

ATOMIC STRUCTURE

Dalton's atomic theory (1807)

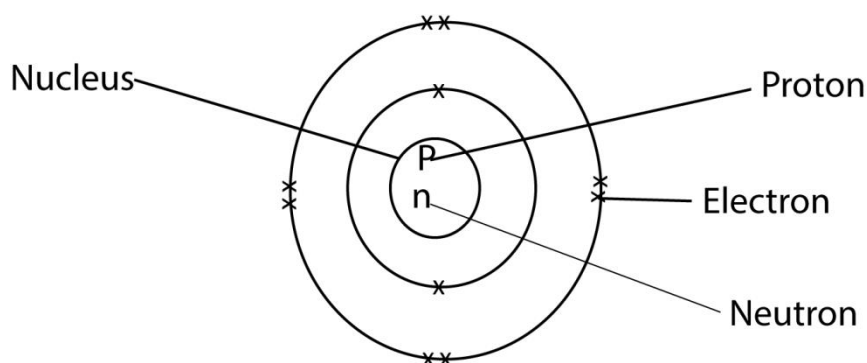
1. Matter is made of tiny, invisible particles called atoms.
2. Atoms can neither be created nor destroyed.
3. All atoms of the same element are the same and are different from atoms of other elements.
4. When atoms combine, they do so in simple whole numbers.

An atom

Is the smallest invisible, electrically neutral particle of an element that can take part in a chemical reaction.

An atom is made up of:

- A nucleus at the centre consisting of protons & neutrons called **nucleons**.
- The nucleus is surrounded by negatively charged particles called **electrons**, in a sphere called **energy levels** or **quantum shells**, which rotate around it.



The nature of the atom

All atoms contain some:

- Negatively charged particles called **electrons**.
- Positively charged particles called **protons**.
- Particles without a charge are called **neutrons** (n).
 - Neutrons + protons = **Atomic mass** (Z).
 - The number of protons present is called **atomic number**.
 - The number of electrons in an atom is = number of protons.
- The atomic mass (Z) and atomic number (p) of an atom X are often represented symbolically as Z_pX .

Exercise

1. The number of protons lithium (Li) is 3 and the neutron is 3.
 - a. The atomic number of Li is.....
 - b. The atomic mass of Li.....
 - c. Li has electrons.
2. The atomic number of Na is 11, the neutron number is 12.
 - a) Na has protons.
 - b) Na has electrons.
 - c) The atomic mass of Na =.....

Answers

1	a.	3	2	a)	11
	b.	$3 + 3 = 6$		b)	11
	c.	3		c)	$11 + 12 = 23$

Isotopes:

are different atoms of the same element, with the same number of protons but different number of neutrons therefore different atomic masses e.g.

Hydrogen isotopes.

Hydrogen atoms has: 1 proton, 1 electron, 0,1,2 neutrons: the isotopes are called:

- Hydrogen
- Deuterium (heavy hydrogen)
- Tritium

Chlorine isotopes

Chlorine atom has 17 protons, 17 electrons, the atom can have 18 or 20 neutrons.

Carbon

Carbon has three isotopes. 6 protons, 6 electrons, the atoms have 6 or 7 or 8 neutrons.

Electronic Configuration.

Electronic configuration shows the arrangement of electrons in the energy levels of an atom. The inner most energy level accommodates a maximum of two electrons. This energy level is filled first. The second energy level can only accommodate eight electrons. This energy level is filled after the first energy level. The third energy level can accommodate maximum of eighteen electrons and this is filled after the second energy level is filled

Period 1

Element	Symbol	Atomic number	Electronic configuration
Period 1 of periodic table			
Hydrogen	H	1	1
Helium	He	2	2

Period 2 of periodic table

Element	Symbol	Atomic number	Electronic configuration
Lithium	Li	3	2:1
Beryllium	Be	4	2:2
Boron	B	5	2:3
Carbon	C	6	2:4
Nitrogen	N	7	2:5
Oxygen	O	8	2:6
Fluorine	F	9	2:7
Neon	Ne	10	2:8

Period 3 of periodic table

Element	Symbol	Atomic number	Electronic configuration
sodium	Na	11	2:8:1
Magnesium	Mg	12	2:8:2
Aluminium	Al	13	2:8:3
Silicon	Si	14	2:8:4
Phosphorus	P	15	2:8:5
Sulphur	S	16	2:8:6
Chlorine	Cl	17	2:8:7
Argon	Ar	18	2:8:8

The electronic configurations of the first 20 elements are given below a colon is used to separate electrons on different energy levels.

Relationship between electronic configuration and valency

Valency: is the number of electrons gained or lost or shared by an atom to obtain a stable configuration.

- (a) An atom is said to be stable when it contains eight electrons in its outer most energy level (or two electrons in case an atom has only one energy level.) For

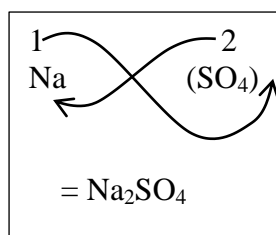
example, neon has 10 electrons. The configuration of neon is 2:8 which makes it a stable element.

- (b) The valency of an element can be determined from the electronic structure of its atoms.
- (i) Elements with atoms that have **1-3** electrons in their outer most energy level / shell have valences equivalent to the number of outer most energy level electrons lost by an atom to obtain a stable configuration. For example, the electronic configuration of sodium is 2, 8, 1, therefore, the valency of sodium is 1 because it attains a stable configuration by losing 1 electron.
 - (ii) Elements with atoms that have **4,5,6,7** electrons in their outer most energy level have their valences is equivalent to the number of electrons required to obtain a stable configuration. For example, the electronic configuration of chlorine atom is 2: 8:7. The valency of chlorine is 1 because it requires one electron to obtain stable configuration.

Valency can also be defined as the combining power of an element or a radical. OR the number of electrons an element loses or acquires to be stable. The table below shows the valences of common elements and radicals.

	Valency I	Valency II	Valency III
Metals	K Na Ag	Ca Mg Zn Pb Cu	Al Fe III
Non metals	H Cl	O S	N P
Radicals	OH Cl NO ₃ HCO ₃	CO ₃ SO ₄	PO ₄

Uses: valency can help us to write a compound or a molecule e.g. sodium sulphate, sodium has a valency of 1 and sulphate has a valency of 2 , therefore,



Predict the symbols of the following molecules

Aluminium Oxide

Copper nitrate

Sodium carbonate

Copper hydroxide
 Sodium oxide
 Magnesium hydrogen sulphate
 Copper (II) oxide
 Iron (III)oxide
 Iron(III)chloride

IONS

The electronic configuration of noble gases is very stable. This is why noble gases do not take part in any chemical reactions.

+

Atoms combine to attain the noble gas configuration.

Elements attain this noble configuration by either losing or acquiring electrons.

An atom, which has either acquired or lost electrons is called an **ION**

Element	electron configuration	ion formed
Na	2:8:1	Na ⁺ (2:8)
O	2:6	O ²⁻ (2:8)
Cl	.....	.....
Mg	.....	.....
F	.....	.....
A	.....	.....
Li	.....	.....
Ca	.....	.....
K	.....	.....

Complete the above

Cations and anions

A **cation** is an atom that has lost electron(s). Cations thus, have fewer electrons than atoms and has positive charges equal to the number of electrons lost.

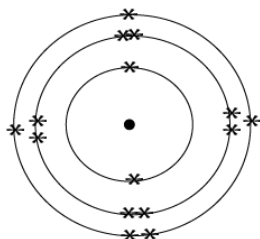
An element which has gained electrons is called **anion**. Always this leads to an increase in the number of electrons.

Exercise

1. The full symbols of atoms of elements R, T, X, Y and Z are ${}^{20}_{14}\text{R}$, ${}^{31}_{15}\text{Y}$, ${}^{30}_{15}\text{T}$, ${}^{34}_{16}\text{X}$, and ${}^{35}_{17}\text{Z}$ respectively

Which one of the following is an isotope of Y

- A. R
 - B. T
 - C. X
 - D. Z
2. The electronic structure of an atom of an element Y is shown in the diagram



Which one of the following is the formula of an oxide of Y

- A. YO
 - B. YO₃
 - C. YO₅
 - D. Y₂O₃
3. Which of the following is not a property of an element, R whose full symbol is ${}^{32}_{16}\text{S}$?
- A. It is a non-metal
 - B. It forms an ion with the formula R²⁻
 - C. It forms a basic oxide
 - D. It is in period 3 of the periodic table
4. The atomic numbers of elements, U, V, W and X are 13, 14, 16 and 17 respectively. Which one of the elements will react with oxygen to form an ionic compound? (Atomic number of oxygen is 8)
- A. X
 - B. V
 - C. W
 - D. U
5. The atomic numbers of elements W, X, Y and Z are 12, 13, 15 and 19 respectively. Which one of the elements reacts most readily with cold water
- A. W
 - B. X
 - C. Y
 - D. Z
6. The atomic numbers of elements X and Y are 12 and 9 respectively. Which one of the following is a property of a compound formed between X and Y?
- A. It conducts electricity
 - B. It is soluble in organic solvent
 - C. It is a solid of low melting point
 - D. It has a giant molecular structure

7. The full symbol of an ion of an element is ${}^{39}_{19}\text{X}^{+}$? Which one of the following is the number of electrons in the ion?
- A. 18
 - B. 19
 - C. 20
 - D. 39
8. The atomic numbers of elements W, X, Y and Z are 9, 11, 18 and 20 respectively. Which one of the elements shows similar properties as an element with atomic number 10?
- A. W
 - B. X
 - C. Y
 - D. Z
9. Element Y forms acidic oxide and reacts with hydrogen to form hydride with the formula YH_3 . To which one of the following groups in the periodic table does Y belong
- A. I
 - B. III
 - C. V
 - D. VII
10. Which of the elements does not react with chlorine?
- A. Aluminium
 - B. Oxygen
 - C. Sodium
 - D. Argon
11. The atomic number of element M, N, R, and T are 1, 8, 12 and 14 respectively. The element which can form ions by either losing or gaining electron(s) is
- A. M
 - B. N
 - C. R
 - D. T

12. The atomic number and the mass number of an element X are 11 and 23 respectively. The number of protons, neutrons and electrons in an atom of X is

	Protons	Neutrons	electron
A.	11	12	11
B.	12	11	11
C	11	12	12
D.	11	12	12

13. The full symbol of an atom, Y is ${}^{24}_{11}\text{Y}$, and the atomic numbers of element L, M, R and Z are 12, 13, 19 and 20 respectively. The element that can form an oxide with similar formula to oxide of Y is

- A. R
- B. Z
- C. M
- D. L

14. The atomic numbers of elements Q, W, X and Y are 4, 9, 10 and 14 respectively. Which elements can form positively charged ion?

- A. Q
- B. W
- C. X
- D. Y

15. The formula of a compound is $\text{Y}_3(\text{PO}_4)_2$. The electronic configuration of the atom of Y is

- A. 2.8.2
- B. 2.8.3
- C 2.8.4
- D. 2.8.5

16. The atomic numbers and mass numbers of atoms, W, X, Y and Z are shown in the table below

Atom	Atomic number	Mass number
W	46	106
X	47	106
Y	47	109
Z	48	112

Which one of the following pairs of atoms are isotopes?

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

17. A metal Y and a non-metal M are elements in period 3 of the periodic Table. Which one of the following statements is not true about Y and M?

- A. The solution of the compound formed between Y and M conducts electricity
- B. The atomic radius of M is smaller than that of Y
- C. The chloride of Y is ionic while that of M is covalent
- D. The oxide of M is ionic while that of Y is acidic

18. The atomic number of elements P, Q, R and T are 19, 17, 14 and 6 respectively. The pair of elements that can react to form an ionic compound is
- Q and T
 - R and Q
 - Q and P
 - R and T
19. The number of protons, neutrons and electrons in some particle are shown in the table below

Particle	Proton	Neutron	Electron
P	1	1	2
Q	2	2	2
R	3	4	2
T	4	5	4

- Which one of the following particles is an anion?
- P
 - Q
 - R
 - T
20. The full symbol of an atom of an element X is ${}^{40}_{20}\text{X}$. The charge on an ion of X is
- +2
 - +1
 - 1
 - 2
21. The electronic configuration of the atom of an element X is 2.8.6. The number of electrons in the ion commonly formed by X is
- 14
 - 15
 - 17
 - 18
22. The atomic number of an element T is 10. T shows similar properties to an element with atomic number
- 14
 - 16
 - 18
 - 20
23. The electron configurations of elements W, X, Y and Z are 2.8.2, 2.8.3, 2.8.4, and 2.8.5 respectively. Which of the following pair of elements are non-metals?
- Y and Z
 - Y and X
 - W and Y
 - W and X
24. The atom which is isotopic with an element whose full symbol is ${}^{30}_{15}\text{Y}$ is
- ${}^{30}_{14}\text{R}$
 - ${}^{34}_{15}\text{T}$
 - ${}^{30}_{17}\text{X}$
 - ${}^{32}_{16}\text{Z}$
25. The atomic numbers of elements A and Y are 9 and 11 respectively. Which one of the following properties is shown by the compound formed when X combines with

Y?

- A. It is non-conductor of electricity
B. It has high melting point
C. It is insoluble in water
D. It is a gas at room temperature
- 26 The number of protons, neutrons, electrons in some particles are shown in the table below

Particle	Protons	Neutrons	electrons
P	1	1	2
Q	2	2	2
R	3	4	2
T	4	5	4

Which one of the following particles represent a cation?

- A. T
B. R
C. Q
D. P
- 27 The formula of the chloride of metal M is MCl_3 . The formula of sulphate of M is
A. MSO_4
B. M_2SO_4
C. $M_2(SO_4)_3$
D. $M_3(SO_4)_2$
- 28 Element X reacts with chlorine to form a compound with formula XCl_4 . The formula of the oxide of X is
A. X_2O
B. XO
C. XO_4
D. XO_2
29. The atomic number of elements, W, X, Y and Z are 12, 14, 16 and 18 respectively. Which one of the following elements is likely to show properties similar to an element with atomic number 10?
A. W
B. X
C. Y
D. Z
30. Which one of the following is not true about an element, M with electronic configuration of 2,8,3?
A. It conducts electricity
B. It is a metal
C. It dissolves in dilute acids to give hydrogen
D. Its valence s 1, 2, 3.
- 31 The number of protons, electrons and neutrons in aluminium ion Al^{3+} is
Protons Electron neutrons
A. 27 27 14
B. 13 14 14
C. 13 10 14
D. 10 14 17
32. The formula of the compound formed between elements Q and L is
(Q =12, L =15)
A. Q_2L_3

- B. Q_2I_5
 C. Q_3L_2
 D. QL_3
33. Element M belongs to group III of the periodic table. The likely formula of its oxide is
 A. M_2O
 B. MO_3
 C. M_3O_2
 D. M_2O_3
34. Which one of the following with the following atomic numbers react most vigorously with water?
 A. 2.8.1
 B. 2.8.2
 C. 2.8.8.1
 D. 2.8.8.2
35. Isotopes of an elements have got
 A. Same number of protons and neutrons
 B. Same number of electrons and neutrons
 C. Different number of electrons and protons
 D. Same number of protons and electrons
36. Which one of the elements whose atomic numbers are given below gives acidic oxide?
 A. 2.8.1
 B. 2.8.3
 C. 2.8.6
 D. 2.8.8.2
37. Which one of the metal atoms whose electronic structure given below forms a nitrate of the type $M(NO_3)_2$?
 A. 2.8.0
 B. 2.8.1
 C. 2.8.2
 D. 2.8.3
38. Which one of the following atomic number will indicate the least reactive element?
 A. 2.8.1
 B. 2.8.2
 C. 2.8.7
 D. 2.8.8
39. The element M belong to group IV in the Periodic Table. The formula of the oxide of metal M is
 A. M_4O
 B. MO_4
 C. MO_2
 D. M_3O_4

The table below shows the number of protons, electrons and neutrons of atom R, S, T U and V. Use it to answer questions 40 to 43.

Atom	No. of protons	No. of electrons	No. of neutrons
R	11	11	12
S	17	17	18
T	18	18	22
U	19	19	20
V	17	17	20

40. Which of the above atoms are isotopes
- R and S
 - S and T
 - U and V
 - S and V
41. Which atoms form positive ions of the same charge?
- R and S
 - R and U
 - U and V
 - S and V
42. Which of the above atoms belong to inert element
- R
 - S
 - T
 - U
43. If atom R belong to element R ant atom V belong to element V, what would be the formula of the compound formed between R and V?
- RV
 - R_2V
 - RV_2
 - R_2V_3
44. The electronic configuration of elements W and X are 2.8.3 and 2.6 respectively. The formula of a compound formed between M and x is
- W_3X_2
 - W_2X_3
 - W_2X
 - WX_2

Questions 45 to 47 consist of an assertion (statement) on the left hand side and a reason on the right hand side.

Select

- If both assertion and reason are true statements and the reason is a correct explanation of the assertion.
- If both assertion and reason are true statements and the reason is **not** a correct explanation of the assertion
- If the assertion is true but the reason is not correct statement.
- If the assertion is not correct but the reason is a correct statement.

Instruction summarized

Assertion	
A. True	True and a correct explanation
B. True	True but not a correct explanation
C. True	Incorrect
D. Incorrect	Correct

- | | | |
|--|---------|---|
| 45. Element X, atomic number 11 combines with element Z atomic number 17 to form ionic compound | because | X and Y are element in period 3 of the periodic table |
| 46. Element X (atomic number 13) combines with element W (atomic number 8) to form an ionic compound | because | Element X is in period three of the periodic table |
| 47. Potassium with atomic number 19 belongs to Group 1 in the Periodic Table | because | Potassium gains one electron to form potassium ion. |

For question 48 to 54 one or more of the answers given may be correct. Read each question carefully and then indicate the correct answer according to the following

- A. If 1, 2, 3, only are correct
- B. If 1 and 3 only are correct
- C. If 2 and 4 only are correct
- D. If 4 only is correct

48. The atomic number of element Q and R are 6 and 16 respectively. Which of the following is/are the property/properties of the compound formed between Q and R?
1. It is very soluble in water
 2. It has a high boiling point
 3. It conducts electricity
 4. It has a molecular structure
49. Element X (atomic number 12) combines with element W (atomic number 17) to form a compound Q. Compound Q
1. is soluble in water
 2. is a solid at room temperature
 3. conducts electricity in molten state
 4. is soluble in organic solvent
50. On going down the group in the Periodic Table
1. Atomic number increases
 2. Number of shells increase
 3. Ionic radius increase
 4. Non-metallic character increase
51. The electronic configuration of elements T and Q are 2.6 and 2.8.5 respectively. The formula(e) of compound(s) formed between T and Q is/are
1. Q_5T_2
 2. Q_2T_3

3. Q_3T_2
4. Q_2T_5
52. The electronic configurations of elements B, D, E and F are 2:4, 2:6, 2:8:3 and 2:8:7 respectively. Which elements when reacted together will form covalent compounds
 1. B and D
 2. D and E
 3. B and F
 4. E and F
53. The electronic structure of element P, Q, R and S are shown in the table below

Element	Electronic configuration
P	2.8.2
Q	2.8.7
R	2.8.6
S	2.8.1

- Which of the following pairs of elements will combine to form ionic compound(s)?
1. P and Q
 2. P and R
 3. Q and S
 4. Q and R
54. Calcium ion possesses
1. 20 protons
 2. 22 electrons
 3. 20 neutrons
 4. 40 neutrons

Section B

55. (a) (i) Name the fundamental particles of an atom in each case state the type of charge on the particle (03 marks)
- (ii) Draw a labelled diagram to show the location of the particles in an atom. (02marks)
- (b) The full symbol of atoms of elements Q and R are ${}_{11}^{23}Q$ and ${}_{17}^{35}R$ (03marks) respectively. Write the name and number of particles in the atoms of Q and R
- (c) Name the type of bond that would be formed between
- (i) Two atoms of R (½ mark)
 - (ii) An atom of R and an atom of Q (½ mark)
- (d) (i) With the aid of diagrams describe how the bonds you have named in (c) are formed (05marks)
- (ii) State one property of the compound formed between Q and R (01mark)
56. The atomic number of an element Q, R and T are 6, 17, and 19 respectively.
- (a) Write the electron configuration of
- (i) Q (½ mark)
 - (ii) R (½ mark)
 - (iii) T (½ mark)
- (b) R reacted separately with Q and T to form compounds X and Y

- respectively. State the type of bond that exist in compound
- (i) X (½ mark)
 - (ii) Y (½ mark)
- (c) Identify which one of the compounds in (b) would be soluble in
- (i) Water (½ mark)
 - (ii) petrol (½ mark)
57. The full symbol of element A is $^{32}_{16}\text{X}$
- (a) (i) State the number of protons in X (01mark)
 - (ii) Write electron configuration of X (01mark)
 - (iii) State the group in the periodic table to which X belongs (½ mark)
 - (b) (i) Write the formula of the oxide of X (01mark)
 - (ii) State the type of bonding that exist in the oxide of X (01mark)
58. The atomic numbers of element X and Y are 7 and 20 respectively.
- (a) Write the electronic configuration of the elements (2marks)
 - (b) State the periods in the periodic table to which X and Y belong (1mark)
 - (i) X
 - (ii) Y
 - (c) Write the formula of the compound formed between X and Y (1mark)
 - (d) State the type of bond in the compound formed in (c) (1 mark)
59. (a) (i) Name the fundamental particles in an atom (1 ½ mark)
- (ii) With the aid of a labelled diagram, describe how the three particles are located in an atom (04 marks)
- (b) The full symbol of the atom of element is $^{32}_{16}\text{Q}$. State what the numbers 16 and 32 stands for. (02 marks)
- (c) If the full symbol of another atom is $^{34}_{16}\text{R}$, state the
- (i) Similarity and difference between the atoms of Q and R (01 mark)
 - (ii) Name given to the atoms of Q and R (01mark)
- (d) The atomic number of element W, X and Y are 6, 12 and 17 respectively
- (i) Write electronic configurations of W, X and Y (1 ½ mark)
 - (ii) Using the outer most shell electron only, draw to show how W and Y form compound. (01mark)
 - (iii) State the type bonds formed between X and Y; W and Y. (2marks)
 - (iv) Identify the element that exist as a diatomic molecule. (1mark)

60.

[illegible]

- | | | |
|------|---|-----------|
| (a) | Which one of the elements is a noble (an inert) gas? | (½ marks) |
| (b) | What name is given to elements in the group to which G belong? | (½ marks) |
| (c) | Which element is likely to: | |
| (i) | React violently with chlorine | (½ marks) |
| (ii) | Form coloured compounds | (½ marks) |
| (d) | Write the formula of the | |
| (i) | Oxide of element D | (01 mark) |
| (ii) | Compound formed between element F and hydrogen | (01 mark) |
| (e) | State the type of bond that would exist in the chloride of element E. | (01 mark) |
| 61. | The electron configuration of an element A is 2.8.3 | |
| (a) | State the group in the periodic table to which A belong. | (01 mark) |
| (b) | Write the | |
| (i) | Electronic configuration of ion of A | (01 mark) |
| (ii) | Formula of the oxide of A | (02 mark) |
| (c) | State the type of bond that exists in the oxide of A | (01 mark) |

62.

Atoms	Protons	electrons	Neutrons
Q	1	1	0
T	8	8	8
W	12	12	12
X	16	16	16
Y	1	1	1

- | | | | |
|-----|---------|---|------------|
| | (a) | State the | |
| | (i) | Atomic number of Y | (½ mark) |
| | (ii) | Mass number of Q | (½ mark) |
| | (iii) | Atoms which are isotopes | (01 mark) |
| | (b) | Identify the atoms that belong to elements in the same group of the Periodic table | (01marks) |
| | (c) | Write the structural formula of the compound that can be formed when Q combines with T. | (01mark) |
| | (d) (i) | State one property of the compound formed between T and W. | (01 mark) |
| | (ii) | Give a reason for your answer in (d)(i) above. | (01mark) |
| 63. | (a) | The atomic numbers of the elements, M, X and Q are 6, 11 and 17 respectively. | |
| | (i) | Explain what is meant by the term atomic number | (01mark) |
| | (ii) | Write the electronic structures of Q, M and X | (03 marks) |
| | (b) | Q and M can each combine with X to form compounds | |
| | (i) | Use valency electrons to explain briefly how the atoms M and X, Q and X form compounds | (06maks) |

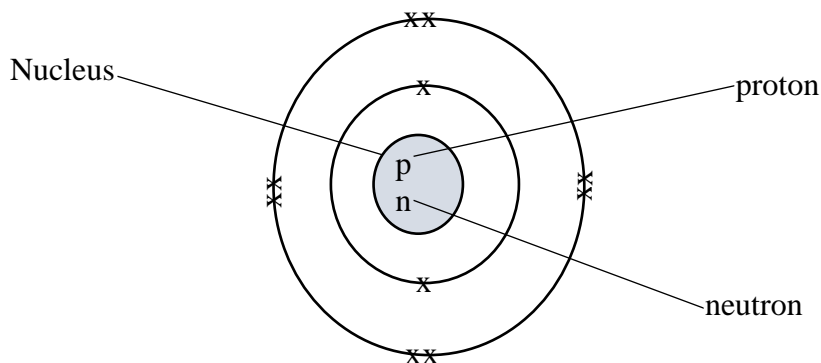
- (ii) Write the formula of the compound formed when Q combines with X (01mark)
- (c) State two properties of compound formed between
- (i) M and Q
- (ii) Q and X
64. An atom of an element X contains 15 electrons and 16 neutrons
- (a) (i) State the mass number of X (01mark)
- (ii) Write the electronic structure of X (01mark)
- (b) (i) Write the formula of a chloride of X (01mark)
- (ii) State the type of bond that exist in the chloride of X. (01mark)
65. (a) An element X is in group II of the periodic table
- (i) State the type of bond that exist in the chloride of X. (01mark)
- (ii) Write the formula of the ion of X. (01mark)
- (b) The nitrate of X was strongly heated
- (i) State what was observed (1½ mark)
- (ii) Write an equation for the reaction
- 66 .
- | | | | | | | | |
|---|----|-----|----|---|----|-----|------|
| I | | | | | | | VIII |
| | II | III | IV | V | VI | VII | |
| | | | W | | V | | Z |
| | Y | T | | | | Q | |
- (a) Using the elements in the periodic table above, state
- (i) The most reactive metal (1mark)
- (ii) The most reactive nonmetal (1mark)
- (iii) The atom that forms the largest anion (1mark)
- (iv) The most nonreactive element (1mark)
- (b) Write the formulae of compounds formed between the following pairs of elements and in each case state the type of bonding
- (i) W and Q (1mark)
- (ii) T and V (1mark)

- | | | | | | |
|-------|-------|-------|-------|-------|-------|
| 1. A | 11. A | 21. A | 31. C | 41. B | 51. C |
| 2. D | 12. A | 22. D | 32. C | 42. C | 52. B |
| 3. C | 13. A | 23. A | 33. D | 43. A | 53. A |
| 4. A | 14. A | 24. B | 34. C | 44. B | 54. B |
| 5. D | 15. B | 25. B | 35. D | 45. B | |
| 6. A | 16. B | 26. B | 36. C | 46. B | |
| 7. A | 17. C | 27. C | 37. D | 47. C | |
| 8. C | 18. C | 28. D | 38. D | 48. D | |
| 9. C | 19. A | 29. D | 39. C | 49. A | |
| 10. D | 19. A | 30. D | 40. D | 50. A | |

55. (a) (i)

Particle	charge
Proton	+
Electron	-
Neutron	0

(ii)



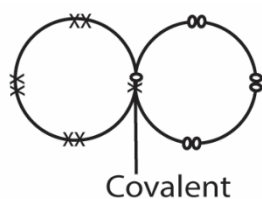
(b)

Element	Particle		
	Protons	Electrons	Neutrons
Q	11	11	12
R	17	17	18

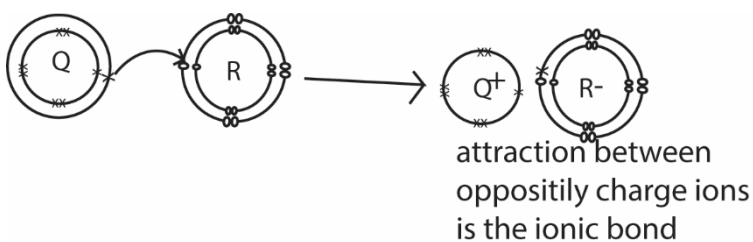
(c) (i) Covalent

(ii) Ionic

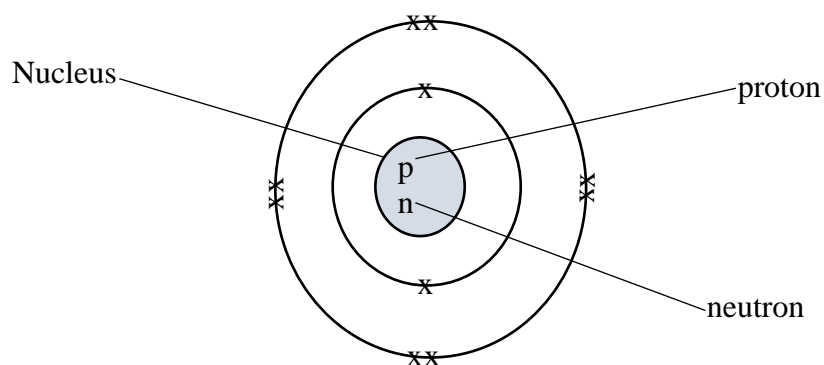
(d) (i) Covalent bond is formed by sharing electrons



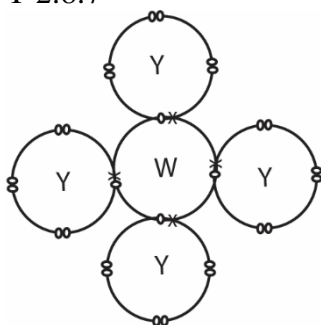
(ii) Ionic bond is formed by transfer of electron from Q to R; the attraction between the opposite ions formed constitute ionic bond



56. (a) (i) Q 2:4
(ii) R 2:8:7
(iii) T 2:8:8:1
(b) (i) Covalent
(ii) ionic
(c) (i) Y
(ii) X
- 57 (a) (i) 16
(ii) 2:8:6
(iii) Group 6
(b) (i) XO_3
(ii) Covalent
- 58 (a) X 2:5
Y 2:8:8:2
(b) (i) X – period 2
(ii) Y – period 4
(c) Y_3X_2
(d) Ionic
- 59 (a) (i) Protons
Electrons
Neutrons
(ii)



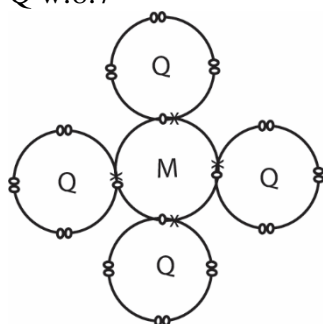
- (b) 16 – atomic number
32 - atomic mass
- (c) (i) Q and R have the same number of protons and electrons but different number of neutrons
(ii) Isotopes
- (d) (i) W 2:4
X 2:8:2
Y 2:8:7
(ii)



compound formed by sharing electrons

- (iii) X and Y covalent

- W and Y ionx
- (iv) Y
- 60 (a) H or I
(b) Halogen
(c) (i) B
(ii) C
(d) (i) D_2O_3
(ii) H_2F
(e) Covalent
- 61 (a) Group 3
(b) (i) 2:8
(ii) A_2O_3
(c) Ionic
- 62 (a) (i) 1
(ii) 1
(iii) Q and Y
(b) T and X
(c) TQ_2
(d) (i) - conducts electricity in molten and solution form
- soluble in water
- has high melting point
(ii) It is ionic
- 63 (a) (i) Atomic number is the number of protons in the nucleus of an atom
(ii) M 2:4
X 2:8:1
Q w:8:7
(b) (i)



compound formed by sharing electrons

- (c) (i) - has low melting point
- soluble in organic solvent
- non electrolyte
- insoluble in water
(ii) Electrolyte
Has high melting points
Soluble in water
- 64 (a) (i) $15 + 16 = 31$
(ii) 2:8:5
(b) (i) XCl_3
(ii) Covalent bond
- 65 (a) (i) Ionic
(ii) X^{2+}
(b) (i) Brown fumes and white residue
 $2X(NO_3)_2(s) \xrightarrow{\text{heat}} 2XO(s) + 4NO_2(g) + O_2(g)$

- 66 (a) (i) Y
(ii) V
(iii) Q (has 3 electron shells)
(iv) Z
- (b) (i) WQ_4
(ii) T_2V_3