

3.1 Atomic Structure and The Periodic Table

Question Paper

Level	IGCSE
Subject	Chemistry (0620)
Exam Board	Cambridge International Examinations (CIE)
Topic	Atoms Elements and Compounds
Sub-Topic	3.1 Atomic Structure and The Periodic Table
Booklet	Question Paper

Time Allowed: 65 minutes

Score: /55

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	75%	60%	45%	35%	25%	<25%

- 1 An aluminium atom has a nucleon number of 27 and a proton number of 13.

How many neutrons does this aluminium atom contain?

- A** 13 **B** 14 **C** 27 **D** 40

- 2 An atom of element Q contains 19 electrons, 19 protons and 20 neutrons.

What is Q?

- A** calcium
B potassium
C strontium
D yttrium

- 3 The table shows the atomic structure of four atoms.

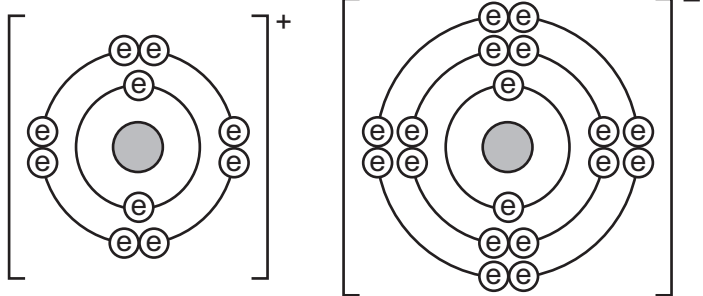
Which atom is **not** a metal?

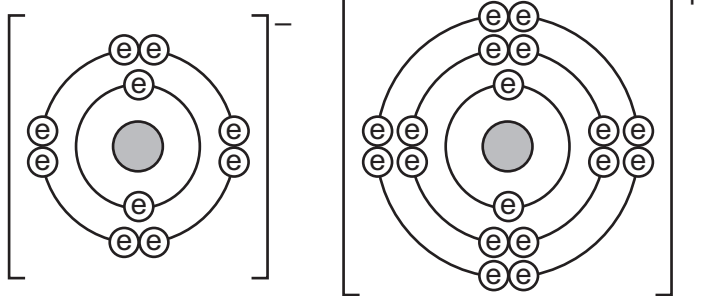
	electrons	neutrons	protons
A	18	22	18
B	19	20	19
C	19	21	19
D	20	20	20

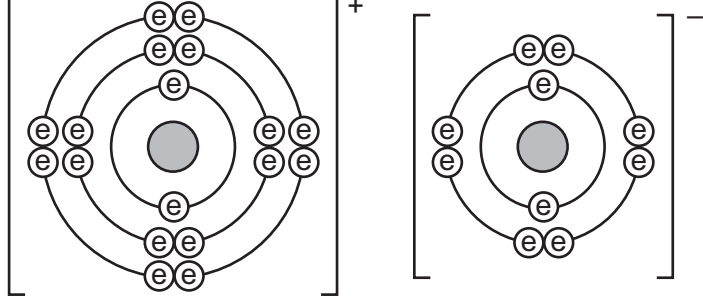
- 4 Which statement about atoms is correct?

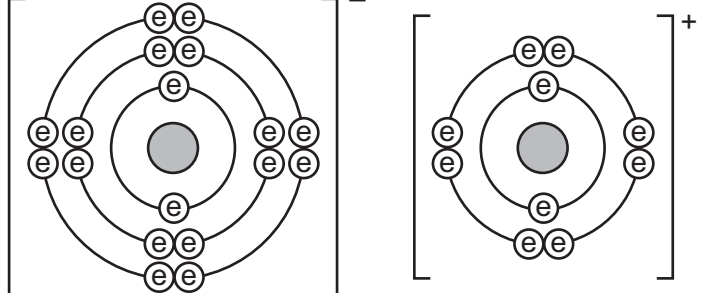
- A** Atoms contain protons and electrons in the nucleus.
B Neutrons are negatively charged.
C Protons are positively charged.
D The nucleon number is the number of neutrons.



5 Which diagram correctly shows the ions present in the compound potassium fluoride?

A K^+  F^-

B K^-  F^+

C K^+  F^-

D K^-  F^+

key
 = nucleus
 = electron

6 What do the nuclei of ${}^1_1\text{H}$ hydrogen atoms contain?

- A electrons and neutrons
- B electrons and protons
- C neutrons only
- D protons only

7 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.

8 The relative atomic mass of chlorine is 35.5.

When calculating relative atomic mass, which particle is the mass of a chlorine atom compared to?

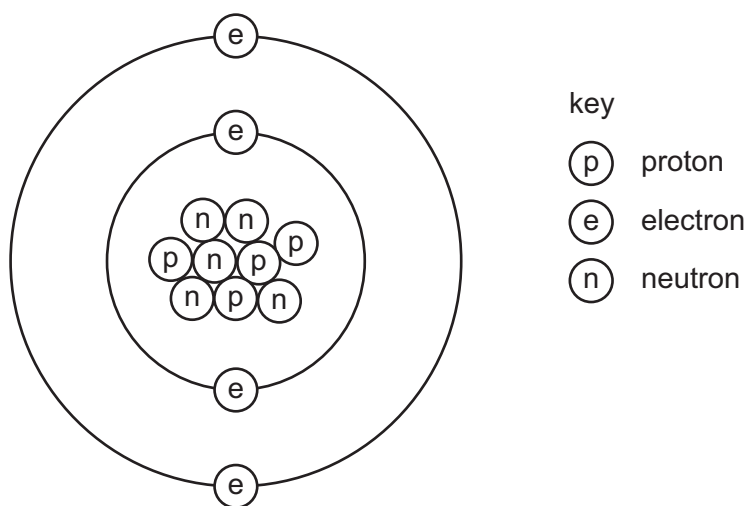
- A a neutron
- B a proton
- C an atom of carbon-12
- D an atom of hydrogen-1

9. 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

10. The diagram shows the atomic structure of an element X.



What is X?

- A aluminium
- B beryllium
- C boron
- D fluorine

11. 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	✓	x
C	x	✓
D	x	x

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12 The atomic structures of four particles are shown.

particle	electrons	neutrons	protons
W	8	9	8
X	7	9	7
Y	8	10	8
Z	9	10	9

Which two particles are isotopes?

- A** W and X **B** W and Y **C** X and Z **D** Y and Z

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



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.

14 Two atoms have the same relative atomic mass but different chemical properties.

Which row about the proton and neutron numbers of these atoms is correct?

	proton numbers	neutron numbers
A	different	different
B	different	same
C	same	different
D	same	same

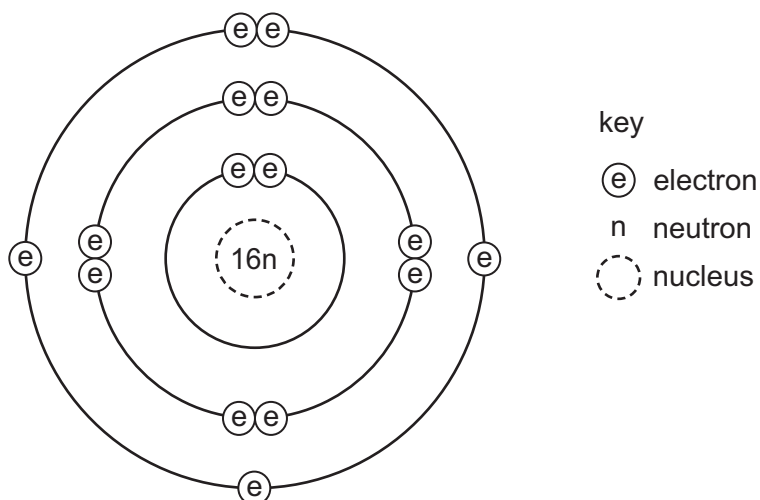
- 15 The table shows the numbers of particles present in the nuclei of four atoms or ions.

	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 3 **C** 2 and 3 **D** 2 and 4
- 16 What is different for isotopes of the same element?
- A** nucleon number
B number of electron shells
C number of electrons in the outer shell
D proton number

- 17 Which element has the atomic structure shown?



- A** Al **B** P **C** S **D** Si
- 18 How many atoms of hydrogen are there in a molecule of ethanol, C₂H₅OH?
- A** 1 **B** 2 **C** 5 **D** 6

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- 19 Which statement about a neutron is **not** correct?
- A It can be present in different numbers in atoms of the same element.
 - B It has no electrical charge.
 - C It is always found in the nucleus of an atom.
 - D It weighs much less than a proton.

- 20 Element X, ${}^{19}_9\text{X}$, forms a compound with element Y, ${}^{39}_{19}\text{Y}$.

Which statement describes the bonding in the compound formed?

- A X and Y share electrons.
 - B X gives away one electron to Y.
 - C Y gives away one electron to X.
 - D Y gives away two electrons to X.
- 21 The table shows the numbers of atoms present in the formula of some compounds.

Which row is **not** correct?

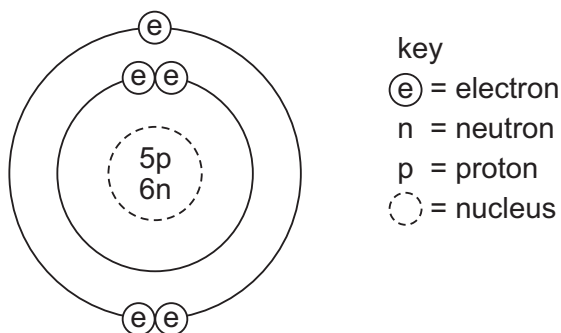
	numbers of atoms	formula
A	1 × calcium, 1 × carbon, 3 × oxygen	CaCO ₃
B	1 × carbon, 5 × hydrogen, 1 × oxygen	C ₂ H ₅ OH
C	1 × hydrogen, 1 × oxygen, 1 × sodium	NaOH
D	2 × hydrogen, 4 × oxygen, 1 × sulfur	H ₂ SO ₄

- 22 An element, X, can be represented as ${}^a_b\text{X}$.

Which statement is correct?

- A The number of protons in an atom of X is **a**.
- B The exact position of X in the Periodic Table can be found from **a**.
- C The relative atomic mass of X is **b**.
- D The total number of electrons in one atom of X is **b**.

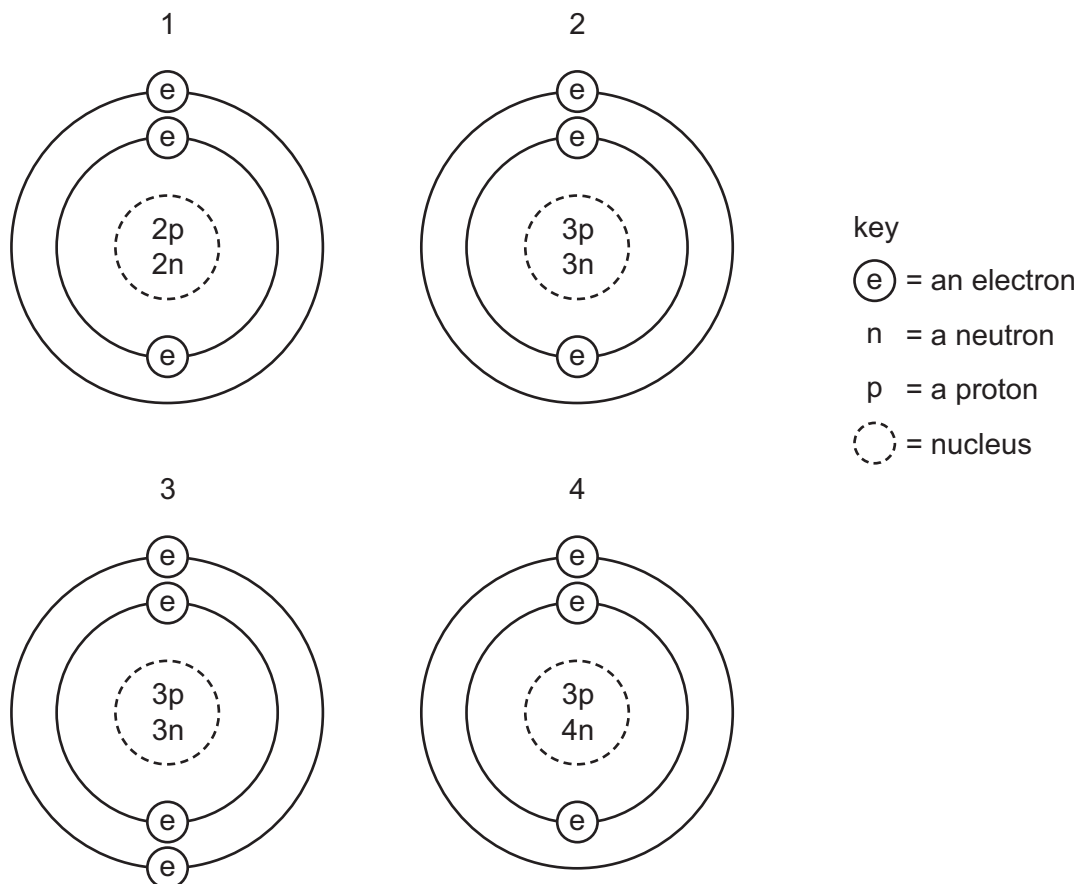
23 The diagram shows the structure of an atom of element X.



What is X?

- A boron
- B carbon
- C sodium
- D sulfur

24 The diagrams show four particles.



Which two diagrams show **atoms** that are isotopes of each other?

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

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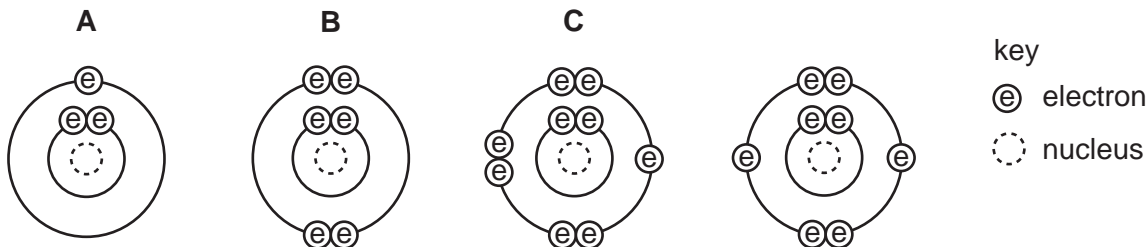
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- 25 A compound contains one atom of calcium, two atoms of hydrogen and two atoms of oxygen.
What is the correct chemical formula of the compound?
- A** CaO_2H_2 **B** HOCaOH **C** H_2CaO_2 **D** $\text{Ca}(\text{OH})_2$
- 26 Which statements about a phosphorus atom, $^{31}_{15}\text{P}$, are correct?
- 1 The nucleon number is 16.
 - 2 The number of outer electrons is 5.
 - 3 The proton number is 15.
- A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only
- 27 Element X has 7 protons.
Element Y has 8 more protons than X.
Which statement about element Y is correct?
- A** Y has more electron shells than X.
B Y has more electrons in its outer shell than X.
C Y is in a different group of the Periodic Table from X.
D Y is in the same period of the Periodic Table as X
- 28 Which statements about a sodium atom, $^{23}_{11}\text{Na}$, are correct?
- 1 The number of protons and neutrons is the same.
 - 2 The number of protons and electrons is the same.
 - 3 The number of outer electrons is one.
- A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

- 29 The diagrams show the electron arrangements in the atoms of four elements.
Which element does **not** form a covalent bond?



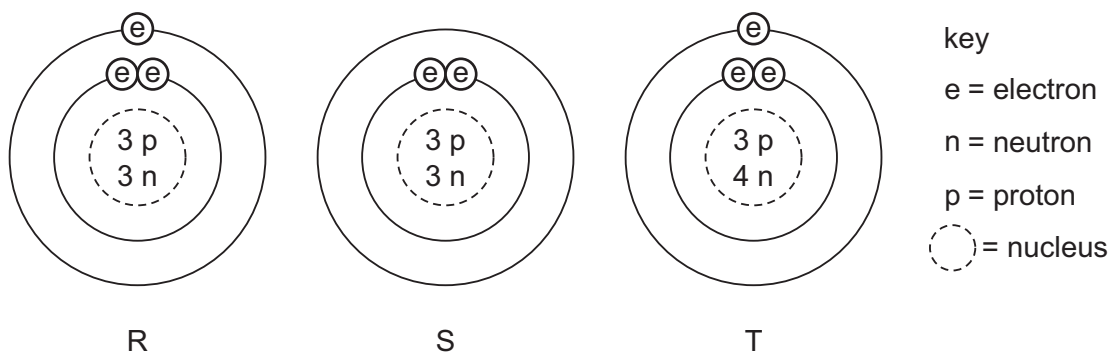
- 30 The atomic structures of four atoms are shown.

atom	number of neutrons	number of protons	number of electrons
W	6	6	6
X	7	7	7
Y	8	6	6
Z	8	8	8

Which pair of atoms are isotopes?

- A** W and X **B** W and Y **C** X and Y **D** Y and Z

- 31 The diagram shows the structure of three particles, R, S and T.



Which row describes these particles?

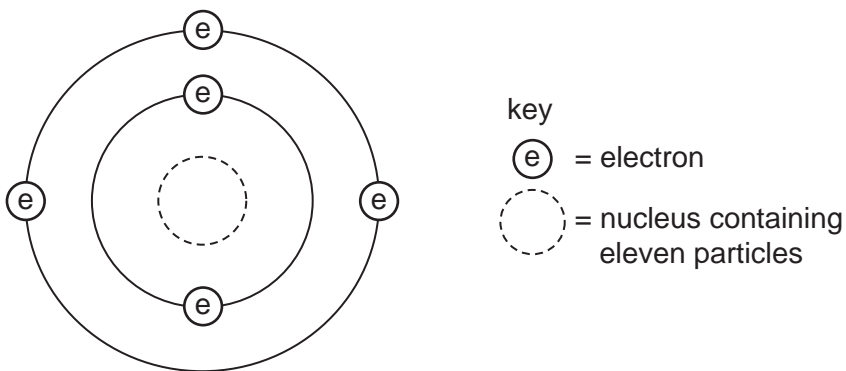
	ions	isotopes
A	R	S and T
B	R and S	T
C	S	R and T
D	T	R and S

32 Element X is represented by ${}_{13}^{27}\text{X}$.

Which statement about element X is correct?

- A An atom of X contains 13 protons and 13 neutrons.
- B An atom of X contains 27 protons and 13 electrons.
- C X forms an ion by gaining electrons.
- D X is placed in Group III of the Periodic Table.

33 The diagram shows an atom of an element.



How many protons and neutrons are in the nucleus of the atom and in which group and period of the Periodic Table is the element found?

	number of protons	number of neutrons	group number	period number
A	5	6	3	2
B	5	11	2	3
C	6	5	3	2
D	6	11	2	3

- 34 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	✓	x
C	x	✓
D	x	x

- 35 Which row gives the number of electrons in the outer electron shell of fluorine and of neon?

	${}^{19}_9\text{F}$	${}^{20}_{10}\text{Ne}$
A	7	8
B	7	10
C	9	8
D	9	10

- 36 The nucleon number of an isotope of rubidium is 85.
How many protons, neutrons and electrons are present in an atom of this isotope?

	protons	neutrons	electrons
A	37	48	37
B	37	48	39
C	39	46	37
D	39	46	39

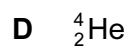
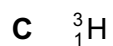
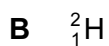
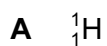
37 An element Y has the proton number 18.

The next element in the Periodic Table is an element Z.

Which statement is correct?

- A** Element Z has one more electron in its outer shell than element Y.
- B** Element Z has one more electron shell than element Y.
- C** Element Z is in the same group of the Periodic Table as element Y.
- D** Element Z is in the same period of the Periodic Table as element Y.

38 Which atom has twice as many neutrons as protons?



39 Elements X, Y and Z are in Group VII of the Periodic Table.

X is a gas.

Y is less reactive than Z

Z is a red liquid.

When X, Y and Z are put in order of increasing proton number, which order is correct?

- A** $X \rightarrow Y \rightarrow Z$ **B** $X \rightarrow Z \rightarrow Y$ **C** $Y \rightarrow X \rightarrow Z$ **D** $Y \rightarrow Z \rightarrow X$

40 Two isotopes of helium are ${}^3_2\text{He}$ and ${}^4_2\text{He}$.

Which two diagrams show the arrangement of particles in these two isotopes?

	${}^3_2\text{He}$	${}^4_2\text{He}$	
A			<p>key</p> <p>⊖ = electron</p> <p>⊕ = proton</p> <p>⊖ = neutron</p> <p>⊖ = nucleus</p>
B			
C			
D			

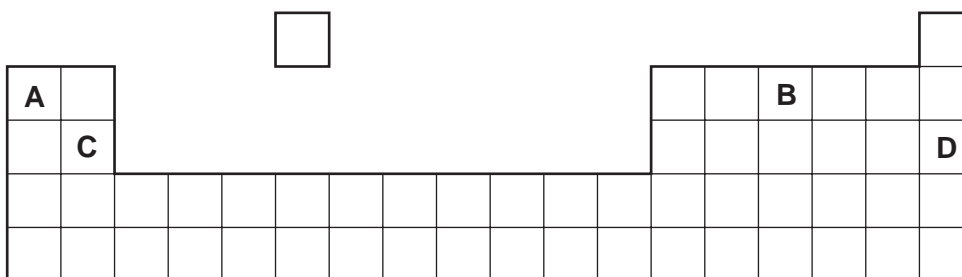
41 The table describes the structures of four particles.

particle	number of protons	number of neutrons	number of electrons
O	8	8	8
O ²⁻	8	8	X
Na	11	Y	11
Na ⁺	11	12	Z

What are the correct values of **X**, **Y** and **Z**?

	X	Y	Z
A	9	11	10
B	9	11	11
C	10	12	10
D	10	12	11

42 The diagram shows part of the Periodic Table.



Which element is correctly matched with its electronic structure?

	electronic structure
A	2,8,1
B	2,4
C	2,8,2
D	2,8

- 43 The nucleon number and proton number of the lithium atom are shown by the symbol ${}^7_3\text{Li}$.

What is the correct symbol for the lithium ion in lithium chloride?

- A** ${}^6_2\text{Li}^-$ **B** ${}^6_3\text{Li}^+$ **C** ${}^7_3\text{Li}^+$ **D** ${}^7_3\text{Li}^-$

- 44 Element X has a nucleon (mass) number of 19 and a proton (atomic) number of 9.

To which group in the Periodic Table does it belong?

- A** I **B** III **C** VII **D** 0

- 45 The table shows the structure of different atoms and ions.

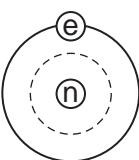
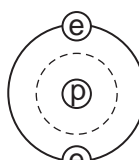
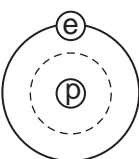
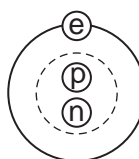
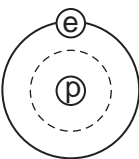
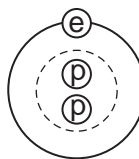
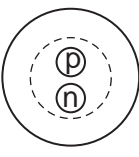
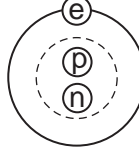
particle	proton number	nucleon number	number of protons	number of neutrons	number of electrons
Mg	12	24	12	W	12
Mg ²⁺	X	24	12	12	10
F	9	19	9	Y	9
F ⁻	9	19	9	10	Z

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

46 Two isotopes of hydrogen are ${}^1_1\text{H}$ and ${}^2_1\text{H}$.

Which diagram shows the arrangement of particles in the two isotopes?

	${}^1_1\text{H}$	${}^2_1\text{H}$
A		
B		
C		
D		

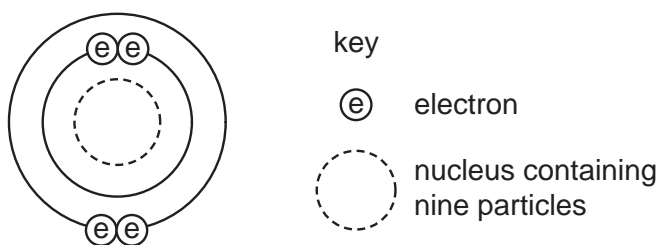
key

- ⓔ = an electron
- Ⓟ = a proton
- Ⓝ = a neutron
- = a nucleus

47 Which row shows the change that takes place when element X gains the new particle shown?

	particle gained	change
A	electron	an isotope of element X is formed
B	electron	the element one place to the right of X in the Periodic Table is formed
C	proton	an isotope of element X is formed
D	proton	the element one place to the right of X in the Periodic Table is formed

48 The diagram shows an atom.



What is the proton number and neutron number of the atom?

	proton number	neutron number
A	4	5
B	4	9
C	5	4
D	5	9

49 The symbols of two atoms may be written as shown.



Which statement about these atoms is correct?

- A** They are different elements because they have different numbers of neutrons.
- B** They are different elements because they have different numbers of protons.
- C** They are isotopes of the same element because they have the same nucleon number.
- D** They are isotopes of the same element because they have the same proton number.

50 Atom X has 8 more electrons than atom Y.

Student 1 says they are in the same group.

Student 2 says they are unreactive.

Which students can be correct?

	student 1	student 2
A	✓	✓
B	✓	x
C	x	✓
D	x	x

51 Which number is different for isotopes of the same element?

A number of electrons

B number of full shells

C number of nucleons

D number of protons

52 Which atom has two more electrons than an atom of a noble gas?

A aluminium

B bromine

C calcium

D rubidium

53 An element S has the proton number 18. The next element in the Periodic Table is an element T.

Which statement is correct?

- A** Element T has one more electron in its outer shell than element S.
- B** Element T has one more electron shell than element S.
- C** Element T is in the same group of the Periodic Table as element S.
- D** Element T is in the same period of the Periodic Table as element S.

54 Which numbers are added together to give the nucleon number of an ion?

- A** number of electrons + number of neutrons
- B** number of electrons + number of protons
- C** number of electrons + number of protons + number of neutrons
- D** number of protons + number of neutrons

55 Element V forms an acidic, covalent oxide.

Which row in the table shows how many electrons there could be in the outer shell of an atom of V?

	1	2	6	7
A	✓	x	x	x
B	✓	✓	x	x
C	x	x	x	✓
D	x	x	✓	✓