



# ATOMIC STRUCTURE

---

# ATOMIC STRUCTURE

---

## Contents

FAHAD H. AHMAD.....	1
0323 509 4443.....	1
ATOMIC STRUCTURE (GCE 5070 MCQS) .....	3
ATOMIC STRUCTURE (IGCSE 0620 MCQS).....	14
ATOMIC STRUCTURE (IGCSE 0620 THEORY).....	42

# ATOMIC STRUCTURE

---

Past Papers Compiled are from 2002-2014

## ATOMIC STRUCTURE (GCE 5070 MCQS)

24 How many electrons and protons are in an **ion** of an element in Group 2 of the Periodic Table?

	Number of electrons	Number of protons
<b>A</b>	6	4
<b>B</b>	10	12
<b>C</b>	22	20
<b>D</b>	139	137

5070\_s12\_qp12

---

1 In which option do the three particles each have the same number of electrons?

- A**  $Cl^-$   $Br^-$   $I^-$
- B**  $F^-$   $Ne$   $Na^+$
- C**  $K^+$   $Ca^{2+}$   $Br^-$
- D**  $Li^+$   $Na^+$   $K^+$

5070\_w09\_qp1

---

3 Naturally occurring bromine has a relative atomic mass of 80 and consists entirely of two isotopes of relative isotopic masses 79 and 81.

What can be deduced about naturally-occurring bromine from this information only?

- A** Bromine isotopes have different numbers of protons.
- B** Bromine contains the two isotopes in equal proportions.
- C** Bromine has different oxidation states.
- D** Bromine is radioactive.

5070\_w08\_qp1

---

6 An element X forms a positive ion with the electronic structure 2,8,8.

What is the proton (atomic) number of X?

- A** 16
- B** 17
- C** 18
- D** 19

5070\_s09\_qp1

---

# ATOMIC STRUCTURE

---

9 Which statement about the numbers of particles in atoms is correct?

Apart from hydrogen, most atoms contain

- A more neutrons than protons.
- B more protons than neutrons.
- C more electrons than protons.
- D more protons than electrons.

5070\_s09\_qp1

---

8 The atoms  ${}_{29}^{64}\text{Cu}$  and  ${}_{30}^{65}\text{Zn}$  have the same

- A nucleon number.
- B number of electrons.
- C number of neutrons.
- D proton number.

s/08/qp1

---

6 What is the structure of the ion  ${}_{38}^{90}\text{Sr}^{2+}$ ?

	protons	neutrons	electrons
A	38	52	36
B	38	52	38
C	38	90	36
D	52	38	36

s/07/qp1

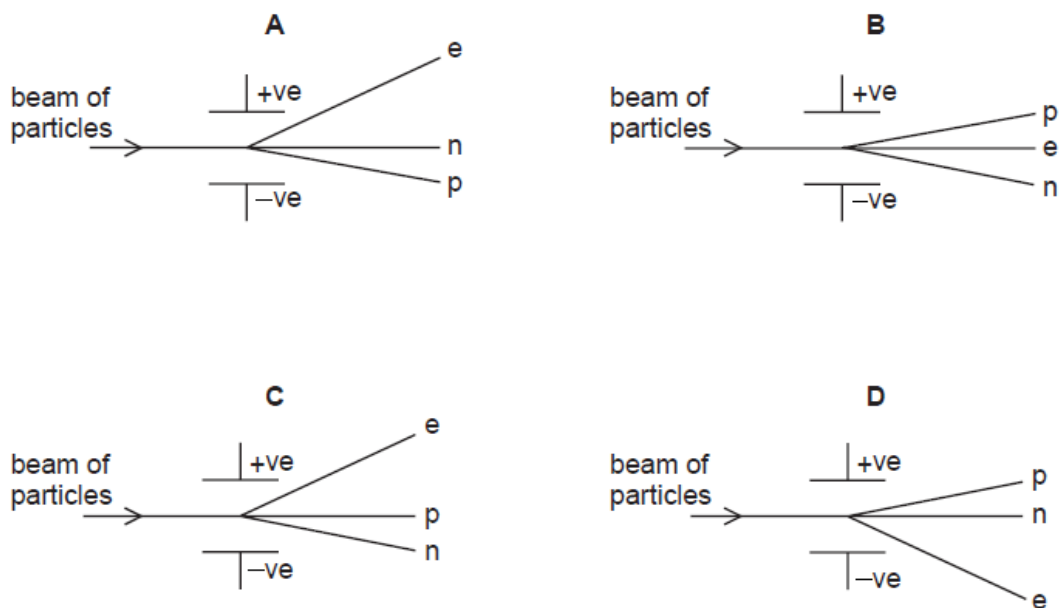
---

# ATOMIC STRUCTURE

6 A beam of particles contains neutrons, n, protons, p, and electrons, e.

The beam is passed between charged plates.

Which diagram shows how the particles are affected by the plates?



w/06/qp1

6 The atoms  $^{31}_{15}\text{P}$  and  $^{32}_{16}\text{S}$  have the same

- A nucleon number.
- B number of electrons.
- C number of neutrons.
- D number of protons.

w/05/qp1

6 Two particles X and Y have the composition shown in the table.

particle	number of electrons	number of neutrons	number of protons
X	10	8	8
Y	18	18	17

The particles X and Y are

- A metal atoms.
- B non-metal atoms.
- C negative ions.
- D positive ions.

# ATOMIC STRUCTURE

---

w/04/qp1

---

- 7 What is the nucleon number of the isotope of uranium,  ${}_{92}^{235}\text{U}$ ?
- A** 92                      **B** 143                      **C** 235                      **D** 327

w/04/qp1

---

- 6 An atom of element **X** is represented by  ${}^7_3\text{X}$ .
- Which statement about an atom of **X** is correct?
- A** It is in Group III of the Periodic Table.  
**B** It is in Group VII of the Periodic Table.  
**C** The total number of protons and electrons is 6.  
**D** The total number of protons and neutrons is 10.

w/03/qp1

---

- 22 Which property decides the order of the elements in the Periodic Table?
- A** the masses of their atoms  
**B** the number of electrons in the outer shell  
**C** the number of neutrons in the nucleus  
**D** the number of protons in the nucleus

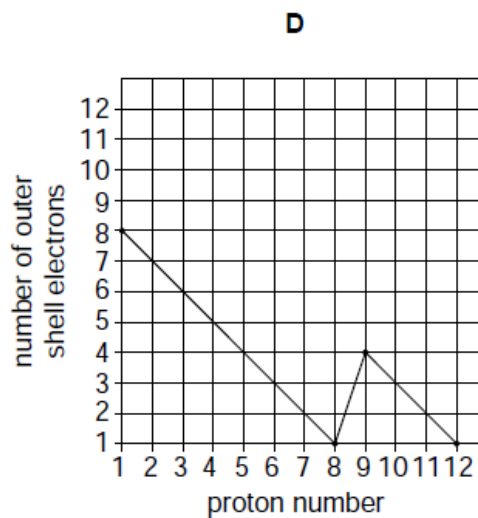
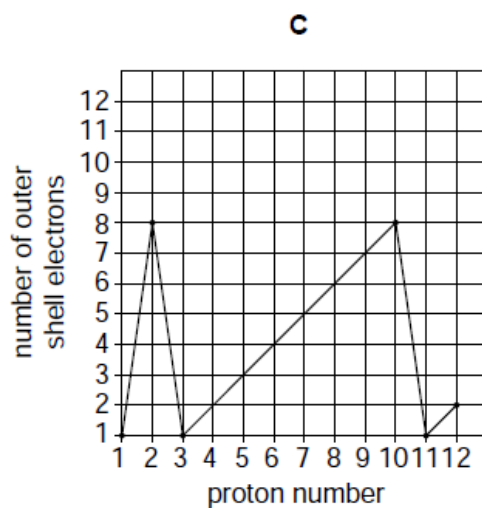
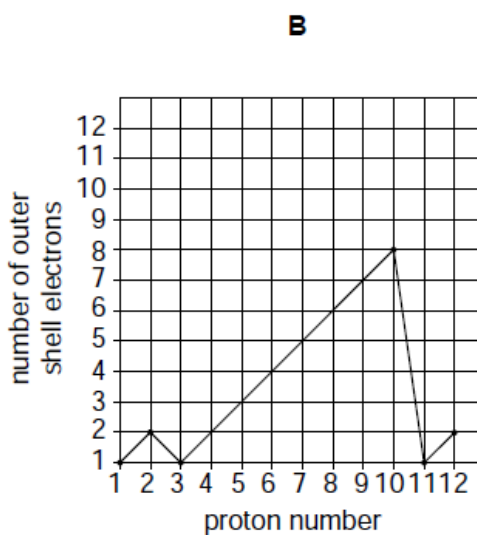
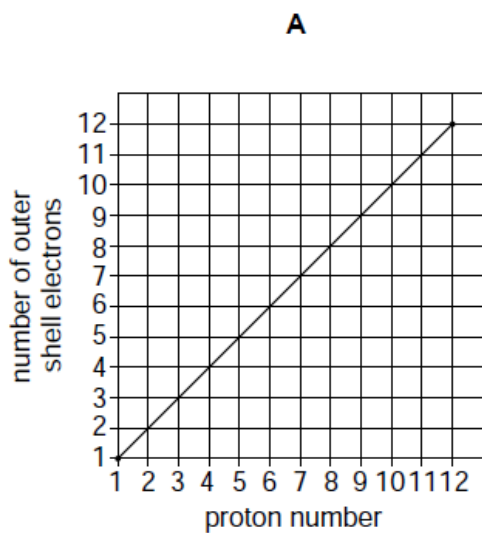
w/02/qp1

---

# ATOMIC STRUCTURE

- 7 The number of outer shell electrons for the atoms of the first 12 elements in the Periodic Table is plotted against the proton number of the element.

Which graph is obtained?



w/02/qp1

- 5 Which ion has the most shells that contain electrons?

- A  $Al^{3+}$
- B  $Be^{2+}$
- C  $N^{3-}$
- D  $S^{2-}$

w/02/qp1

# ATOMIC STRUCTURE

25 Which atom has the same electronic configuration as the strontium ion?

- A calcium
- B krypton
- C rubidium
- D selenium

s/06/qp1

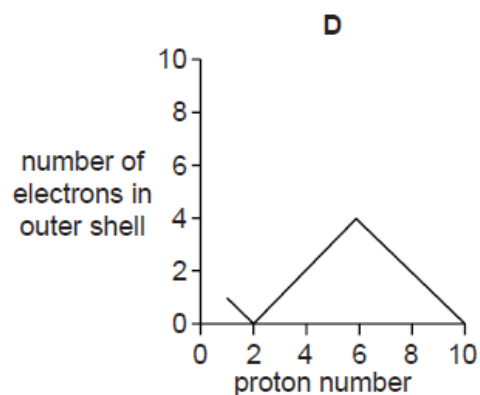
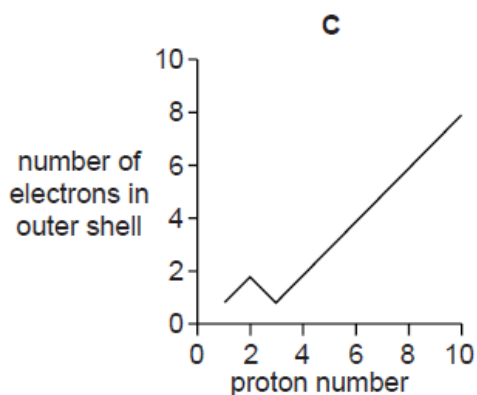
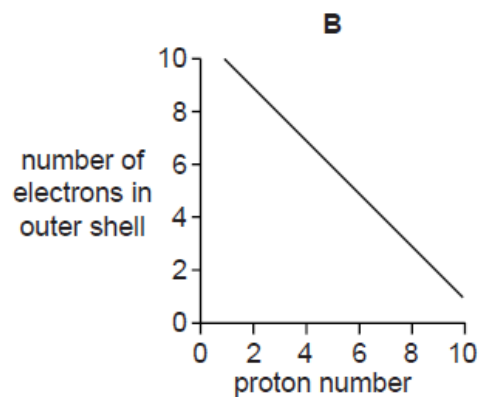
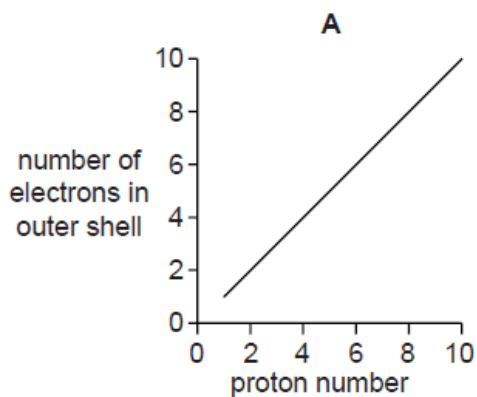
5 Hydrogen can form both  $H^+$  ions and  $H^-$  ions.

Which statement about these two ions is correct?

- A An  $H^+$  ion has no electrons in its first shell.
- B An  $H^+$  ion has more protons than an  $H^-$  ion.
- C An  $H^-$  ion has one more electron than an  $H^+$  ion.
- D An  $H^-$  ion is formed when a hydrogen atom loses an electron.

s/06/qp1

6 Which graph shows the number of electrons in the outer shell of an atom, plotted against the proton (atomic) number for the first ten elements in the Periodic Table?



s/06/qp1



# ATOMIC STRUCTURE

---

- 7 An element X has two isotopes,  $^{238}\text{X}$  and  $^{235}\text{X}$ .

How does  $^{238}\text{X}$  differ from  $^{235}\text{X}$ ?

- A It has 3 more protons and 3 more electrons.
- B It has 3 more protons, but no more electrons.
- C It has 3 more neutrons and 3 more electrons.
- D It has 3 more neutrons, but no more electrons.

s/04/qp1

---

- 8 The formulae of the ions of four elements are shown below.



Which statement about these ions is correct?

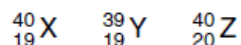
They all have

- A the same number of electrons in their outer shells.
- B the same electronic structure as a noble gas.
- C the same number of protons in their nuclei.
- D more electrons than protons.

s/04/qp1

---

- 7 The letters X, Y and Z represent different atoms.



What can be deduced from the proton numbers and nucleon numbers of X, Y and Z?

- A X and Y are the same element.
- B X and Z are the same element.
- C X has more protons than Y.
- D Z has more neutrons than Y.

s/03/qp1

---

- 11 Which of the following contains the same number of electrons as an atom of neon?

- A  $\text{Cl}^{-}$
- B Li
- C  $\text{Li}^{+}$
- D  $\text{O}^{2-}$

s/03/qp1

---

# ATOMIC STRUCTURE

---

- 5 The table contains information on the structure of four particles.

particle	proton number	number of protons	number of neutrons	number of electrons
Mg	12	12	W	12
Mg <sup>2+</sup>	12	12	12	X
F	Y	9	10	9
F <sup>-</sup>	9	9	10	Z

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

	W	X	Y	Z
<b>A</b>	10	12	9	10
<b>B</b>	12	10	9	10
<b>C</b>	12	10	10	9
<b>D</b>	12	12	10	9

5070\_w14\_qp11

---

- 4 An atom of element Z has 14 neutrons and 13 protons.

It forms a positive ion.

How many electrons does the ion of Z have?

- A** 10                      **B** 13                      **C** 14                      **D** 27

5070\_w14\_qp12

---

- 26 An atom of which element gains three electrons when it forms an ion?

- A** aluminium  
**B** iron  
**C** nitrogen  
**D** silicon

5070\_s12\_qp11

---

# ATOMIC STRUCTURE

---

10 An atom, X, contains 16 protons.

Which statement about X is correct?

- A It cannot form an ion.
- B It contains 6 electrons in the outer shell.
- C It contains 6 neutrons.
- D It has relative atomic mass of 16.

5070\_s12\_qp11

---

23 Element Q is in Period 3 of the Periodic Table. It can form ions with the formula  $Q^{3-}$ .

Which element is most likely to be Q?

- A aluminium
- B arsenic
- C phosphorus
- D sulfur

5070\_s14\_qp12

---

6 An ion  $X^+$  has 23 nucleons and 10 electrons.

What does the nucleus of X contain?

	protons	neutrons
A	9	14
B	10	13
C	11	12
D	13	10

5070\_s14\_qp12

---

5 Which electronic configurations represent three metallic elements in the same period of the Periodic Table?

	element 1	element 2	element 3
A	2, 8, 7	2, 8, 8	2, 8, 1
B	2, 1	2, 8, 1	2, 8, 8, 1
C	2, 2	2, 3	2, 4
D	2, 8, 1	2, 8, 2	2, 8, 3

5070\_s14\_qp11

---

# ATOMIC STRUCTURE

---

- 2 A radioactive isotope of carbon has more nucleons than the non-radioactive isotope,  $^{12}_6\text{C}$ .

How many protons, neutrons and electrons could there be in this **radioactive** isotope of carbon?

	protons	neutrons	electrons
<b>A</b>	6	6	6
<b>B</b>	6	8	6
<b>C</b>	8	6	8
<b>D</b>	8	8	8

5070\_s14\_qp11

---

- 4 Two particles have the compositions shown.

	electrons	neutrons	protons
X	4	6	5
Y	6	4	5

Which statement about X and Y is correct?

- A** They are both positively charged.
- B** They are particles of the same element.
- C** They have the same mass number.
- D** They have the same number of nucleons.

5070\_w12\_qp12

---

- 22 An element X forms an ion  $\text{X}^{3-}$ .

In which group of the Periodic Table will this element be found?

- A** Group I
- B** Group III
- C** Group V
- D** Group VII

5070\_w12\_qp11

---

# ATOMIC STRUCTURE

---

11 Which statement about the particles  $O^{2-}$ ,  $F^-$ , Ne,  $Na^+$  and  $Mg^{2+}$  is true?

They all

- A contain more electrons than protons.
- B contain more neutrons than protons.
- C contain the same number of electrons.
- D contain the same number of neutrons.

5070\_w12\_qp11

---

# ATOMIC STRUCTURE

---

## ATOMIC STRUCTURE (IGCSE 0620 MCQS)

10 An element, X, can be represented as  ${}^a_b X$ .

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**.

0620\_w/14/qp13

---

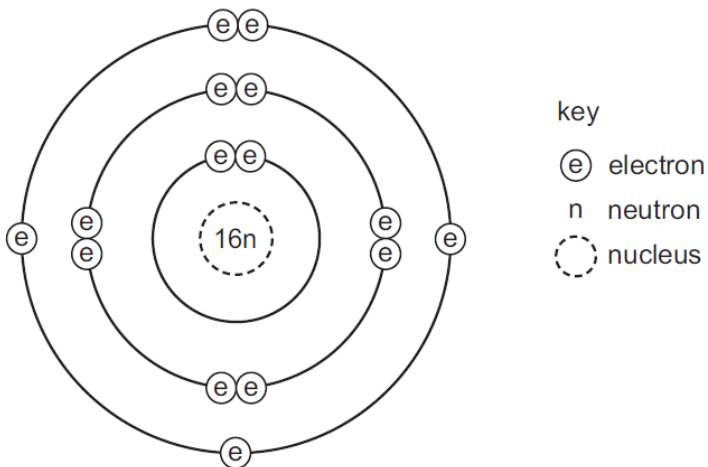
4 Which statement about a neutron is **not** correct?

- 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.

0620\_w/14/qp13

---

5 Which element has the atomic structure shown?



- A Al
- B P
- C S
- D Si

0620\_w/14/qp11

---

# ATOMIC STRUCTURE

---

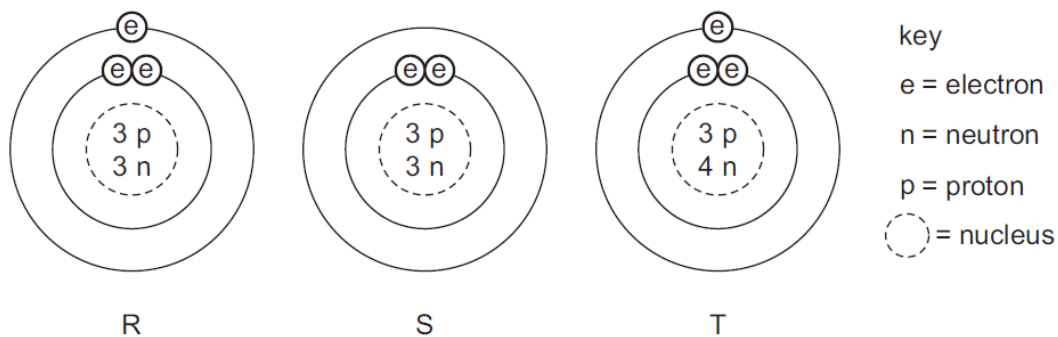
4 What is different for isotopes of the same element?

- A nucleon number
- B number of electron shells
- C number of electrons in the outer shell
- D proton number

0620\_w/14/qp11

---

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



Which row describes these particles?

	ions	isotopes
<b>A</b>	R	S and T
<b>B</b>	R and S	T
<b>C</b>	S	R and T
<b>D</b>	T	R and S

0620\_w/13/qp13

---

# ATOMIC STRUCTURE

---

- 4 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

0620\_w/13/qp13

---

- 21 Calcium, on the left of Period 4 of the Periodic Table, is more metallic than bromine on the right of this period.

Why is this?

Calcium has

- A** fewer electrons.  
**B** fewer protons.  
**C** fewer full shells of electrons.  
**D** fewer outer shell electrons.

0620\_w/13/qp11

---

- 5 Which statements about a sodium atom,  ${}_{11}^{23}\text{Na}$ , 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

0620\_w/13/qp11

---



# ATOMIC STRUCTURE

---

- 4 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

0620\_w/13/qp11

---

- 4 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
<b>A</b>	37	48	37
<b>B</b>	37	48	39
<b>C</b>	39	46	37
<b>D</b>	39	46	39

0620\_w/12/qp13

---

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

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

0620\_w/12/qp11

---

# ATOMIC STRUCTURE

---

4 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
<b>A</b>	✓	✓
<b>B</b>	✓	x
<b>C</b>	x	✓
<b>D</b>	x	x

0620\_w/12/qp11

---

7 The table describes the structures of four particles.

particle	number of protons	number of neutrons	number of electrons
O	8	8	8
O <sup>2-</sup>	8	8	<b>X</b>
Na	11	<b>Y</b>	11
Na <sup>+</sup>	11	12	<b>Z</b>

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

	<b>X</b>	<b>Y</b>	<b>Z</b>
<b>A</b>	9	11	10
<b>B</b>	9	11	11
<b>C</b>	10	12	10
<b>D</b>	10	12	11

0620\_w/11/qp11

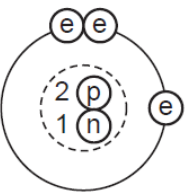
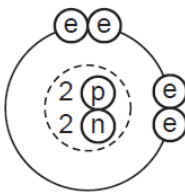
---

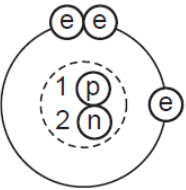
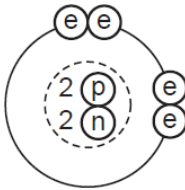
# ATOMIC STRUCTURE

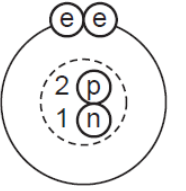
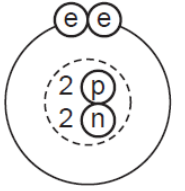
5 Two isotopes of helium are  ${}^3_2\text{He}$  and  ${}^4_2\text{He}$ .

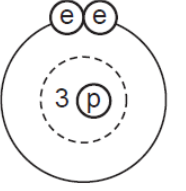
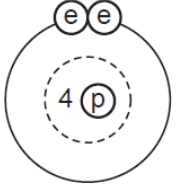
Which two diagrams show the arrangement of particles in these two isotopes?

${}^3_2\text{He}$                        ${}^4_2\text{He}$

**A**  

**B**  

**C**  

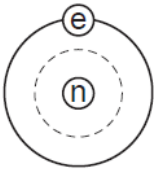
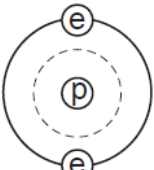
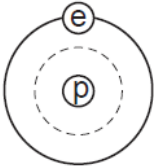
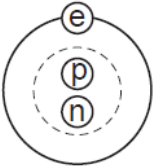
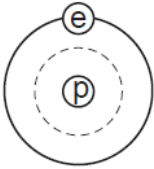
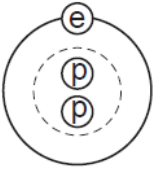
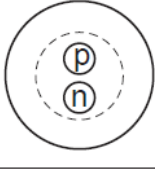
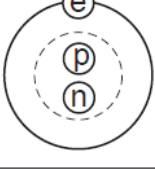
**D**  

key  
ⓔ = electron  
Ⓟ = proton  
Ⓝ = neutron  
⊖ = nucleus

# ATOMIC STRUCTURE

6 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?

	${}^1_1\text{H}$	${}^2_1\text{H}$
<b>A</b>		
<b>B</b>		
<b>C</b>		
<b>D</b>		

key

- $\textcircled{e}$  = an electron
- $\textcircled{p}$  = a proton
- $\textcircled{n}$  = a neutron
- $\textcircled{\quad}$  = a nucleus

# ATOMIC STRUCTURE

---

- 5 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 <sup>2+</sup>	X	24	12	12	10
F	9	19	9	Y	9
F <sup>-</sup>	9	19	9	10	Z

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

	W	X	Y	Z
<b>A</b>	10	10	9	9
<b>B</b>	10	12	10	9
<b>C</b>	12	10	9	10
<b>D</b>	12	12	10	10

0620\_w/10/qp11

---

- 4 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

0620\_w/10/qp11

---

- 9 Which change to an atom occurs when it forms a positive ion?

- A** It gains electrons.  
**B** It gains protons.  
**C** It loses electrons.  
**D** It loses protons.

0620\_w/09/qp11

---

# ATOMIC STRUCTURE

---

5 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

0620\_w/09/qp11

---

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

- A aluminium
- B bromine
- C calcium
- D rubidium

0620\_w/09/qp11

---

4 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

0620\_w/09/qp11

---

26 What is the formula of a strontium ion?

- A  $\text{Sr}^{2+}$
- B  $\text{Sr}^+$
- C  $\text{Sr}^-$
- D  $\text{Sr}^{2-}$

0620\_w/08/qp1

---

# ATOMIC STRUCTURE

---

8 Which particle is an ion?

	number of protons	number of neutrons	number of electrons
<b>A</b>	1	0	1
<b>B</b>	3	4	3
<b>C</b>	6	6	6
<b>D</b>	11	12	10

0620\_w/08/qp1

---

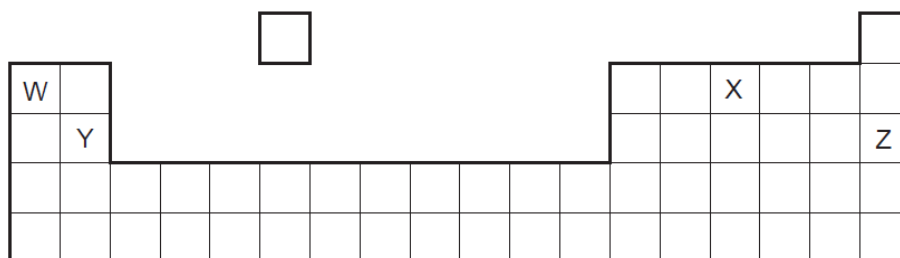
5 What do the nuclei in hydrogen molecules contain?

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

0620\_w/08/qp1

---

6 The diagram shows part of the Periodic Table.



Which element is correctly matched with its electronic structure?

	element	electronic structure
<b>A</b>	W	2,8,1
<b>B</b>	X	2,4
<b>C</b>	Y	2,8,2
<b>D</b>	Z	2,8

0620\_w/08/qp1

---

5 Which atom has twice as many neutrons as protons?

- A**  ${}^1_1\text{H}$
- B**  ${}^2_1\text{H}$
- C**  ${}^3_1\text{H}$
- D**  ${}^4_2\text{He}$

0620\_s/12/qp11

---

# ATOMIC STRUCTURE

---

- 4 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.

0620\_s/12/qp11

---

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

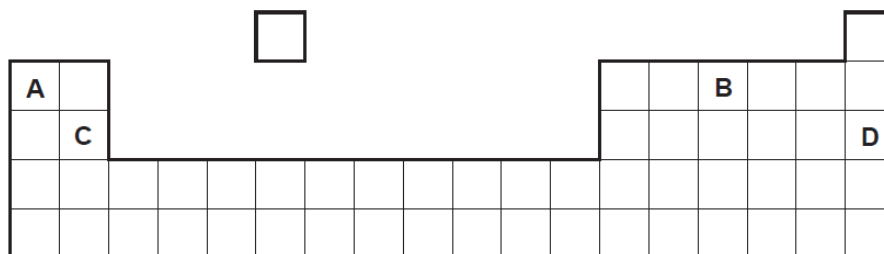
What is the correct symbol for the lithium ion in lithium chloride?

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

0620\_s/11/qp11

---

- 5 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

0620\_s/11/qp11

---



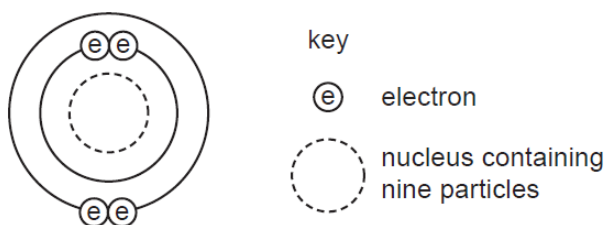
# ATOMIC STRUCTURE

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

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

0620\_s/10/qp11

- 5 The diagram shows an atom.



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

	proton number	neutron number
<b>A</b>	4	5
<b>B</b>	4	9
<b>C</b>	5	4
<b>D</b>	5	9

0620\_s/10/qp11

- 6 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.

0620\_s/10/qp11

# ATOMIC STRUCTURE

---

- 5 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

0620\_s/09/qp11

---

- 6 The electronic configuration of an ion is 2.8.8.

What could this ion be?

	S <sup>2-</sup>	Ca <sup>2+</sup>
A	✓	✓
B	✓	x
C	x	✓
D	x	x

0620\_s/09/qp11

---

- 4 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.

0620\_s/09/qp11

---

- 4 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  ${}^7_3\text{Li}^-$

0620\_s/08/qp1

---

# ATOMIC STRUCTURE

---

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

	protons	neutrons	electron 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

0620\_s/08/qp1

---

- 6 What are the nucleon numbers for carbon and magnesium?

	carbon	magnesium
<b>A</b>	6	12
<b>B</b>	6	24
<b>C</b>	12	12
<b>D</b>	12	24

0620\_s/08/qp1

---

- 6 Element Y is in the second Period of the Periodic Table. An atom of element Z has six more protons than an atom of element Y.

Which statement **must** be correct?

- A** Elements Y and Z are in the same Period.  
**B** Elements Y and Z have the same number of electrons in the first shell.  
**C** Element Z has six more electrons in its outer shell than element Y.  
**D** The nucleon number of element Z is six more than that of element Y.

0620\_s/07/qp1

---

# ATOMIC STRUCTURE

---

5 An atom has the symbol  ${}^p_qX$ .

Which value determines the position of the element in the Periodic Table?

- A  $p$
- B  $q$
- C  $p - q$
- D  $p + q$

0620\_s/07/qp1

---

7 Which change to an atom occurs when it forms a positive ion?

- A It gains an electron.
- B It gains a proton.
- C It loses an electron.
- D It loses a proton.

0620\_s/06/qp1

---

5 Which numbers are added 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

0620\_s/06/qp1

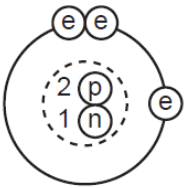
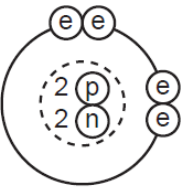
---

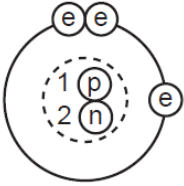
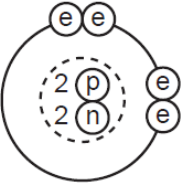
# ATOMIC STRUCTURE

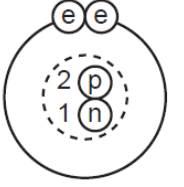
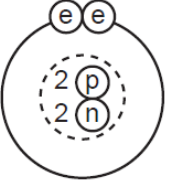
- 4 Two isotopes of helium are  ${}^3_2\text{He}$  and  ${}^4_2\text{He}$ .

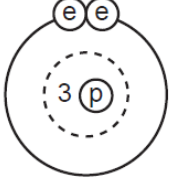
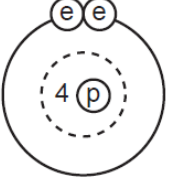
Which two diagrams show the arrangement of particles in these two isotopes?

${}^3_2\text{He}$                        ${}^4_2\text{He}$

**A**  

**B**  

**C**  

**D**  

key  
ⓔ electron  
Ⓟ proton  
Ⓝ neutron  
⋯ nucleus

0620\_s/05/qp1

- 5 Which row gives the outer electronic shell of fluorine and of neon?

	${}^9\text{F}$	${}^{10}\text{Ne}$
<b>A</b>	7	8
<b>B</b>	7	10
<b>C</b>	9	8
<b>D</b>	9	10

0620\_s/05/qp1

# ATOMIC STRUCTURE

---

6 The electronic configuration of an ion is 2.8.8.

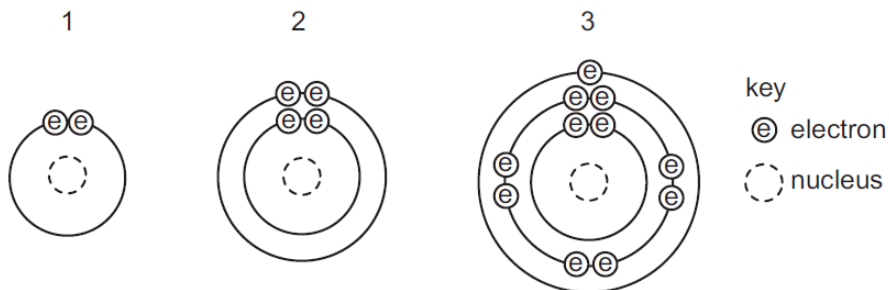
What could this ion be?

	$S^{2-}$	$Ca^{2+}$
<b>A</b>	✓	✓
<b>B</b>	✓	x
<b>C</b>	x	✓
<b>D</b>	x	x

0620\_s/05/qp1

---

22 The diagrams show the arrangement of electrons in three different atoms.



Which atoms are metals?

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

0620\_s/04/qp1

---

11 The proton number of helium is 2.

What information does this give about helium?

- A** Its atom has two electrons.  
**B** Its atom is twice as heavy as a hydrogen atom.  
**C** It is a Group II element.  
**D** Its molecule has two atoms.

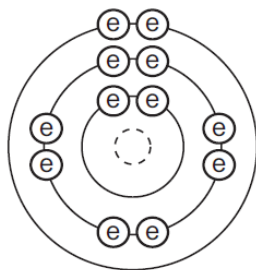
0620\_s/04/qp1

---

# ATOMIC STRUCTURE

---

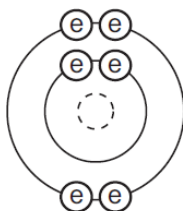
6 The electronic structure of an element is shown.



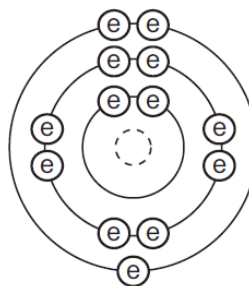
key  
⊙ electron  
⊖ nucleus

Which diagram shows the electronic structure of another element in the same group in the Periodic Table?

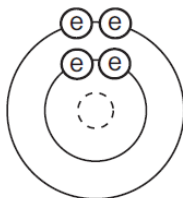
**A**



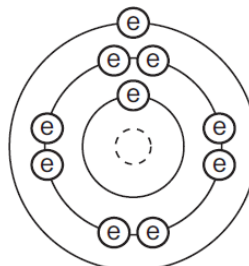
**B**



**C**



**D**



# ATOMIC STRUCTURE

---

- 9 The relative atomic mass of oxygen is 16 and that of hydrogen is 1.

This means that ... (i) ... of oxygen has the same mass as ... (ii) ... of hydrogen.

Which words correctly complete the gaps?

	gap (i)	gap (ii)
<b>A</b>	an atom	thirty-two molecules
<b>B</b>	an atom	eight molecules
<b>C</b>	a molecule	sixteen atoms
<b>D</b>	a molecule	eight atoms

0620\_s/03/qp1

---

- 5 Which number in the table is  $-1$ ?

particle	charge	relative mass
electron	<b>A</b>	<b>B</b>
neutron	<b>C</b>	1
proton	<b>D</b>	1

0620\_s/03/qp1

---

- 6 What is the electronic structure of an atom with a proton number 5 and a nucleon number 11?

**A** 1, 8, 2

**B** 2, 8, 1

**C** 2, 3

**D** 3, 2

0620\_s/03/qp1

---

- 7 What changes when an ion is made from an atom?

**A** the number of electrons only

**B** the number of neutrons only

**C** the number of protons only

**D** the number both of protons and of neutrons

0620\_s/03/qp1

---



# ATOMIC STRUCTURE

---

5 Students are asked to draw a diagram of an atom with symbol  ${}^3_1\text{X}$ .

Which diagram is correct?

**A**

**B**

**C**

**D**

key

Ⓟ proton

Ⓝ neutron

ⓔ electron

⊖ nucleus

0620\_w/07/qp1

---

6 The table describes the structures of four particles.

particle	number of protons	number of neutrons	number of electrons
O	8	8	8
$\text{O}^{2-}$	8	8	<b>X</b>
Na	11	<b>Y</b>	11
$\text{Na}^+$	11	12	<b>Z</b>

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

	<b>X</b>	<b>Y</b>	<b>Z</b>
<b>A</b>	9	11	10
<b>B</b>	9	11	11
<b>C</b>	10	12	10
<b>D</b>	10	12	11

0620\_w/07/qp1

---

8 Which atom has twice as many neutrons as protons?

- A**  ${}^1_1\text{H}$ 
**B**  ${}^2_1\text{H}$ 
**C**  ${}^3_1\text{H}$ 
**D**  ${}^4_2\text{He}$

0620\_w/06/qp1

---

# ATOMIC STRUCTURE

---

- 5 The table shows the nucleon numbers and proton numbers of some atoms.

nucleon number	35	37	40	39	40
proton number	17	17	18	19	19

How many are atoms of non-metallic elements?

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

0620\_w/06/qp1

---

- 4 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

0620\_w/06/qp1

---

- 4 What do the nuclei in hydrogen molecules contain?

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

0620\_w/05/qp1

---

- 5 Which statements about isotopic atoms of the same element are correct?

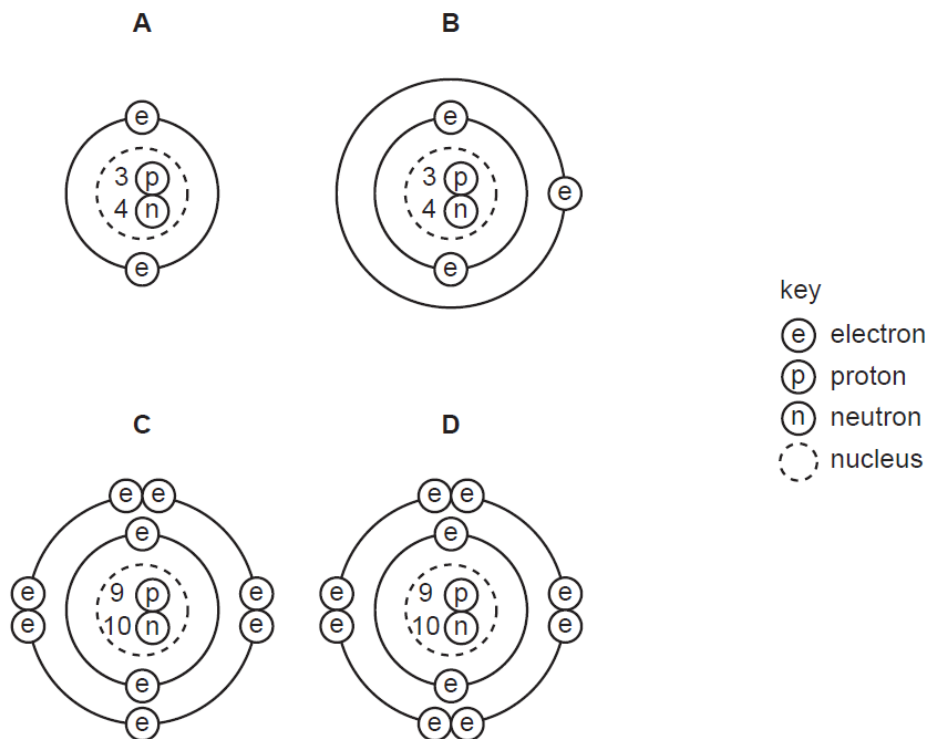
	different number of electrons	different number of neutrons
<b>A</b>	✓	✓
<b>B</b>	✓	✗
<b>C</b>	✗	✓
<b>D</b>	✗	✗

0620\_w/05/qp1

---

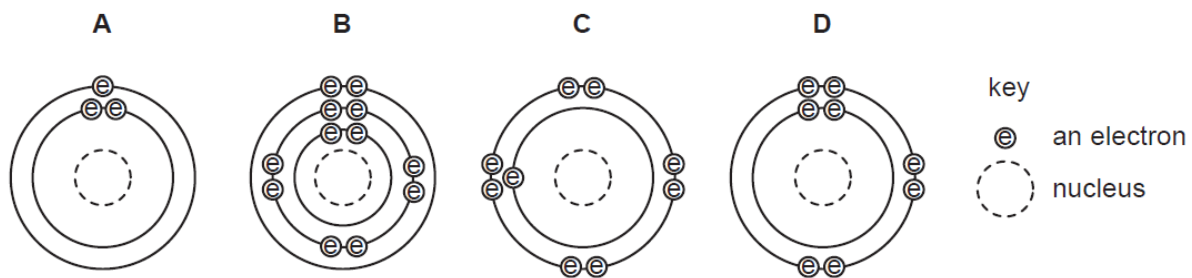
# ATOMIC STRUCTURE

6 Which diagram shows a positively charged ion?



0620\_w/05/qp1

8 Which diagram shows an atom in the same group of the Periodic Table as sodium?



0620\_w/04/qp1

# ATOMIC STRUCTURE

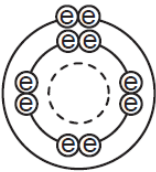
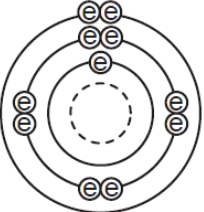


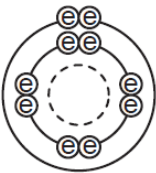
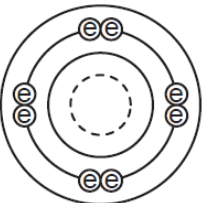
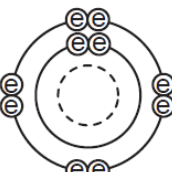
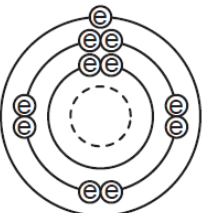
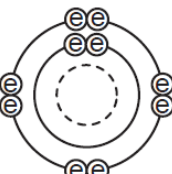
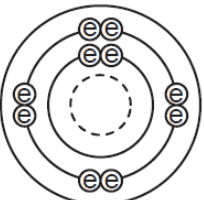
5 Hydrogen and helium have isotopes, as shown.

In which of these isotopes does the nucleus have twice as many neutrons as protons?

- A  ${}^2_1\text{H}$
- B  ${}^3_1\text{H}$
- C  ${}^3_2\text{He}$
- D  ${}^4_2\text{He}$

0620\_w/04/qp1

6 How are the electrons arranged in a neon **atom**, Ne, and a sodium **ion**,  $\text{Na}^+$ ?

	neon <b>atom</b>	sodium <b>ion</b>	
A			key
			 electron
			 nucleus
B			
C			
D			

0620\_w/04/qp1

# ATOMIC STRUCTURE

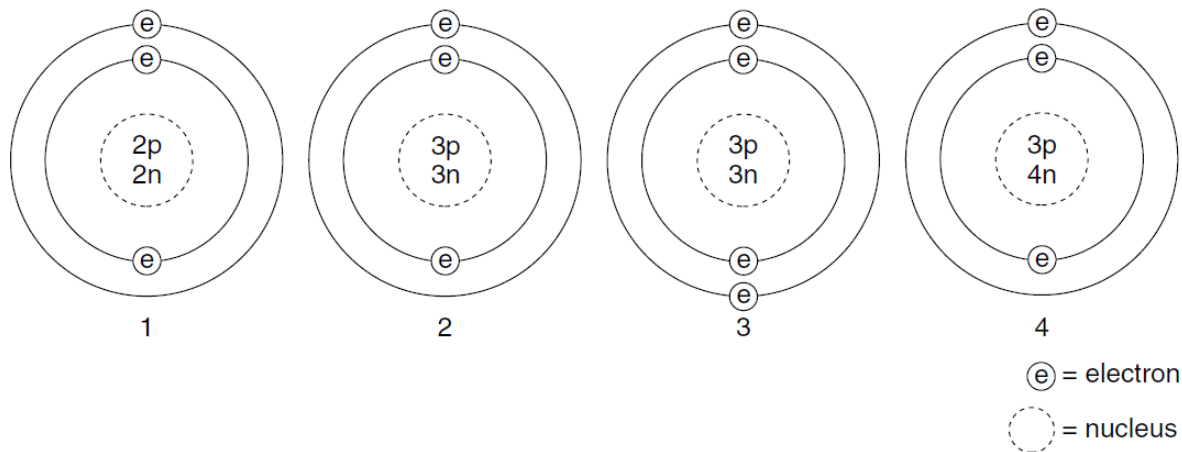
5 The table shows the electronic structures of four elements.

Which element is a noble gas?

element	number of electrons	
	shell 1	shell 2
<b>A</b>	1	0
<b>B</b>	2	0
<b>C</b>	2	2
<b>D</b>	2	6

0620\_w/03/qp1

6 The diagrams show four particles.



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

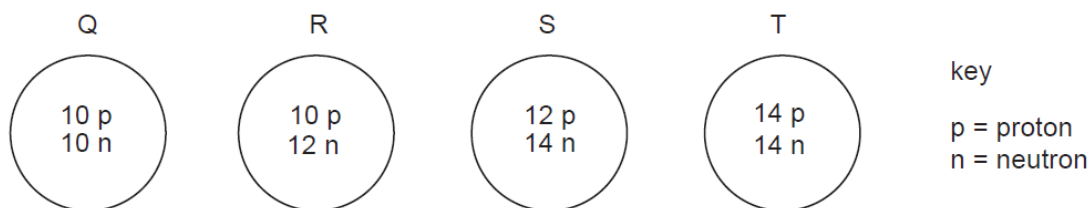
- A** 1 and 2
- B** 1 and 3
- C** 2 and 3
- D** 2 and 4

0620\_w/03/qp1

# ATOMIC STRUCTURE

---

5 The diagrams show the nuclei of four different atoms.



Which two atoms are isotopes of each other?

- A** Q and R                      **B** Q and T                      **C** R and S                      **D** S and T

0620\_w/02/qp1

---

6 Which atom has twice as many neutrons as protons?

- A**  ${}^1_1\text{H}$                       **B**  ${}^2_1\text{H}$                       **C**  ${}^3_1\text{H}$                       **D**  ${}^4_2\text{He}$

0620\_w/02/qp1

---

7 Which change takes place when an atom becomes a positive ion?

- A** An electron is added.  
**B** An electron is removed.  
**C** A proton is added.  
**D** A proton is removed.

0620\_w/02/qp1

---

4 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

0620\_s/14/qp12

---

# ATOMIC STRUCTURE

---

7 Element X is in Group I of the Periodic Table. X reacts with element Y to form an ionic compound.

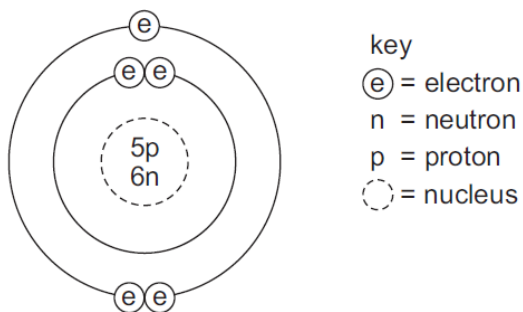
Which equation shows the process that takes place when X forms ions?

- A  $X + e^- \rightarrow X^+$
- B  $X - e^- \rightarrow X^-$
- C  $X + e^- \rightarrow X^-$
- D  $X - e^- \rightarrow X^+$

0620\_s/14/qp11

---

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



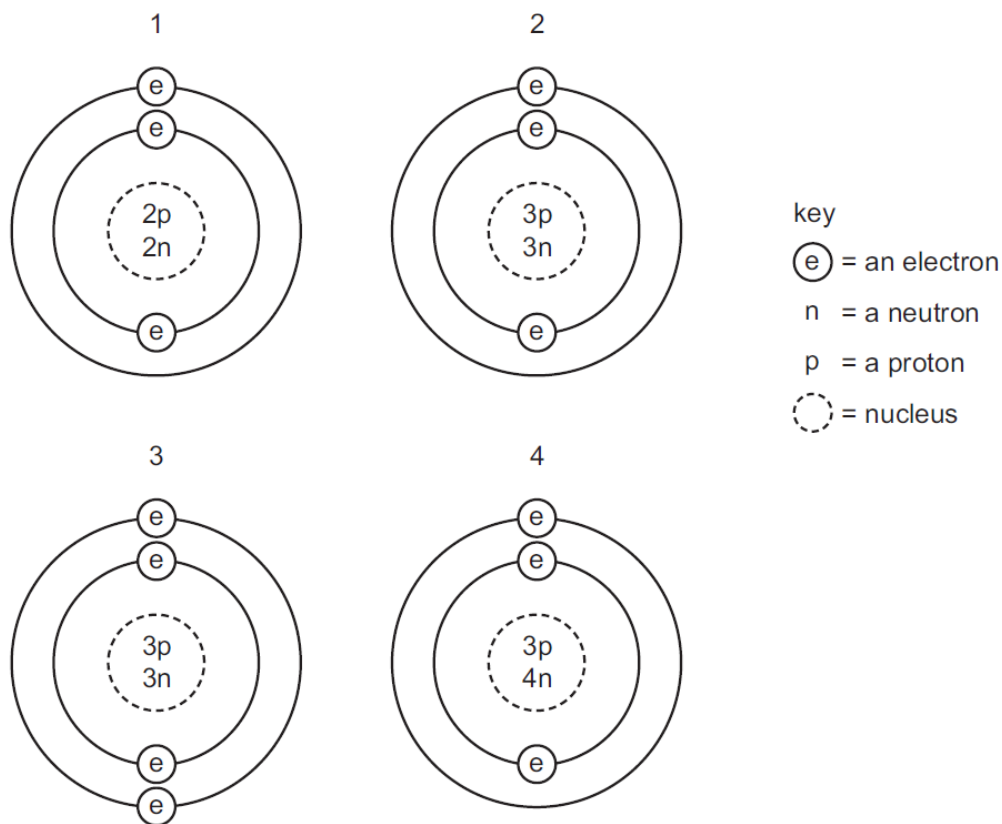
What is X?

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

0620\_s/14/qp11

# ATOMIC STRUCTURE

5 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

0620\_s/14/qp11

4 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.

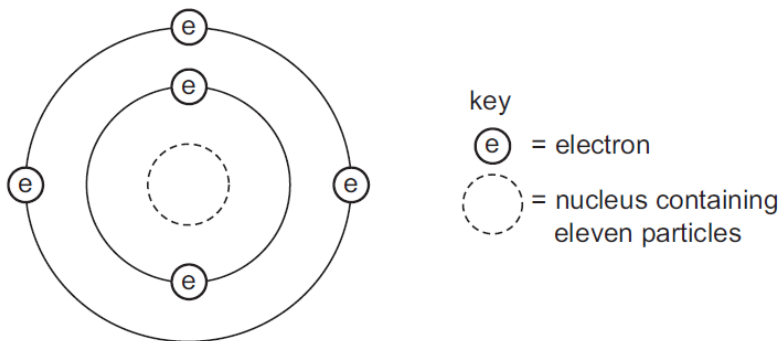
0620\_s/13/qp11



# ATOMIC STRUCTURE

---

5 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
<b>A</b>	5	6	3	2
<b>B</b>	5	11	2	3
<b>C</b>	6	5	3	2
<b>D</b>	6	11	2	3

0620\_s/13/qp12

---

# ATOMIC STRUCTURE

---

## ATOMIC STRUCTURE (IGCSE 0620 THEORY)

1 Zirconium (Zr) is a metal in Period 5. Its main oxidation state is +4.

(a) The following are all zirconium atoms:  ${}_{40}^{90}\text{Zr}$ ,  ${}_{40}^{91}\text{Zr}$  and  ${}_{40}^{92}\text{Zr}$ .

In terms of numbers of electrons, neutrons and protons, how are these three atoms the same and how are they different?

They are the same because .....

.....

They are different because .....

..... [3]

(b) Containers for fuel rods in nuclear reactors are made of zirconium.  
Nuclear reactors are used to produce energy and to make radioactive isotopes.

(i) Which isotope of a different element is used as a fuel in nuclear reactors?

..... [1]

(ii) State one medical and one industrial use of radioactive isotopes.

.....

..... [2]

(iii) Above 900 °C, zirconium reacts with water to form zirconium(IV) oxide,  $\text{ZrO}_2$ , and hydrogen. Write an equation for this reaction.

..... [2]

(iv) In a nuclear accident, water may come in contact with very hot zirconium.  
Explain why the presence of hydrogen inside the reactor greatly increases the danger of the accident.

..... [1]

# ATOMIC STRUCTURE

---

(b) A radioactive isotope of iodine,  $^{131}_{53}\text{I}$ , is used to treat cancer.

(i) Define the term *isotope*.

.....  
..... [2]

(ii) How many protons, electrons and neutrons are there in one atom of  $^{131}_{53}\text{I}$ ?

number of protons .....  
number of electrons .....  
number of neutrons ..... [2]

(iii) When this isotope,  $^{131}_{53}\text{I}$ , emits radiation, a different element with a proton number of 54 is formed.

What is the name of this element?  
..... [1]

0620/w12/qp31

1 The table below includes information about some of the elements in Period 2.

element	carbon	nitrogen	fluorine	neon
symbol	C	N	F	Ne
structure	macromolecular	simple molecules $\text{N}_2$	simple molecules $\text{F}_2$	single atoms Ne
boiling point/ $^{\circ}\text{C}$	4200	-196	-188	-246

(a) Why does neon exist as single atoms but fluorine exists as molecules?

.....  
..... [2]

(b) What determines the order of the elements in a period?

..... [1]

0620/s12/qp32

---

# ATOMIC STRUCTURE

---

- 2 (a) Complete the table which gives the names, symbols, relative masses and relative charges of the three subatomic particles.

name	symbol	relative mass	relative charge
electron	$e^-$		
proton		1	
	n		0

[3]

- (b) Use the information in the table to explain the following.

- (i) Atoms contain charged particles but they are electrically neutral because they have no overall charge.

.....  
..... [2]

- (ii) Atoms can form positive ions.

.....  
..... [2]

- (iii) Atoms of the same element can have different masses.

.....  
..... [2]

- (iv) Scientists are certain that there are no undiscovered elements missing from the Periodic Table from hydrogen to lawrencium.

..... [1]

[Total: 10]

# ATOMIC STRUCTURE

---

5 The first three elements in Period 6 of the Periodic Table of the Elements are caesium, barium and lanthanum.

(a) How many **more** protons, electrons and neutrons are there in one atom of lanthanum than in one atom of caesium. Use your copy of the Periodic Table of the Elements to help you.

number of protons .....

number of electrons .....

number of neutrons ..... [3]

0620/s03/qp3

2 The table below gives the number of protons, neutrons and electrons in atoms or ions.

particle	number of protons	number of electrons	number of neutrons	symbol or formula
A	9	10	10	${}^{19}_{9}\text{F}^{-}$
B	11	11	12	
C	18	18	22	
D	15	18	16	
E	13	10	14	

(a) Complete the table. The first line is given as an example. [6]

(b) Which atom in the table is an isotope of the atom which has the composition 11p, 11e and 14n? Give a reason for your choice.

.....

..... [2]

[Total: 8]

0620/w07/qp3

---

# ATOMIC STRUCTURE

---

5 Strontium and zinc are both metals with a valency of 2. Strontium is more reactive than zinc. Its chemistry is similar to that of calcium.

(a) (i) Complete the following table that shows the number of protons, electrons and neutrons in each particle.

particle	protons	electrons	neutrons
$^{88}\text{Sr}$			
$^{90}\text{Sr}$			
$^{65}\text{Zn}^{2+}$			

[3]

(ii) Explain why  $^{88}\text{Sr}$  and  $^{90}\text{Sr}$  are isotopes.

..... [1]

(iii) Complete the electron distribution of an atom of strontium.

2 + 8 + 18 + ..... + ..... [1]

# ATOMIC STRUCTURE

---

1 The table below gives the composition of six particles which are either atoms or ions.

particle	number of protons	number of neutrons	number of electrons
<b>A</b>	33	40	33
<b>B</b>	19	20	18
<b>C</b>	34	45	36
<b>D</b>	33	42	33
<b>E</b>	13	14	13
<b>F</b>	24	28	21

(a) Which particles are atoms? Explain your choice.

.....  
..... [2]

(b) Which particle is a negative ion and why has this particle got a negative charge?

.....  
..... [2]

(c) Which particles are positive ions?

..... [1]

(d) Explain why particle **A** and particle **D** are isotopes.

.....  
..... [2]

[Total: 7]

# ATOMIC STRUCTURE

---

- 2 (a) The table below gives the number of protons, neutrons and electrons in atoms or ions. Complete the table. The first line is given as an example. You will need to use the Periodic Table.

particle	number of protons	number of electrons	number of neutrons	symbol or formula
A	4	4	5	${}^9_4\text{Be}$
B	19	18	20	.....
C	30	30	35	.....
D	8	10	8	.....
E	31	31	39	.....

[6]

- (b) Using the data in the table, explain how you can determine whether a particle is an atom, a negative ion or a positive ion.

.....  
.....  
..... [3]

[Total: 9]



# ATOMIC STRUCTURE

---

1 Cobalt is an element in Period 4 of the Periodic Table.

(a) Use your copy of the Periodic Table to help you complete the table below.

particle	number of protons	number of neutrons	number of electrons
Co			
Co <sup>2+</sup>			

[2]

(b) <sup>60</sup>Co is a cobalt isotope.

(i) Explain the term *isotope*.

.....  
.....  
..... [2]

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

..... [1]

(iii) State **one** industrial use and **one** medical use of radioactive isotopes.

industrial use ..... [1]

medical use ..... [1]

[Total: 7]

# ATOMIC STRUCTURE

---

1 The table gives the composition of three particles.

particle	number of protons	number of electrons	number of neutrons
<b>A</b>	15	15	16
<b>B</b>	15	18	16
<b>C</b>	15	15	17

(a) What is the evidence in the table for each of the following?

(i) Particle **A** is an atom.

.....  
..... [1]

(ii) They are all particles of the same element.

.....  
..... [1]

(iii) Particle **B** is a negative ion.

.....  
..... [2]

(iv) Particles **A** and **C** are isotopes.

.....  
..... [2]

(b) (i) What is the electronic structure of particle **A**?

..... [1]

(ii) What is the valency of the element?

..... [1]

(iii) Is the element a metal or a non-metal? Give a reason for your choice.

.....  
..... [1]

[Total: 9]