

O-level

The Periodic Table (PT)

The periodic table is a tabular arrangement such that the columns contain elements with electronically similar atoms.

The rows of the periodic table are called **periods** while the vertical columns are called **groups**.

There are 7 periods and 8 groups.

Some special groups

Group I or alkali metals

This consists of the elements, H, Li, Na, K, Rb, Cs, and Fr; except hydrogen, these elements are highly metallic in character

Group II or alkaline earth metals.

This consists of the elements, Be, Mg, Ca, Sr, Ba and Ra. All these elements are metals but their metallic character is less than that of group 1.

Group VII or **halogens**

This consists of elements, F, Cl, Br, I and At. All these elements are nonmetals.

Group VIII or **noble elements, inert elements** or **zero elements**

Consists of the elements, He, Ne, Ar, Kr, Xe and Rn. and are all gaseous elements at room temperature.

Summary

The extreme left end of the periodic table consists of metals with exception of hydrogen; the extreme right end consists of non-metals. The middle part of the periodic table consists of semi-metals or metalloids.

Simplified PT to show the variation of properties



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Trends in physical properties of elements in the periodic table

1. The nonmetallic character increases from left to the right of the periodic table.
2. atomic size decrease from left to the right due to increase in nuclear attraction.
3. Ionization energy is the energy required to remove an electron from a gaseous atom to form positively charged gaseous ion. Ionization energy increases across the period and for this reason metal atoms easily lose electron whereas nonmetal atoms do not. Generally metals react by loss of electrons forming positive ions whereas nonmetals react by gaining electron forming negative ion.

Bonding

A bond is the force of attraction that binds the atoms within a molecule.

There are four types of chemical bonding namely: -

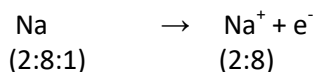
1. Ionic (electrovalent) bonding.
2. Covalent bonding.
 - (a) Normal covalent bonding.
 - (b) Dative (coordinate) bonding.
3. Metallic bonding.
4. Van der Waals forces

Elements react to attain stable (doublet or octet) electronic configurations of the noble gases.

Ionic bonding

It is usually formed between metal and non-metals

This involves transfer of one or more electrons from one atom (metal) to another (nonmetal), e.g.

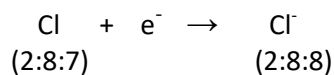


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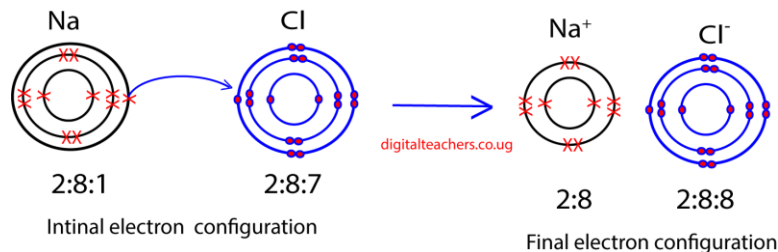


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Or



By losing one electron, sodium atom achieves the stable electronic structure (similar to that of neon) while addition of an electron to a chlorine atom makes it achieve a stable electronic configuration (similar to that of argon).

It is the **electrostatic** attraction resulting from the opposite charges that constitute the ionic or electrovalent bond between Na^+ and Cl^- ions in sodium chloride.

Characteristic properties of ionic compounds

1. They consist of ions and not molecules.
2. They are electrolytes, i.e., when dissolved in water or when fused, conduct an electric current and decompose into constituent ions.
3. They are solids of high melting points.
4. They are insoluble in organic solvents but many of them are soluble in water.

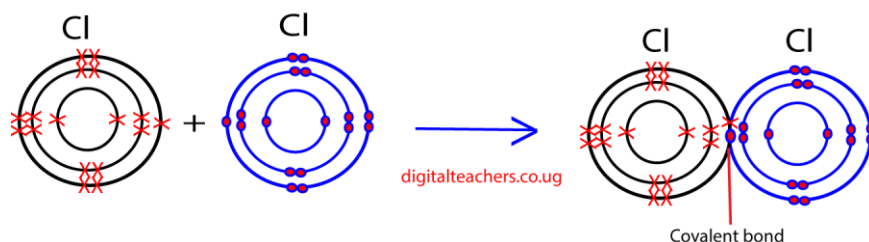
Covalent bonding

This is divided into two types, namely, the normal covalent bond and the dative or a coordinate bond.

(a) The normal covalent bonding

This involves sharing of one or more pairs of electrons to attain stable electron configurations similar to those of noble gases. Considering a chlorine atom, which has seven electrons in its outermost shell, if one electron is provided by each atom and shared equally, then each chlorine atom can acquire a complete octet configuration as it forms a chlorine molecule. The **shared** pair of electrons constitutes a **covalent bond**.

Formation of a covalent bond by chlorine atoms



Characteristics of covalent compounds

- a) They consist of discrete molecules.

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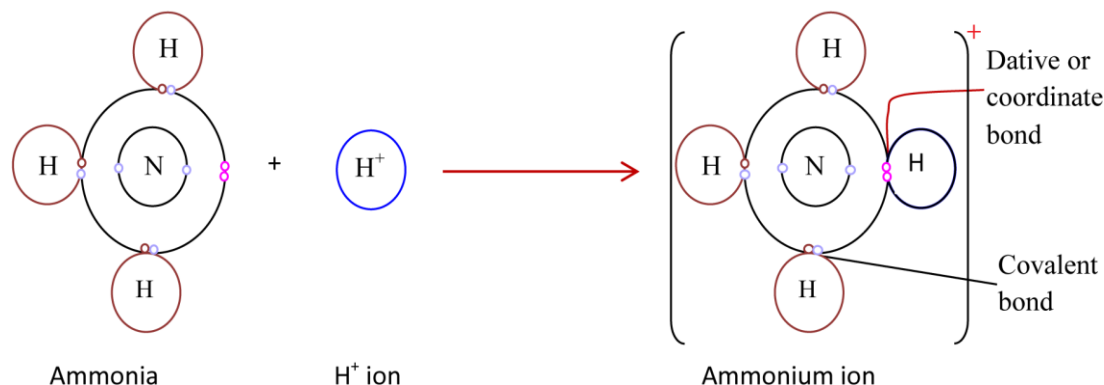
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- b) They are non-electrolytes.
- c) They have low boiling and melting points.
- d) They are insoluble in water and other polar solvents but soluble in organic or non polar solvents.

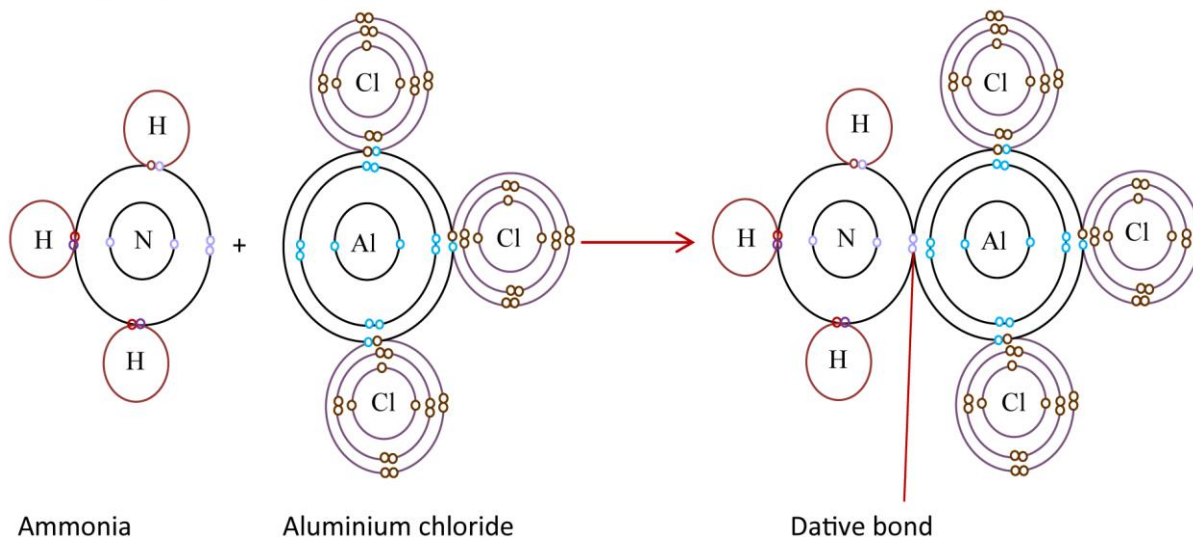
(b) Dative or coordinate bonding

The dative bond is like a covalent bond once formed except that both electrons in the shared pair are provided by one atom. The atom providing the two electrons is called the **donor** and the atom which accepts the two electrons is the **acceptor**. The donor atom must have an unshared pair of electrons available and such a pair of electrons is called a **lone pair**. An example is reaction of ammonia with H^+ or $AlCl_3$. By reacting with ammonia, H^+ attains doublet structure of helium whereas Al^{3+} attains an octet configuration of argon.

Formation of dative bonds between ammonia and hydrogen ion



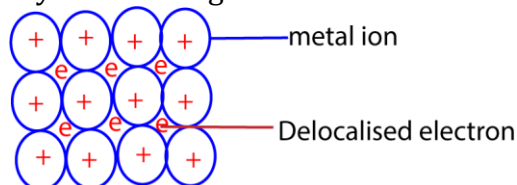
Formation of dative bonds between ammonia and aluminium chloride



Metallic bond

Arrangement of ions and delocalized electrons in metals. Pure metals are made up of atoms, all of the same kind; each atom loses its valence electrons and becomes a positive ion. The lost electrons are free to move and they are called delocalized electrons.

A metal therefore consists of positively charged atoms surrounded by its valence electrons, which are free to move about within the solid. The free or delocalized electrons attract the positively charged ions thus binding them together equally and strongly. At the same time the positively charged ions attract the delocalized electrons preventing them from dispersing, resulting into a metallic bond. These electrostatic attractions bind the entire crystal as a single unit. This is illustrated below:



Properties of metals

- 1) They conduct electricity due to the presence of delocalized electrons. When the voltage is applied across the metal, the delocalized electrons are able to move freely through the structured conducting an electric current.
- 2) Metals generally have high densities because the ions are closely packed in the lattice.
- 3) They usually have high melting and boiling points due to the strong attraction between the positive metal ions and the delocalized electrons. Most non-metals have low melting points and boiling points.
- 4) They are malleable and ductile.

Malleable: means that metals can be harmed into different shapes

Ductile: means that the metals can be pulled out into thin wires. Unlike those in diamond, the bonds are not rigid but are still strong. If a force is applied to a metal, rows of ions can slide over one another. They reposition themselves and the strong bonds reform.

Molecular or van der Waals bond

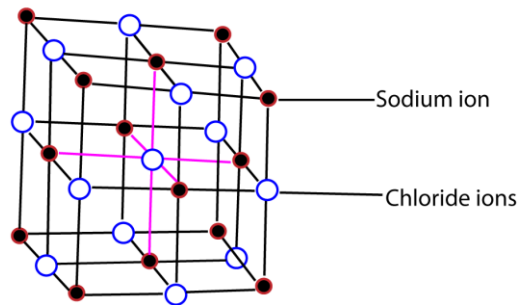
These are intermolecular forces which occur between non polar molecules as a result of momentarily induced dipoles in neighboring molecules. These are a weaker type of bonding whose magnitude increase with size or mass of the molecules. The melting points of hydrides of group 5 elements from phosphorus and the boiling points of halogens from chlorine to iodine all increase down the group due to increase in molecular mass.

Van der Waals forces are weak forces the reason why substances bound by these forces like iodine have low melting and boiling points. In fact, iodine sublimates at room temperature.

Giant atomic structure

Also called giant molecular structures. Examples are diamond and graphite (both comprising of carbon atoms only), silicon dioxide (silicon IV oxide)

Structure of sodium chloride



Giant ionic structures consist of many oppositely charged ions held together by electrostatic force of attraction e.g. Sodium chloride. In sodium chloride each sodium ion has six equidistant chloride ions around it and arranged octahedrally as shown above.

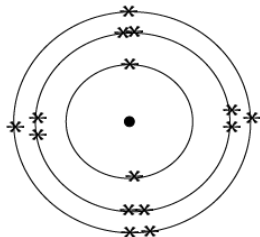
Substances with giant ionic structures have high melting points because a large amount of energy is needed to break the structure due to strong electrostatic forces between the ions.

Exercise

1. The full symbols of atoms of elements R, T, X, Y and Z are ${}_{14}^{20}\text{R}$, ${}_{15}^{31}\text{Y}$, ${}_{15}^{30}\text{T}$, ${}_{16}^{34}\text{X}$, and ${}_{17}^{35}\text{Z}$ 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 ${}_{16}^{32}\text{S}$?
- 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 ${}_{11}^{24}\text{Y}$, 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
- R
 - Z
 - M
 - 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?
- Q
 - W
 - X
 - Y
15. The formula of a compound is $\text{Y}_3(\text{PO}_4)_2$. The electronic configuration of the atom of Y is
- 2.8.2
 - 2.8.3
 - 2.8.4
 - 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?
- W and X
 - X and Y
 - Y and Z
 - 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?
- The solution of the compound formed between Y and M conducts electricity
 - The atomic radius of M is smaller than that of Y
 - The chloride of Y is ionic while that of M is covalent
 - 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?
- A. P
B. Q
C. R
D. T
20. The full symbol of an atom of an element X is ${}_{20}^{40}\text{X}$. The charge on an ion of X is
- A. +2
B. +1
C. -1
D. -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
- A. 14
B. 15
C. 17
D. 18
22. The atomic number of an element T is 10. T shows similar properties to an element with atomic number
- A. 14
B. 16
C. 18
d. 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?
- A. Y and Z
B. Y and X
C. W and Y
D. W and X
24. The atom which is isotopic with an element whose full symbol is ${}_{15}^{30}\text{Y}$ is
- A. ${}_{14}^{30}\text{R}$
B. ${}_{15}^{34}\text{T}$
C. ${}_{17}^{30}\text{X}$
D. ${}_{16}^{32}\text{Z}$

- 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?
- It is non-conductor of electricity
 - It has high melting point
 - It is insoluble in water
 - 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?

- T
 - R
 - Q
 - P
- 27 The formula of the chloride of metal M is MCl_3 . The formula of sulphate of M is
- MSO_4
 - M_2SO_4
 - $M_2(SO_4)_3$
 - $M_3(SO_4)_2$
- 28 Element X reacts with chlorine to form a compound with formula XCl_4 . The formula of the oxide of X is
- X_2O
 - XO
 - XO_4
 - 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?
- W
 - X
 - Y
 - Z
30. Which one of the following is not true about an element, M with electronic configuration of 2,8,3?
- It conducts electricity
 - It is a metal
 - It dissolves in dilute acids to give hydrogen
 - 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_2L_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 $\text{M}(\text{NO}_3)_2$?
- 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?
- 2.8.1
 - 2.8.2
 - 2.8.7
 - 2.8.8
39. The element M belong to group IV in the Periodic Table. The formula of the oxide of metal M is
- M_4O
 - MO_4
 - MO_2
 - 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

- If 1, 2, 3, only are correct
- If 1 and 3 only are correct
- If 2 and 4 only are correct
- If 4 only is correct

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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 (03 marks)
state the type of charge on the particle
- (ii) Draw a labelled diagram to show the location of the (02marks)
particles in an atom.
- (b) The full symbol of atoms of elements Q and R are ${}^{23}_{11}\text{Q}$ and ${}^{35}_{17}\text{R}$ respectively. Write the name and number of particles in the atoms of Q and R (03marks)
- (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 (05marks)
named in (c) are formed
- (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)

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. The number of particles (proton, electrons and neutrons) in atoms Q, T, W, X, and Y are shown in the table below

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)

- 66 .
- (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

	I							VIII
		II	III	IV	V	VI	VII	
			W		V			Z
		Y	T				Q	

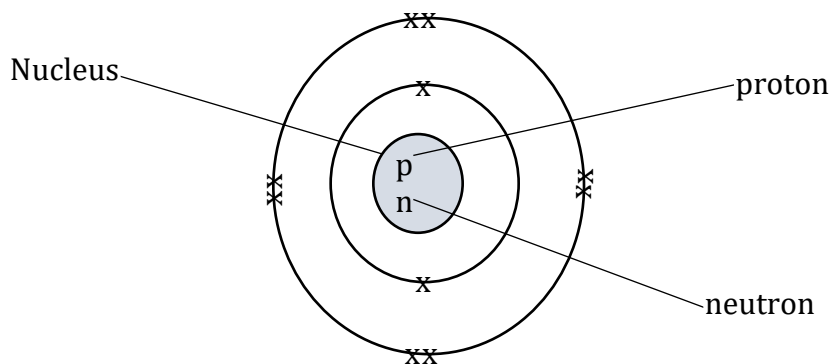
- (a) Using the elements in the periodic table above, state
- (i) The most reactive metal (1mark)
- (ii) The most reactive nonmetal (1mark)
- (iii) The atom that forms the largest anion (1mark)
- (iv) The most nonreactive element (1mark)
- (b) Write the formulae of compounds formed between the following 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)



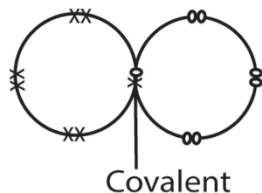
(b)

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

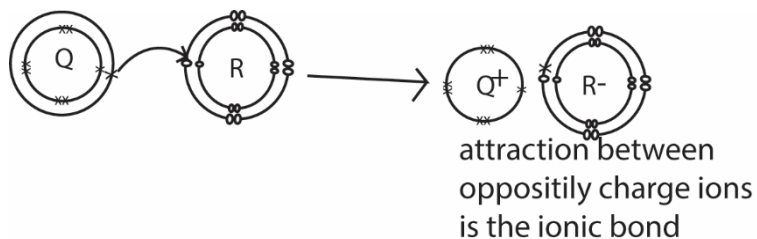
(c) (i) Covalent

(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

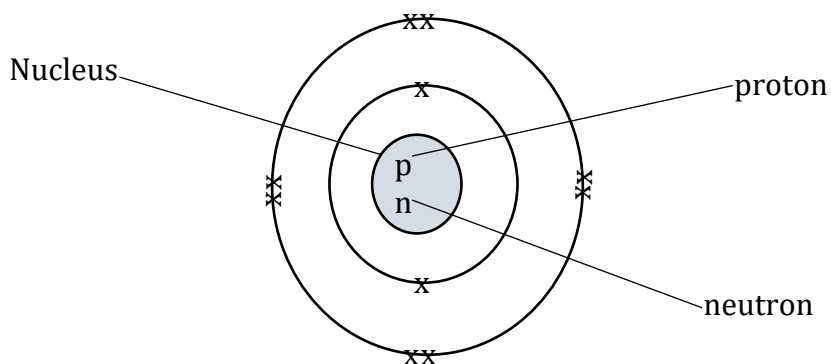


56. (a) (i) Q 2:4
(ii) R 2:8:7
(iii) T 2:8:8:1
(b) (i) Covalent
(ii) ionic
(c) (i) Y
(ii) X

- 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

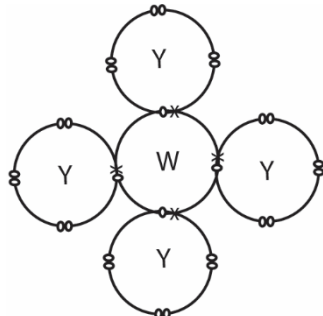
- 59 (a) (i) Protons
Electrons
Neutrons
(ii)



- (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)



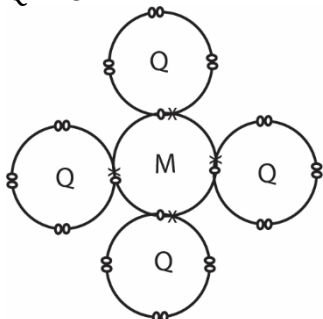
compound formed by sharing electrons

(iii) X and Y covalent
W and Y ions

(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 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