Atomic structure

Which statement explains why isotopes of the same element have the same chemical properties?

A They have a different number of neutrons in the nucleus.

B They have the same number of neutrons in the nucleus.

C They have the same number of outer shell electrons.

D They have the same number of protons as neutrons.

Carbon has three naturally occurring isotopes, ^{12}C, ^{13}C and ^{14}C.

Which statement explains why the isotopes have the same chemical properties?

A They have the same number of electrons in the first shell.

B They have the same number of electrons in the outer shell.

C They have the same number of neutrons in the nucleus.

D They have the same number of protons as neutrons.

The table shows information about four different particles.

particle	proton number	nucleon number	number of protons	number of neutrons	number of electrons
Na	11	23	11	W	11
Na^+	11	23	11	12	X
O	8	16	8	Y	8
O^{2-}	8	16	8	8	Z

What are the values of W, X, Y and Z?

	W	X	Y	Z
A	11	10	10	8
B	11	11	8	10
C	12	10	8	10
D	12	11	10	8

Which element does **not** form a stable ion with the same electronic structure as argon?

A aluminium

B chlorine

C phosphorus

D potassium

X and Y are isotopes of the same element.

Which statement is correct?

A X and Y have atoms with different numbers of electron shells.

B X and Y have atoms with the same nucleon number.

C X and Y have atoms with the same number of outer shell electrons.

D X and Y have different chemical properties.

The table shows information about atoms of three different elements.

element	proton number	nucleon number	number of protons	number of neutrons	number of electrons
chlorine	17	35	17	W	17
chlorine	17	X	17	19	17
argon	Y	40	18	22	18
potassium	19	39	19	20	Z

What are the values of W, X, Y and Z?

	W	X	Y	Z
A	18	35	18	19
B	18	36	18	19
C	19	35	19	18
D	19	36	19	18

Which statements about isotopes of the same element are correct?

1 They are atoms which have the same chemical properties because they have the same number of electrons in their outer shell.

2 They are atoms which have the same number of electrons and neutrons but different numbers of protons.

3 They are atoms which have the same number of electrons and protons but different numbers of neutrons.

A 1 and 2 **B** 1 and 3 **C** 2 only **D** 3 only

An atom has three electron shells. There are three electrons in the outer shell.

How many protons and how many neutrons are in this atom?

	protons	neutrons
A	13	14
B	13	27
C	14	13
D	21	24

Which statement about atoms is correct?

A Atoms contain protons and electrons in the nucleus.

B Neutrons are negatively charged.

C Protons are positively charged.

D The nucleon number is the number of neutrons.

What do the nuclei of ${}_{1}^{1}\mathrm{H}$ hydrogen atoms contain?

A electrons and neutrons

B electrons and protons

C neutrons only

D protons only

The table shows the nucleon number and the number of neutrons in one atom of isotopes W, X, Y and Z.

isotope	nucleon number	number of neutrons
W	35	18
X	37	20
Y	39	20
Z	40	22

Which statement about W, X, Y and Z is correct?

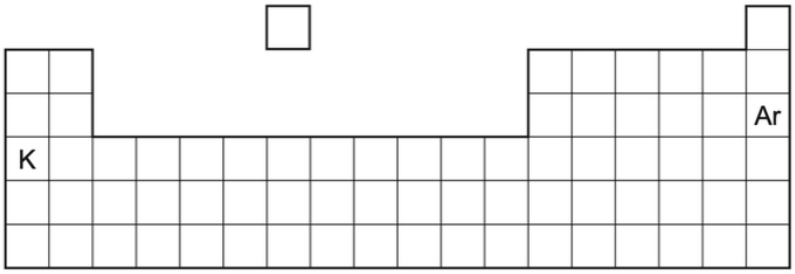
A W and X are isotopes of the same element.

B X and Y are isotopes of elements in the same group of the Periodic Table.

C Y and Z are isotopes of elements in the same period of the Periodic Table.

D Z has a higher proton number than Y.

Argon, Ar, has a higher relative atomic mass than potassium, K, but appears before it in the Periodic Table.



Why is argon listed before potassium in the Periodic Table?

A Argon has fewer neutrons than potassium.

B Argon has fewer protons than potassium.

C Argon has more neutrons than potassium.

D Argon has more protons than potassium.

Atoms contain electrons, neutrons and protons.

What is the definition of nucleon number?

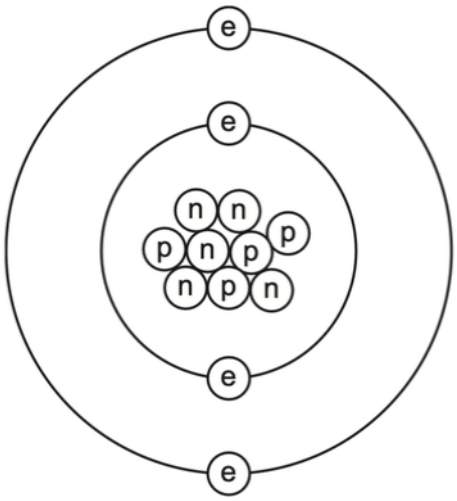
A the number of neutrons in the nucleus of an atom

B the number of protons in the nucleus of an atom

C the total number of neutrons and protons in the nucleus of an atom

D the total number of particles in an atom

The diagram shows the atomic structure of an element X.



key

(p) proton

(e) electron

(n) neutron

What is X?

A aluminium

B beryllium

C boron

D fluorine

Which statements comparing the properties of electrons, neutrons and protons are correct?

	neutrons and protons are both heavier than electrons	only electrons and neutrons are charged
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

Q^+ is an ion of element Q.

What has the highest value in the ion?

A the nucleon number

B the number of electrons

C the number of neutrons

D the proton number

Two atoms, X and Y, can be represented as shown.

$^{41}_{20}X$ $^{45}_{20}Y$

Which statement is **not** correct?

A X and Y are atoms of different elements.

B X and Y are isotopes.

C X and Y have different mass numbers.

D X and Y have the same number of electrons.

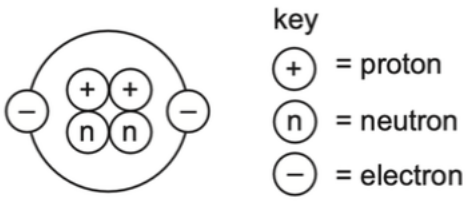
The table shows the numbers of particles present in the nuclei of four atoms or ions.

	protons	neutrons	electronic structure
1	18	22	2,8,8
2	19	20	2,8,8
3	19	21	2,8,8,1
4	20	20	2,8,8,2

Which two particles belong to the same element?

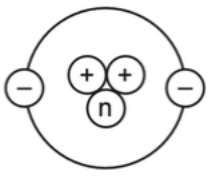
A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

The diagram shows the structure of an atom.



Which diagram shows the structure of an isotope of this atom?

A



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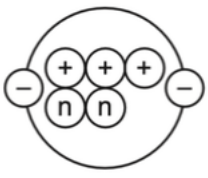

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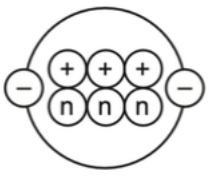

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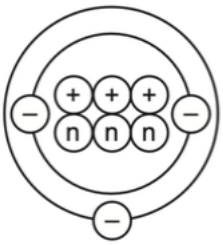

The table shows the structure of different atoms and ions.

particle	proton number	nucleon number	number of protons	number of neutrons	number of electrons
Mg	12	24	12	W	12
Mg^{2+}	X	24	12	12	10
F	9	19	9	Y	9
F^-	9	19	9	10	Z

What are the values of W, X, Y and Z?

	W	X	Y	Z
A	10	10	9	9
B	10	12	10	9
C	12	10	9	10
D	12	12	10	10

(a) Define the term *isotope*.

.....

..... [2]

(b) The table gives information about four particles, **A**, **B**, **C** and **D**.

Complete the table.
The first line has been done for you.

particle	number of protons	number of electrons	number of neutrons	nucleon number	symbol or formula
A	6	6	6	12	C
B	11	10	12		
C	8		8		O^{2-}
D		10		28	Al^{3+}

[7]

Complete the following table which gives the number of protons, electrons and neutrons in each of the five particles.

particle	number of protons	number of electrons	number of neutrons
.....	19	19	20
$^{56}_{26}Fe$	.....	.....	.....
.....	3	2	4
$^{70}_{31}Ga^{3+}$	.....	.....	.....
.....	34	36	45

(a) The symbols of six particles are shown below.

Na^+ Ca^{2+} Kr P Si O^{2-}

Select from the list of particles to answer the following questions. A particle may be selected once, more than once or not at all.

(i) Which **two** ions have the same electronic structure? ..... [1]

(ii) Which ion has the same electronic structure as an atom of argon? ..... [1]

(iii) Which atom can form an ion of the type X^{3-}? ..... [1]

(iv) Which atom can form a hydride which has a formula of the type XH_4? ..... [1]

(b) **(i)** How many protons, neutrons and electrons are there in one copper(II) ion $^{64}_{29}Cu^{2+}$?

number of protons .....

number of neutrons .....

number of electrons .....

[2]

(ii) $^{45}_{21}Sc$ represents an atom of scandium.

How many nucleons and how many charged particles are there in one atom of scandium?

number of nucleons .....

number of charged particles .....

[2]

(c) Two different atoms of sodium are $^{23}_{11}Na$ and $^{24}_{11}Na$.

(i) Explain why these two atoms are isotopes.

.....

..... [2]

(ii) $^{24}_{11}Na$ is radioactive. It changes into an atom of a different element which has one more proton.

Identify this element.

..... [1]

(a) The table below gives information about particles.

Complete the table. The first line has been done for you.

particle	number of protons	number of electrons	electronic configuration	charge on particle
A	12	10	2,8	2+
B		18	2,8,8	1–
C	18		2,8,8	0
D	8	10		

[4]

(b) Gallium is a Group III element.

Define the term *element*.

.....

.....

..... [1]

(c) The following are gallium atoms.

$^{69}_{31}Ga$ $^{71}_{31}Ga$

Complete the following table.

atom	number of protons	number of neutrons	number of electrons
$^{69}_{31}Ga$			
$^{71}_{31}Ga$			

[3]

Protons, neutrons and electrons are subatomic particles.

(a) Complete the table to show the relative mass and relative charge of a proton, a neutron and an electron.

particle	relative mass	relative charge
proton		
neutron		
electron	$\frac{1}{1840}$	

[3]

(b) Bromine has two isotopes.

(i) Define the term *isotope*.

.....

..... [2]

(ii) Explain why the two isotopes of bromine have the same chemical properties.

.....

..... [2]

(c) The table shows the number of protons, neutrons and electrons in some atoms and ions.

Complete the table.

particle	number of protons	number of neutrons	number of electrons
$^{7}_{3}Li$			
$^{34}_{16}S^{2-}$			
	19	22	18

[5]

(a) (i) Define the term *atomic number*.

..... [1]

(ii) Define the term *nucleon number*.

.....

..... [2]

(b) The table shows the number of protons, neutrons and electrons in some atoms or ions.

Complete the table. The first line is given as an example.

particle	number of protons	number of electrons	number of neutrons	symbol or formula
A	6	6	6	$^{12}_{6}C$
B	12	12	12	
C	8			$^{16}_{8}O^{2-}$
D	11	10	13	

[6]

This question is about atoms, ions and isotopes.

(a) Define the term *nucleon number*.

.....

..... [2]

(b) Give the electronic structure of the following atom and ion.

Na .....

P^{3-} .....

[2]

(c) State **one** medical use of radioactive isotopes.

..... [1]

(d) What is meant by the term *relative atomic mass*?

.....

.....

..... [2]

(e) Suggest why the relative atomic mass of chlorine is **not** a whole number.

.....

.....

..... [2]