

**Let's pave the way for learning and
Move Forward**

STD – 10

Chemistry



**State Council of Educational Research and Training (SCERT),
Kerala
2022**

PREFACE

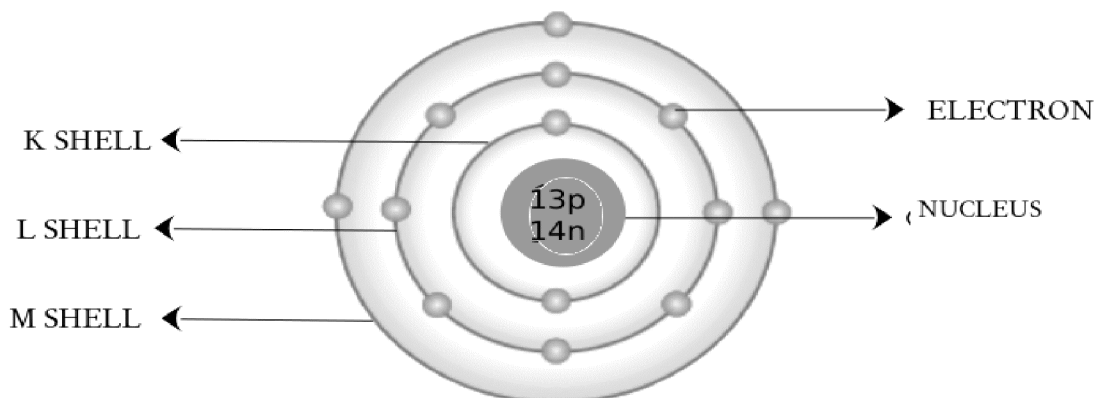
The evaluation of the answer scripts of the First Terminal Examination 2022 and the classroom experiences shared by the teachers concerned, have brought to light the fact that our children have suffered some serious learning gap due to the non-availability of proper learning experiences as a result of the unprecedented situation created by the Covid Pandemic from 2019 to 2022. An activity book has been designed to assist children internalize the concepts which they ought to have mastered in the previous classes and with the intention to facilitate further learning. Necessary explanations and activities are included in the booklet to help children bridge the gap. It is hoped that this package will facilitate the learners for self-study or for studying with the help of their teachers and I wish them success in their endeavors to move forward with confidence.

Director
SCERT, Kerala

CHAPTER 1

ELECTRONIC CONFIGURATION AND PERIODIC TABLE

SHELL- BOHR MODEL (ALUMINIUM)



- Electrons revolve around the nucleus of an atom in fixed paths called orbits or shells
- The shells starting from the nucleus can be numbered as 1,2,3,4,5 or represented by the letters K,L,M,N,O etc
- The energy of shell increases as the distance from the nucleus increases. K shell has the least energy.
- The maximum number of electrons that can be accommodated in any shell is $2n^2$. (n= shell number)
- The arrangement of electrons in shells around the nucleus is called electronic configuration.
- Electrons are filled in the shells in the increasing order of their energy.

Complete the worksheet on the basis of concepts and model of atom given above.

1. Electrons revolve around the nucleus of an atom in fixed paths called
2. Which of the following shell has the greatest energy
(L , K , N , M)
3. Arrange the shells N, K, L, M in the increasing order of their energy.
4. Complete the table

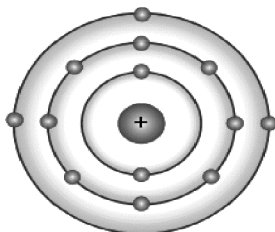
Name of Shell	Shell number	Maximum number of Electrons
K	1	$2 \times 1^2 = 2$
L	2	.....
M	.....	.....
N	4	.....

5. There are 5 electrons in the M shell of element X . (Symbol X is not real)
- Write the electronic configuration of element X
 - What is its atomic number?
 - Find the maximum number of electrons that can be accommodated in M shell?

6. Complete the table

Element	Atomic number	Electronic configuration
C	6	2,4
Mg	12	.....
Ar	.....	2,8,8
Al	13	.....

7. Analyse the Bohr model of atom given below and answer the questions.



- Write the electronic configuration of the given element.
- What is its atomic number?
- How many electrons are there in the shell having least energy?

● **Valency**

The number of electrons lost, gained or shared by an atom during chemical reaction is its valency.

Number of electrons in the outermost shell	Number of electrons lost, gained or shared	Valency
1	1	1
2	2	2
3	3	3
4	4	4
5	3	3
6	2	2
7	1	1

● **Method of writing chemical formula**

- Write the symbol of constituent elements side by side in such a way that symbol of the element having lesser electronegativity comes first.
- Interchange the valency of each element and write them as subscripts (base index).
- Divide each subscript (base index) by the common factor of subscripts.

- The number of shells in an element and the number of the period to which it belongs are the same.

$$\text{Period number} = \text{Number of shells}$$

- The group number is the number of electrons in the outermost shell for elements in group 1 and 2.
- In the case of elements from group 13 to group 18, the group number is obtained by adding 10 to the number of electrons present in the outermost shell.

Oxidation number

- ➔ Oxidation number of an atom in a substance is the formal charge assigned on the atom, if all the bonds in the substance are considered to be ionic.
- ➔ An atom acquires positive oxidation state by losing electrons and negative oxidation state by accepting electrons.

Eg:- When an atom loses an electron, it acquires +1 oxidation number.

By accepting an electron, it acquires -1 oxidation number.

The method of finding Oxidation Number

- ➔ Oxidation number of an atom in a covalent compound is found out by assuming that the electron pair is shifted to the more electronegative atom side.
- ➔ Oxidation number of an atom in element molecule will be zero as the electrons are shared equally between the atoms.
- ➔ The sum of oxidation numbers of the constituent atoms in a molecule will be zero.

Eg:- How to find the oxidation number of sulphur in H_2SO_4

Oxidation number of Hydrogen = +1

Oxidation number of Oxygen = -2

Let 'x' be the oxidation number of sulphur.

The sum of oxidation number of the constituent atoms in a molecule will be zero.

$$\text{Therefore } [2x(+1)] + (1 \times X) + (4 \times (-2)) = 0$$

$$(+2) + X + (-8) = 0$$

$$X - 6 = 0$$

$$X = +6$$

$$\text{Oxidation number of Sulphur} = +6$$

Analyse the concept given above and answer the following.

- The atomic number of an element A is 12 (Symbol is not real).
 - Write down the electronic configuration of A.
 - Which is the most suitable method to attain octet configuration?
 - What is its valency?
 - What is its oxidation number?

2. Complete the table. The atomic number of element B is 17.(Symbol is not real)

Electronic configuration	.....
Valency	.....
Oxidation number	.....

3. Write the chemical formula of the compound formed from the elements A and B given above (In question 1 and 2).(Symbols are not real) .

4. Complete the table.

Element	Atomic number	Electronic configuration	Valency	Oxidation Number
Na	11	2,8,1	1	+1
O	8	.....	.....	.....
Al	13	.....	.....	.....
F	9	.....	.....	-1
Mg	12	.....	.....	.....

5. Magnesium (Mg) combines with oxygen (O) to form Magnesium Oxide. Write the chemical formula of Magnesium oxide.

6. Complete the table

Element	Atomic Number	Electronic configuration	Period Number	Group Number
K	.....	2,8,8,1	.....	.....
N	7	.....	.....	.....
Be	4	.....	.....	.....
Cl	17	.....	.....	.....
Ne	10	.....	.....	.....

7. Complete the table

Compound	Oxidation number of Mn	Symbol of Mn ion
MnCl ₂
Mn ₂ O ₇
MnO ₂

(Hint:- Oxidation number of Cl = -1, O=-2)

Periodic trends in Periodic Table

1. Size of atom

- ◆ As we move from top to bottom of a group in the periodic table, the size of the atom increases as there is an increase in the number of shells .
- ◆ On moving from left to right in a period, the nuclear charge increases but shell number does not increase. The force of attraction of the nucleus on the outermost electron increases; as a result the size of atom decreases.

2. Ionisation energy

The amount of energy required to remove the most loosely bound electron from the outermost shell of an isolated gaseous atom of an element is called its ionisation energy.

Ionisation energy depends mainly on two factors.

Nuclear charge

Size of an atom

In general as nuclear charge increases and as a result size of an atom decreases, the attractive force of nucleus over the outermost electrons increases. Hence ionisation energy increases.

In general

- as we move from top to bottom in a group, ionisation energy decreases.
- on moving from left to right in a period ionisation energy increases.

3. Metallic character

Generally, during chemical reactions metals lose electrons and become positive ions. Hence metals are known as electropositive elements.

- On moving from top to bottom in a group metallic character increases.
- On moving from left to right along a period, metallic character decreases.

4. Non-metallic character

In general during chemical reactions, non metals gain electron and become negative ions. That is why non-metals are called electronegative elements.

- On moving from top to bottom in a group, non-metallic character decreases.
- On moving from left to right along a period, non-metallic character increases.

5. Electronegativity

In a covalent bond, the relative ability of each atom to attract the bonded pair of electrons towards itself is called electronegativity

- On moving from top to bottom in a group electronegativity decreases
- On moving from left to right in a period , electronegativity increases

1. Based on the concepts given above examine the portion of periodic table given and answer the questions.

	1																18	
		2											13	14	15	16	17	A
B																	G	
			3	4	5	6	7	8	9	10	11	12						
	C															H		
					E		F											
D																		

- How many groups are there in a periodic table?
 - How many periods are there in a periodic table?
 - Which element has the highest ionisation energy?
 - Which element has the highest electronegativity?
 - Which element has the largest size of atom?
 - Which is the most non-metallic element?
 - Which are the elements present in group 1?
 - Which is the most metallic element?
 - Which element has the lowest ionisation energy?
2. Complete the table

Periodic Trend	From top to bottom in a group	From left to right along a period
Size of atom	Increases	Decreases
Metallic nature	-----	-----
Non-metallic nature	-----	-----
Ionisation energy	-----	-----
Electronegativity	-----	-----

UNIT 2
Gas laws and mole concept

- Every substance in the universe is made up of molecules
- The characteristics of these particles are different in solid state, liquid state and gaseous state.

Characteristics	Solid	Liquid	Gas
Distance between the molecules	Molecules are very closely packed	Distance between the molecules is more than that of a solid and less than that of a gas	Molecules are far apart
Attractive force between the molecules	Very high	The attractive force between the molecules is less than that of a solid and more than that of a gas	Very less
Energy of the molecules	Very less	More than that of a solid and less than that of a gas	Very high
Freedom of movement of the molecules	Very less	More than that of a solid and less than that of a liquid	Very high

- By absorbing heat, solid substances get converted into liquids. Liquids get converted into gases by absorbing heat.

Activity -1

- How do the characteristics of molecules change during the following change of state.

Characteristics	Solid changes to liquid	Liquid changes to gas
Distance between the molecules	-----	-----
Energy of the molecules	-----	-----
Freedom of movement of the molecules	-----	-----
Attractive force between the molecules	-----	-----

Activity -2

- Choose the statements relevant to gases.
 - Molecules have high freedom of movement
 - Distance between molecules is less than that in a liquid.
 - Distance between molecules is more than that in a liquid.
 - Energy of molecules is more than that in a liquid.
 - Attractive force between molecules is more.
 - Attractive force between molecules is less.

UNIT – 3

Reactivity series and Electrochemistry

Oxidation and Reduction – Electronic concept

- Oxidation is the process of loss of electrons.
- Reduction is the process of gain of electrons.
- Atom which loses electron - reducing agent.
- Atom which gains electron – oxidising agent.

Oxidation number

- Oxidation number of an atom in a substance is the formal charge assigned on the atom, if all the bonds in the substance are considered to be ionic.
- An atom acquires negative oxidation state by accepting electrons and acquires positive oxidation state by losing electrons.

Eg: An atom gets +1 oxidation number when it loses one electron.

An atom gets -1 oxidation number when it gains one electron.

Method to find oxidation number

- Oxidation number of an atom in a covalent compound is found out by assuming that the electron pair is shifted to the more electronegative atom..
- Oxidation number of an atom in a molecule of an element will be zero as the electrons are shared equally between the atoms.
- The sum of the oxidation numbers of the constituent atoms in a molecule will be zero.

Oxidation and reduction - Oxidation number concept

- The process in which the oxidation number increases is called Oxidation.
- The process in which the oxidation number decreases is called Reduction.
- The substance whose oxidation number decreases is called oxidising agent.
- The substance whose oxidation number increases is called reducing agent.
- An oxidising agent gets reduced and a reducing agent gets oxidised

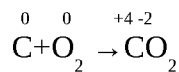
Redox Reaction

The reaction in which both oxidation and reduction take place simultaneously is called a redox reaction

Cation – Positively charged ion

Anion – Negatively charged ion

- Chemical equation for the formation of carbon dioxide by the reaction between Carbon and Oxygen is given below. Analyse the details given in the table related to this.



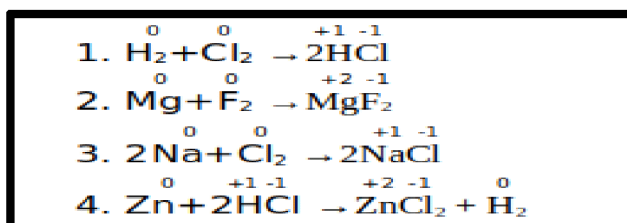
Element	Oxidation Number (Before reaction)	Oxidation Number (After reaction)	Oxidation/ Reduction
C	0	+4	Oxidation
O	0	-2	Reduction

Oxidising Agent - Oxygen

Reducing Agent - Carbon

This reaction is an example for redox reaction.

1. (a) Analyse the chemical equations given in the box and complete the table.



Substance undergoing Oxidation	Substance undergoing Reduction	Oxidising Agent	Reducing Agent
H ₂	Cl ₂	Cl ₂	H ₂
.....
.....
.....

- (b) Are the above chemical reactions redox reactions ? Why ?

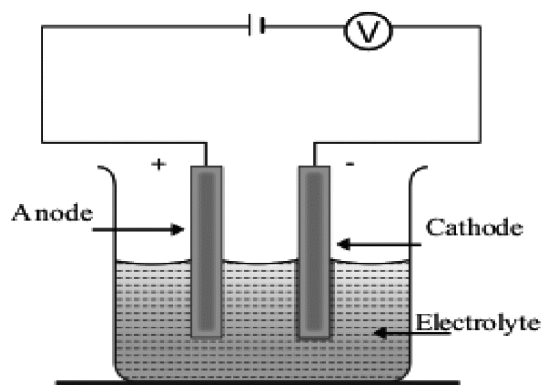
2. Analyse the chemical equations given below and answer the following questions.

Chemical equation	Substance undergoing oxidation	Substance undergoing reduction	Equation for Oxidation	Equation for Reduction	Oxidising Agent	Reducing Agent
$\text{Mg} + \text{Cl}_2 \rightarrow \text{MgCl}_2$	Mg	Cl ₂	$\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}^-$	$\text{Cl} + 1\text{e}^- \rightarrow \text{Cl}^-$	Cl ₂	Mg
$2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$	.....	.....	.....	$\text{O} + 2\text{e}^- \rightarrow \text{O}^{2-}$	.....	.....
$2\text{Na} + \text{F}_2 \rightarrow 2\text{NaF}$	.....	.....	.....	.....	.....	.....

[Hint : Atomic Number Na =11, Mg = 12, H=1, O=8, F =9]

3. Complete the table.

Chemical equation	Substance undergoing oxidation	Substance undergoing reduction	Equation for Oxidation	Equation for Reduction
$\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$	$\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}^-$	$\text{H}^+ + 1\text{e}^- \rightarrow \text{H}$
$\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$	$\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$
$\text{Cu} + 2\text{AgNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{Ag}$	Ag}^+	.....	.....

ELECTROCHEMICAL CELL**Electrolytes**

Electrolytes are substances which undergo chemical change when electricity is passed through them. Acids, alkalies, salts etc. are electrolytes in their molten state or aqueous solution. Ionic compounds dissociate into positive and negative ions in their molten state or aqueous solution. Hence ionic substances conduct electricity in their molten state or aqueous solution. Some polar compound also allow electricity to pass through them.

Electrodes

Electrodes are conductors which lead electricity from the battery to the electrolyte and from the electrolyte to the battery.

Electrolysis

The process in which a substance undergoes decomposition by the absorption of electrical energy is known as electrolysis.

Electrochemical cells

Electrochemical cells are devices in which electrical energy is produced by chemical reaction or those in which electricity brings about chemical reaction.

Electrochemical reactions

The reactions in which electrical energy is absorbed or liberated are called electrochemical reactions.

Electroplating

The process of obtaining a thin coating of one metal over another metal using electricity is known as electroplating. During the process of electroplating, both metal to be plated and article to be coated with the metal act as electrodes. The salt solution of the metal to be plated is used as the electrolyte.

Activity – 1

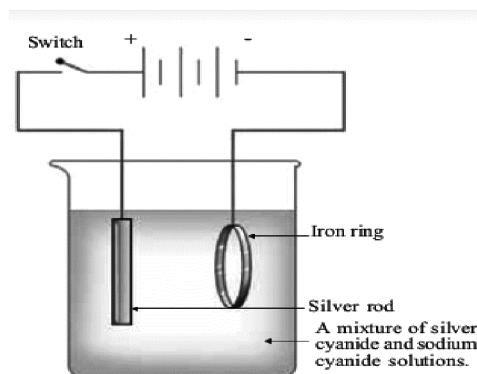
Analyse the concepts given above and complete the worksheet.

The substances which undergo chemical change on passing electricity are generally known as	-----
The process of obtaining a coating of one metal over another metal	-----
The cell which converts chemical energy into electrical energy	-----
The conductors which lead electricity from the battery to the electrolyte and from the electrolyte to the battery.	-----

Activity – 2

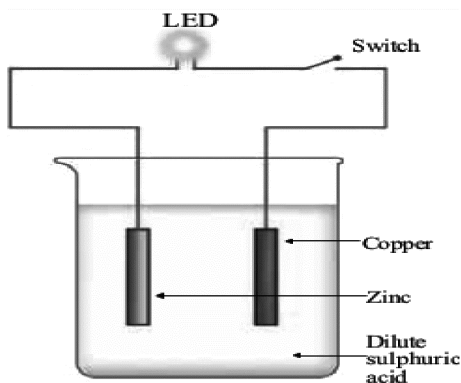
Analyse the figure and answer the following questions

- Which are the electrodes in the given arrangement?
- Which is the electrolyte?
- What is the energy change taking place in this arrangement?
- Which is the suitable electrolyte if copper is to be electroplated instead of silver?
- By what name is the reaction taking place here known?



Activity – 3

Examine the given figure and answer the following questions.

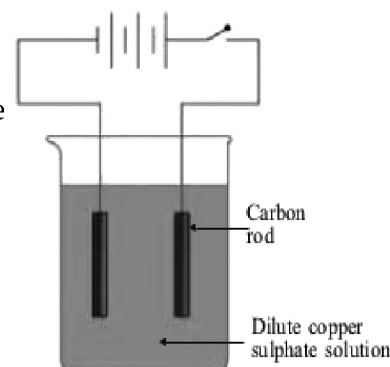


- Which is the energy change taking place here?
- Which are the electrodes used in the arrangement?
- Which is the electrolyte used here?

Activity – 4

Analyse the given figure and answer the following questions

- What change do you observe in the colour of copper sulphate solution?
- Identify the pole of the battery to which carbon rod where copper gets deposited is connected.
- What is the energy change taking place in this cell?



Unit 4 Production Of Metals

- Various uses of metals are based on their characteristics

General characteristics of metals

1. **Malleability** :- Metals can be beaten into thin sheets by hammering. This property is called malleability.
Gold is the most malleable metal.
2. **Ductility** :- Metals can be drawn into thin fine wires. This property is known as ductility.
Platinum is the most ductile metal.
3. **Hardness** :- Metals are generally hard. But there are soft metals also. Sodium and Potassium are soft metals.
4. **Metallic lustre** :- The surface newly formed when metals are cut, has a shining appearance. This property is known as metallic lustre
5. **Electrical conductivity** :- Metals have ability to conduct electricity .
Silver is the best electrical conductor among metals.
6. **Thermal conductivity** :- Metals have ability to conduct heat.
Silver is the best thermal conductor among metals.
7. **Sonority** :- The ability of metals to produce sound when tapped with a hard material is known as sonority.
8. Metals generally have high melting point. But a few metals have low melting point. Gallium, Caesium, Mercury etc have low melting point.
9. Metals generally possess high density. But a few metals have low density. Lithium, Sodium, Potassium etc have low density.

Activity -1

On the basis of the data given above regarding metals, complete the following table.

1. The process of beating metals into thin sheets by hammering.	-----
2. Example for soft metals.	-----
3. The best electrical conductor.	-----
4. The best thermal conductor.	-----
5. The ability of metals to produce sound when tapped with a hard material.	-----
6. The metal having lowest melting point among the following. (Copper, Caesium, Iron)	-----
7. The metal having lowest density among the following. (Gold, Sodium, Platinum)	-----

Activity -2

Certain metals and their uses are given. Write the characteristics of the metals corresponding to their uses and complete the worksheet.

Metal	Use	Characteristics with respect to their uses
Aluminium	Utensils	-----
Gold	Ornaments	-----
Tungsten	Filament of electric bulb	-----
Copper	Electric wire	-----

CHAPTER 5
NON-METALLIC COMPOUNDS

- Conduct the following experiments and tabulate the corresponding observation and inference.

Experiment	Observation	Inference
Take some H ₂ O ₂ solution in a test tube. Introduce a glowing incense stick into the test tube.
Add a small amount of MnO ₂ in H ₂ O ₂ solution in a test tube. Introduce a glowing incense stick into the test tube

Catalyst : Substances which alter the rate of chemical reaction without themselves undergoing any permanent chemical change are called catalysts.

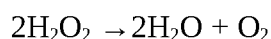
Positive catalyst: Catalyst which increases the rate of chemical reaction.

Eg:- MnO₂ is the catalyst used to increase the rate of decomposition of H₂O₂.

Negative catalyst : Catalyst which decreases the rate of chemical reaction.

Eg:-H₃PO₄ is the catalyst used to decrease the rate of decomposition of H₂O₂.

1. Analyse the chemical equation given below and answer the following questions.

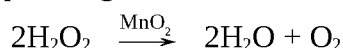


- Which is the catalyst used to increase the rate of decomposition of H₂O₂?
- Which is the catalyst used to decrease the rate of decomposition of H₂O₂?
- The catalysts which increase the rate of reactions are called
- The catalysts which decrease the rate of reactions are called

2. Complete the table

Industrial preparation	Positive catalyst
Ammonia	-----
Sulphuric acid	-----

3. Analyse the equation given below and answer the following questions.



- Name the catalyst used in this reaction ?
- Which are the substances left behind in the test tube after the reaction?

UNIT -6
Nomenclature Of Organic Compounds And Isomerism

Organic compounds are carbon compounds except the inorganic compounds like CO, CO₂, carbonates, bicarbonates etc.

Characteristics of carbon

- The valency of carbon is 4.
- Single bond, double bond and triple bond are possible between carbon atoms.
- In comparison to other elements, the ability of carbon for catenation is very high.
- Catenation is the ability of the atoms of an element to combine among themselves
- Carbon atoms combine together to form many straight chain, ring or branched chain compounds.

Hydrocarbon

Hydrocarbons are compounds containing only carbon and hydrogen.

Activity -1

Complete the table

Symbol	C
Atomic number	_____
Mass number	_____
Electronic configuration	_____
Valency	_____

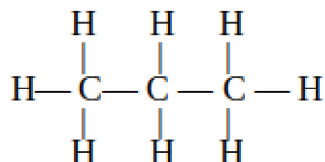
Activity -2

On the basis of the data given above answer the following questions

- a) By what name the compounds containing carbon and hydrogen only are known as?
- b) Choose the hydrocarbon from the following compounds.

(Na₂CO₃ , C₃H₈ , KHCO₃ ,CO₂)

- c) What is the valency of carbon?
- d) Which type of bond is present between the carbon atoms in the given hydrocarbon ?



- (a) Single bond (b) Double bond (c) Triple bond
- e) The number of carbon compounds is very large. Give reason.
- f) What is the minimum number of carbon atoms required to form a cyclic compound?
(a) 3 (b) 2 (c) 4 (d) 5