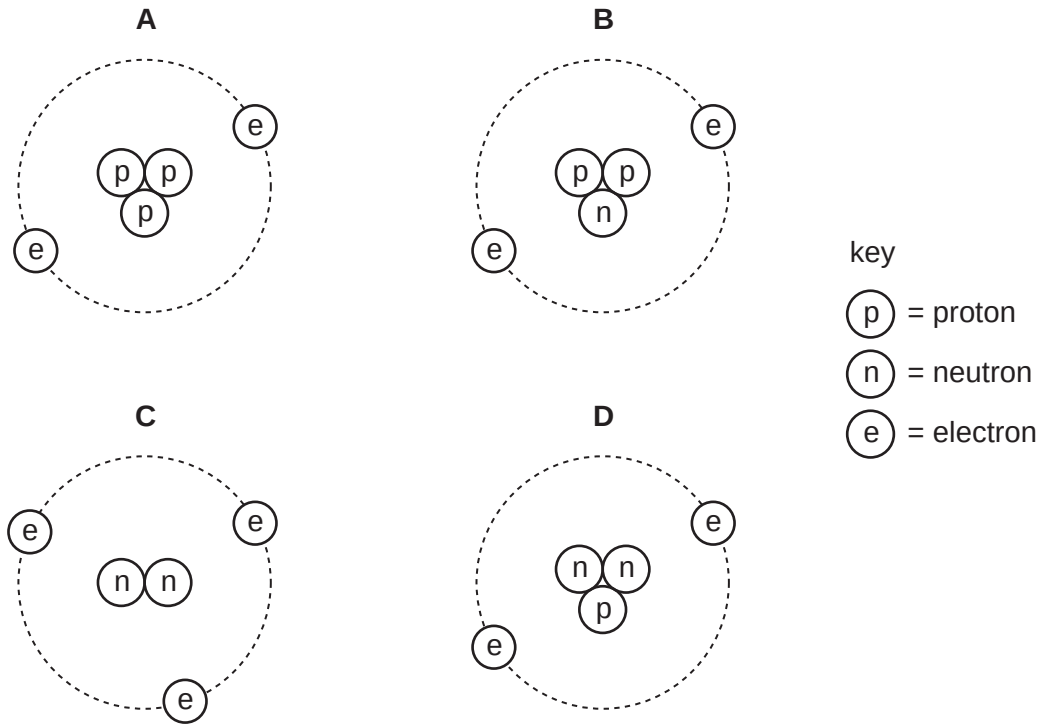
30 A nucleus X has 17 protons and 18 neutrons.

Which notation is correct for this nucleus?

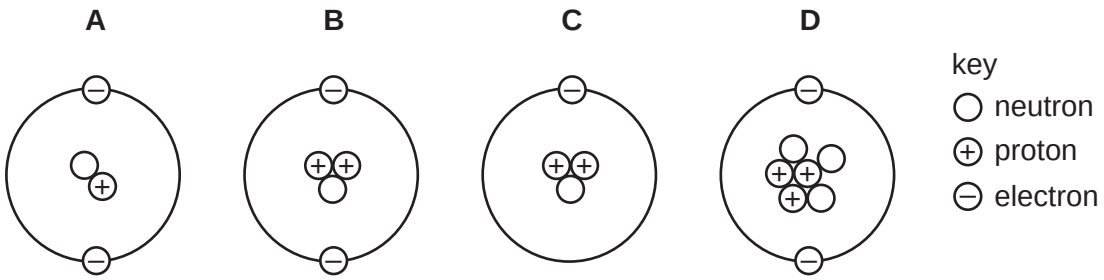
A $^{17}_{18}X$ **B** $^{17}_{35}X$ **C** $^{18}_{17}X$ **D** $^{35}_{17}X$

31 A nucleus of helium has the symbol $^{3}_{2}He$.

Which diagram represents an atom of $^{3}_{2}He$?



32 Which diagram could represent the structure of a neutral atom?



33 Which statement about a neutral atom of $^{226}_{88}Ra$ is correct?

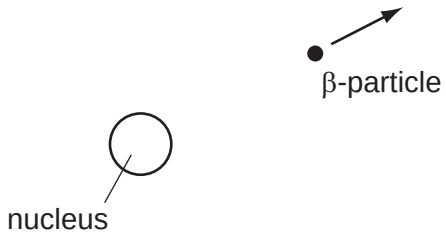
A It has an equal number of neutrons and protons.

B It has more electrons than neutrons.

C It has more electrons than protons.

D It has more neutrons than protons.

34 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.

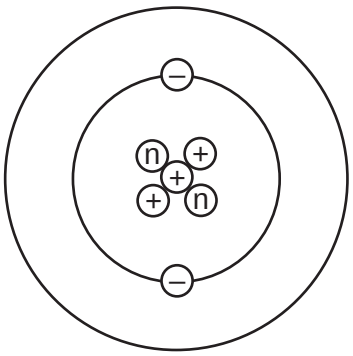
C It decreases by 2.

D It decreases by 4.

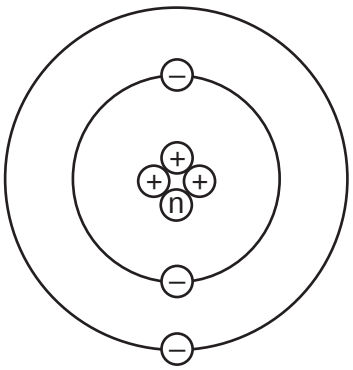
35 An atom of the element lithium has a nucleon number of 7 and a proton number of 3.

Which diagram represents a neutral atom of lithium?

A



B



key

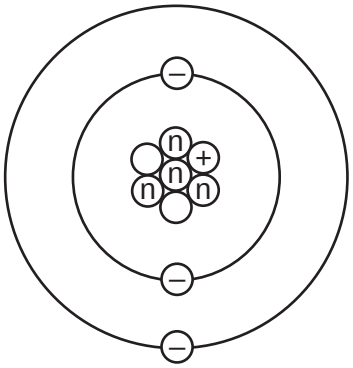
n = a neutron

+ = a proton

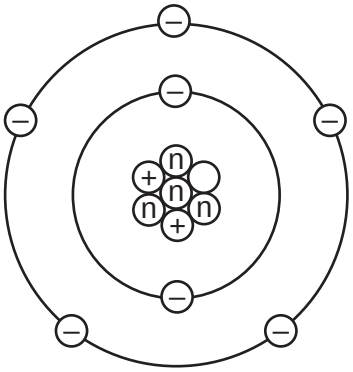
– = an electron

(not to scale)

C



D



36 A nuclide of substance X has the symbol $^{26}_{12}X$.

How many electrons are there in a neutral atom of substance X?

A 12 **B** 14 **C** 26 **D** 38

37 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 $^{243}_{95}Am \rightarrow {}^{239}_{93}Np + {}^{4}_{2}\alpha$

38 A certain element has several isotopes.

Which statement about these isotopes is correct?

A They must have different numbers of electrons orbiting their nuclei.

B They must have the same number of neutrons in their nuclei.

C They must have the same number of nucleons in their nuclei.

D They must have the same number of protons in their nuclei.

39 A very important experiment increased scientists' understanding of the structure of matter.

In the experiment, particles scattered as they passed through a thin metal foil.

Which particles were used, and to which conclusion did the experiment lead?

	particles	conclusion
A	alpha particles	matter is made up of atoms
B	alpha particles	atoms have a very small nucleus
C	beta particles	matter is made up of atoms
D	beta particles	atoms have a very small nucleus

40 Below are the symbols for five different nuclides.

$^{35}_{17}X$	$^{37}_{17}X$	$^{38}_{18}X$	$^{81}_{35}X$	$^{81}_{37}X$
nuclide 1	nuclide 2	nuclide 3	nuclide 4	nuclide 5

Which two nuclides are isotopes of the same element?

A nuclide 1 and nuclide 2

B nuclide 2 and nuclide 3

C nuclide 2 and nuclide 5

D nuclide 4 and nuclide 5

41 Below are four statements about isotopes of a certain element.

Which statement about the isotopes **must** be correct?

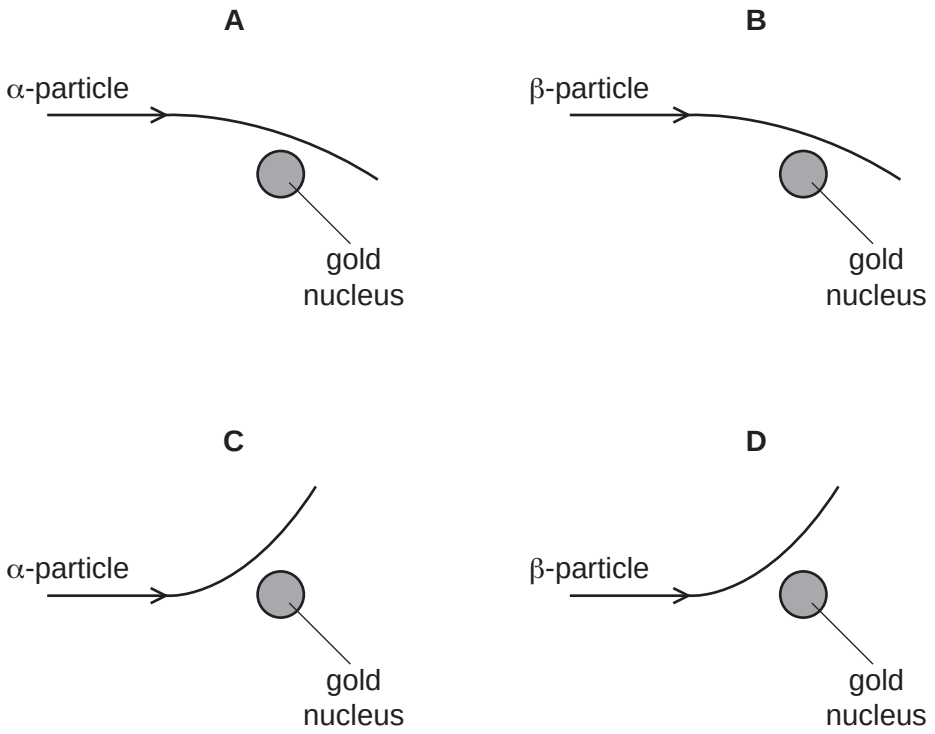
A They are radioactive.

B They are unstable.

C They have the same number of neutrons.

D They have the same number of protons.

42 Which diagram represents an experiment that provided evidence for the nuclear atom?



43 The scattering of α-particles by a thin metal foil supports the nuclear model of an atom.

Why are α-particles used rather than neutrons?

A because they always travel more slowly

B because they are heavier

C because they are larger in diameter

D because they have a positive charge