

Chapter-8
Structure of Atom

1 Mark Questions

1. What is meant by an atom?

Atom:- The smallest unit of a substance is called an atom.

2. What is electronic configuration?

Electronic configuration:- The arrangement of electrons in shells, sub-shells and orbital's of an atom is called electronic configuration.

3. Name the sub-atomic particles of an atom?

The sub atomic particles are Electron, proton and neutron.

4. How many colours are there in a rainbow?

There are seven colours namely violet, indigo, blue, green, yellow, orange and red (VIBGYOR) in a rainbow.

5. What is the value of speed of light in vacuum?

Speed of light in vacuum, $c = 3 \times 10^8 \text{ m s}^{-1}$.

6. What is the relation between wavelength and frequency?

The relation between these quantities is given by, $\lambda \propto \frac{1}{\nu}$ (or) $c = \nu\lambda$.

7. What is meant by an electromagnetic spectrum?

Electromagnetic spectrum:- The entire range of electromagnetic wave frequencies is known as the electromagnetic spectrum.

8. What is meant by a visible spectrum?

Visible spectrum:- The range of wavelengths covering red colour to violet colour is called the visible spectrum.

9. What is a spectrum? How many types of spectrums are there?

Spectrum:- 1. A group of wave lengths or frequencies is called a spectrum.

2. Spectrums are of two types. They are i). Emission spectrum ii) Absorption spectrum.

10. What is an Absorption Spectrum? (AS1) (TQ)

Absorption spectrum:- 1. Absorption spectrum is spectrum obtained when the substances absorb energy.

2. It contains dark lines on bright background.

11. What is Emission Spectrum? (AS1) (TQ)

Emission Spectrum:- The spectrum of radiation emitted by a substance from its excited state is an emission spectrum.

12. When do we get Atomic line spectra?

Atomic line spectra arise because of absorption or emission of certain frequencies of light energy.

13. Write the Plank's equation?

$E = h\nu$. Where E = Energy of radiation.

ν = frequency of the radiation absorbed / emitted.

h = Planck's constant.

14. What is the value of Planks constant?

Plank's constant, $h = 6.626 \times 10^{-34}$ Js (or) $h = 6.626 \times 10^{-27}$ erg.sec

15. Who introduced the elliptical orbits?

Sommerfeld.

16. Who developed the quantum mechanical model of an atom?

Erwin Schrodinger.

17. What is meant by an orbit?

Orbit:- The path of the electron around the nucleus is called an orbit.

18. What is an orbital?

Orbital:- The region of space around the nucleus where the probability of finding the electron is maximum is called an orbital.

19. What are degenerate orbitals?

Degenerate orbital's:- Orbital's which have same energy are called degenerate orbitals.

20. How many spin orientations are possible for an electron in an orbital?

Two spin orientations are possible for an electron in an orbital i.e., clockwise and anti clock wise.

21. Which electronic shell is at a higher energy level K or L? (AS2) (TQ)

L shell is at higher energy shell. Since, it is far away from nucleus than K-shell.

22. The wave length of a radio wave is 1.0m. Find its frequency? (AS7) (TQ)

Given :- Wavelength of radio wave (λ) = 1 m
Speed of light in vacuum, $c = 3 \times 10^8$ m s⁻¹
Frequency, $\nu = ?$

Formula:- $c = \lambda\nu \Rightarrow 3 \times 10^8 = 1 \times \nu$.

$\therefore \nu = 3 \times 10^8$ Hz.

23. State Heisenberg principle of uncertainty?

Heisenberg's uncertainty principle:- "It is not possible to find the exact position and velocity of electron simultaneously".

24. Which type of spectrum is rainbow?

Continuous spectrum.

25. The electron configuration of Helium is 1S². Write the information conveyed by it?

He (Z=2) = 1s²

Where '1' denotes principal quantum number

'S' denotes angular momentum quantum number

'2' denotes the number of electrons present in that orbital.

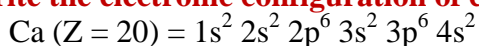
26. Write the values of magnetic quantum number for the sub shell d.

1. The angular momentum quantum number (l) for sub shell d is '2'.
2. So magnetic quantum number $m = 2l + 1 = 2 \times 2 + 1 = 5$.
3. The 'm_s' values are -1, -1, 0, +1, +2.

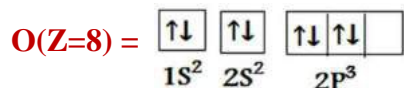
27. What is the maximum value of 'l' for n = 4?

- Given, $n = 4$.
- So $l = n - 1 = 4 - 1 = 3$ i.e., 'f' orbital

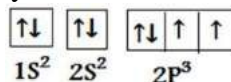
28. Write the electronic configuration of calcium atomic number 20?



29. Following orbital diagram shows the electron configuration of oxygen atom. Which rule does not support this?



Hund's rule. Because degenerate orbital's are filled by one electron after pairing takes place. So the correct electronic configuration of Oxygen is



30. 1. An electron in an atom has the following set of four quantum numbers to which orbital it belongs to and name that element? (AS1) (TQ)

n	l	m	m_s
2	0	0	$+\frac{1}{2}$

2. Write the four quantum numbers for $1s^1$ electron?

- It belongs to $2s^1$.

2.

n	l	m_l	m_s
1	0	0	$+\frac{1}{2}$

31. Why are Bohr's orbits called stationary orbits?

As long as the electron is revolving in an orbit its energy is same. Hence these orbits are called stationary orbits.

32. Among Red and blue colours which is having high energy? Give reason?

- Blue colour having high energy.
- This is because the wavelength of blue colour is less than red colour.
- The colour with lower wave length has higher frequency.

33. How many m_l values are possible for $l = 3$?

- The possible m_l values for $l = 3$ are, $2l + 1 = 2(3) + 1 = 6 + 1 = 7$.
- They are -3, -2, -1, 0, +1, +2, +3.

34. We observe yellow light in street lamps. Which will produce yellow light?

Sodium vapours produce yellow light in street lamps.

35. Which quantum does not follow from the solutions of Schrodinger wave equation?

Spin quantum number.

2 Mark Questions

1. What information does the electronic configuration of an atom provide? (AS1) (TQ)

Electronic configuration:- The arrangement of electrons in shells, sub-shells and orbital's of an atom is called electronic configuration.

The electronic configuration of an element gives,

1. Valency of the element.
2. Which block does the element belongs to.
3. Which period does the element belongs to.
4. Which group does the element belongs to.
5. Reactivity of element.
6. Comparative size of the atom.
7. Metallic character of the element.

2. What is nl^x method? How it is useful? (AS1) (TQ)

1. The short hand notation of electronic configuration is nl^x .
2. It gives the information as shown below,
3. In nl^x method, n = Principle quantum number.
 x = number of electrons in in orbital.
 l = Azimuthal quantum number or angular momentum quantum number.

3. a. How many maximum number of electrons can be accommodated in a principal energy shell?

b. How many maximum number of electrons can be accommodated in a sub shell?

c. How many maximum number of electrons can be accommodated in an orbital?

d. How many sub shells will be present in a principal energy shell?

e. How many spin orientations are possible for an electron in an orbital? (AS1) (TQ)

- a. ' $2n^2$ ', Where n is the principle quantum number.
- b. $2(2l + 1)$, Where $l = 0, 1, 2, 3, \dots$
- c. 2.
- d. $(2l + 1)$, Where $l = 0, 1, 2, 3, \dots$
- e. 2.

Note:- The spin orientation of the electron is clockwise (\uparrow) and anticlockwise (\downarrow) direction. They are represented by $+\frac{1}{2}$ and $-\frac{1}{2}$.

4. In an atom the number of electrons in M shell is equal to the number of electrons in the K and L shell. Answer the following questions? (AS1)(TQ)

a. Which is the outer most shell?

b. How many electrons are there in its outermost shell?

c. What is the atomic number of an element?

d. Write the electronic configuration of the element?

- a. M-Shell.
- b. 10 electrons.
- c. Atomic number = 20.
- d. The atomic number of the element is 22.
- e. $1S^2 2S^2 2P^6 3S^2 3P^6 4S^2$ (or) 2, 8, 10.

Note:- No. of electrons in 'M' shell = No. of electrons in K shell + No. of electrons in L shell = $2+8=10$.

Total no. of electrons = No. of electrons in 'M' shell + No. of electrons in K shell + No. of electrons in L shell.

$$= 10+2+8=20$$

5. Rainbow is an example for continuous spectrum-Explain? (AS1)(TQ)

1. A group of wavelengths is called a spectrum.
2. When white light is falls on a transparent material the white light split into sequence of colours.
3. The colours are Violet, Indigo, Blue, Green, Yellow, Orange, and Red (VIBGYOR).
4. A similar spectrum is produced when a rainbow forms in the sky after a rain shower.
5. It is caused by dispersion of sunlight by ting water droplets present in the atmosphere.
6. Such a spectrum in which there are no sharp boundaries in between colours is known as continuous spectrum.
7. So, rainbow is also a continuous Spectrum.

6. How may elliptical Orbits are added by Somerfield in third Bohr's Orbit? What was the purpose of adding these elliptical Orbits? (AS1)(TQ)

1. Sommerfeld modified Bohr's atomic model by adding elliptical orbits.
2. He added two elliptical orbits to Bohr's third orbit.

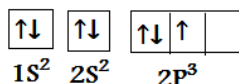
Purpose of adding elliptical Orbit:- 1. Bohr's model failed to account for splitting of line spectra.
2. In an attempt to account for the structure of line spectrum, Sommerfeld modified Bohr's atomic model by adding elliptical orbits.

7. Write the four quantum numbers for the differentiating electron of sodium (Na) atom? (AS1)

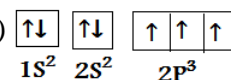
1. The atomic number of Sodium (Na) is 11.
2. Electronic configuration is $1S^2 2S^2 2P^6 3S^1$.
3. The differentiating electron is 3s orbital.
4. The four quantum numbers of Na are,

Orbital	n	l	m_l	m_s
3s	3	0	0	$+\frac{1}{2}$

8. Following orbital diagram shows the electron configuration of nitrogen atom. Which rule does not support this? (AS1) N (z=7) =



1. Hund's rule is violated in the above electronic configuration.
2. According to Hund's rule, electron pairing takes place all the available degenerate orbitals are completely filled by one electron in each.
3. In the above electronic configuration pairing takes place, but degenerate orbitals can not filled by one electron in each.
3. So, the correct electron configuration of Nitrogen is, $1S^2 2S^2 2P_x^1 2P_y^1 2P_z^1$ (or)



9. Collect the wave lengths and corresponding frequencies of three primary colours red, blue and green? (AS4) (TQ)

Red, Blue and green are the primary colours.

Colour	Wavelength	frequency
Red	700 nm	4.0×10^{14} Hz
Blue	470 nm	6.4×10^{14} Hz
Green	530 nm	5.7×10^{14} Hz

10. Which rule is violated in the electronic configuration? $1S^0 2S^2 2P^4$? (AS2) (TQ)

1. Aufbau principle is violated in this electronic configuration.
2. According to Aufbau principle, Electron enters into orbital of lower energy.

- The lowest energy of the orbital is calculated by the formula $(n+l)$. Where,
 n = Principle quantum number.
 l = Angular momentum quantum number.
- Among 1s, 2s, 2p; 1s has least energy.
- So 1s orbital must be filled before the electron should enter into 2s.

11. Write the differences between Orbit and Orbital?

Orbit	Orbital
1. The path of the electrons which revolves around the nucleus is called orbit.	1. The region in space around the nucleus where the probability of finding the electron is maximum is called orbital.
2. Orbits are circular and non-directional.	2. Orbital's have definite shape. Except 's' orbital other orbitals are directional.
3. These are denoted by the letters K, L, M, and N etc.	3. These are denoted by the letters s, p, d, and f etc.

12. Srekanth said that, "The velocity of an electron and its exact position cannot be determined at a time". Do you agree with this statement – explain?

- Yes, I agree with the statement of Krishna. Because electrons are very small.
- To know its position light of very short wave length is required.
- This short wave length light interacts with the electron and disturbs the motion of the electron.
- Hence it is not possible to determine its position and velocity accurately.

13. Write the four quantum numbers for the differentiating electron of potassium atomic number 19?

- K ($Z = 19$) = $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$.
- The last electron enters into 4s orbital. So the four quantum numbers for $4s^1$ is as follows.

n	l	m	s
4	0	0	$+\frac{1}{2}$ (or) $-\frac{1}{2}$

14. The Electronic configuration of an element 'X' is given as below, observe it and Answer the questions?
 $X = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^1$

A) Name the element 'X'

B) Which is the outer most shell?

- Name of the element 'X' is Scandium.
- Outer most shell is '4'.

15. Write the electronic configuration of copper atomic number 29. Which rule is deviated?

- Cu ($Z=29$) = $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^{10}$
- Aufbau principle is deviated here.
- Lower energy orbital '4s' is not completely filled.
- Because half filled and completely filled orbitals are more stable.

16. What information does principle quantum number give?

- The principle quantum number is related to the size and energy of the main shell.
- By increasing the principle quantum, number the size and energy of the main shell also increases.

17. Explain why electrons enter into 4s orbital but not 3d after filling the 3p orbital?

- The $(n+l)$ value of 4s = $4 + 0 = 4$
- The $(n+l)$ value of 3d = $3 + 2 = 5$
- The $(n+l)$ value of 3d orbital has more than 4s orbital.
- According to Aufbau principle electrons are enter into 4s orbital after filling the 3p orbital.

18. How many elliptical orbits are added by Somerfield in third Behr's orbit what was the purpose of adding those elliptical orbits?

1. Two elliptical orbits are added to Bohr's third orbit.
2. To explain the complete model of atomic spectrum Somerfield added the elliptical orbits.

19. Why are chromium and copper exceptions to electronics configuration?

1. The half filled or fulfilled orbital's are in the outer most orbit is more stable.
2. So, the electronic configuration of Cr (z=24) is [Ar] 4s¹ 3d⁵ instead of Cr (24) – [Ar] 4s² 3d⁴.
3. In the same way the electronic configuration of CU (z-29) is [Ar] 4s¹3d¹⁰ instead of cu (29) 4s²3d⁹.
4. Chromium and Copper redistribute one 4s electron to 3d they get half filled and fulfilled orbital's respectively both of them gets more stability.

20. What is ground state and excited state? Does the electron remains in the excited state forever?

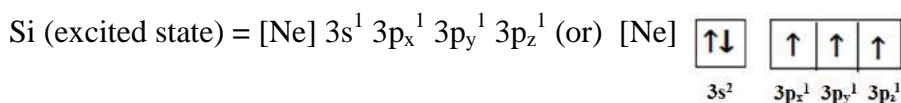
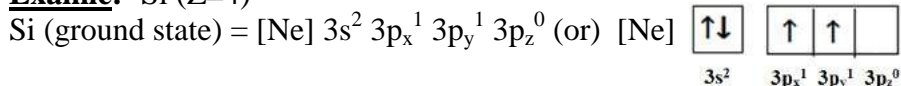
1. Lowest energy state of the electron is known as ground state.
2. By gaining energy it moves to a high energy level called excited state.
3. The electron does not remain in the excited state forever.
4. By loosing energy the electron come back to its ground state.

21. What is ground state and excited state?

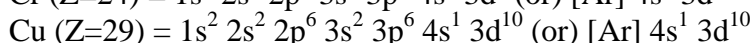
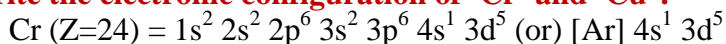
Ground state:- The lowest energy of the electron is known as ground state.

Excited state:- The electron moves to a higher energy level than that state is called excited state.

Examble:- Si (Z=4)



22. Write the electronic configuration of 'Cr' and 'Cu'?



23. Define wavelength and frequency?

Wavelength (λ):- The wavelength (λ) of the wave is the distance from one wave peak to the next.

Frequency (ν):- The frequency (ν) of a wave is simply the number of wave peaks that pass by a given point per unit time, expressed in units of reciprocal seconds ($\frac{1}{s}$ or s⁻¹).

24. Write the limitations of Bohr's theory?

1. Bohr's theory does not explain the spectra of multi electrons.
2. Bohr,s theory does not explain the fine spectrum of hydrogen atom.
3. It does not explain the Zeeman effect and stark effect.
4. bohr's theory is not in agreement with heisenberg's uncertainty principle.

4 – Mark Questions

1. What is an orbital? How is it different from Bohr's orbit? (AS1)(TQ)

1. The region or space around the nucleus where the probability of finding the electron is maximum is called orbital.
2. Bohr's orbit has a definite boundary and fixed energy at different distances from the nucleus.
3. They are circular in shape.
4. Orbital's has no definite boundary.
5. It is a region where we find maximum probability of electron.
6. The shape of each orbital is different.
7. For example, the shape of s-orbital is spherical and p-orbital is dumbbell and d-orbital is double dumbbell.
8. Bohr's orbit can accommodate maximum of $2n^2$ electrons in it.
9. But orbital can accommodate only two (2) electrons.

2. Explain the significance of three Quantum numbers in predicting the positions of an electron in an atom? (AS1)(TQ)

Each electron in an atom is described by a set of three quantum numbers n, l, m . These numbers indicate the probability of finding the electron in the space around nucleus.

1. Principal Quantum Number (n):- 1. It was introduced by Niel's Bohr.

2. It is denoted by the letter 'n'.
3. The number of electrons in a shell is limited to $2n^2$. Where $n = 1, 2, 3, \dots$ etc.
4. The shells are denoted by the letters K, L, M, N, ...etc.
5. Principal quantum number gives the size and energy of the main shell.

Shells	K	L	M	N	O
n	1	2	3	4	5

2. Angular-momentum Quantum Number (l):- 1. It was introduced by Sommerfeld.

2. It is denoted by the letter ' l '.
3. It is also called as Angular momentum Quantum number.
4. ' l ' has integer values from 0 to $(n+1)$ for each value of n . Where $l = 0, 1, 2, 3, \dots$ etc.
5. Azimuthal quantum number gives the shape of the sub-shell.
6. The sub shells are denote by the letters s, p, d, f, ...etc.

l	0	1	2	3	4
Sub shell	s	p	d	f	g

3. Magnetic Quantum Number(m_l):- 1. It was introduced by Lande.

2. It is denoted by the letter ' m_l '.
3. Magnetic Quantum number (m_l) has integer values between $-l$ to $+l$ including zero.
4. For a given ' l ' value the magnetic quantum number has $(2l + 1)$ integer values of m_l
5. It gives the information about the orientation of orbital's in the presence of magnetic field.
6. For example the orientation of the p orbitals are p_x, p_y, p_z .

4. Spin Quantum Number (m_s):- 1. It was introduced by Uhlenbeck and Goudsmith.

2. It is denoted by the letter ' m_s '.
3. This quantum number refers to the two possible orientation of the spin of an electron, one clockwise (\uparrow) and the other anticlockwise (\downarrow) spin.
4. The spin motion of the electrons are represented by $+\frac{1}{2}$ and $-\frac{1}{2}$.

3. State and explain with one example of Aufbau principle (Building up principle)?

Aufbau principle:- 1. According to this principle, the electron occupies the orbital having the lowest energy.

2. The energy of the orbital was calculated by the formula $(n+l)$.

Where n = principle quantum number.

l = Angular momentum quantum number.

Example:- Case-1:- 1. Consider the Hydrogen atom. It has only one electron.

2. The electron enters the '1s' orbital which has the lowest energy.

3. In terms of the quantum number, the incoming electrons go to an orbital whose $(n+l)$ is minimum.

Case-2:- 1. If two orbital's have the same $(n+l)$ value, the orbital having lower, n , values will be occupied first.

2. For example the atomic number of the Scandium is 21.

3. Twenty electrons can be accommodated in 1s, 2s, 2p, 3s, 3p and 4s orbital's.

4. The last electron can enter into either 3d or 4p orbital.

5. The $(n+l)$ value for these orbital's are,

Orbital	$(n+l)$ value
3d	$3+2=5$
4p	$4+1=5$

6. Both the two orbital's have same $(n+l)$ value. But for '3d' orbital the 'n' value is less ($n=3$) compare to the 'n' value of '4p' ($n=4$).

7. Therefore the electron occupies the 3d orbital.

8. Thus the electronic configuration of the Sc is $[\text{Ar}] 4s^2 3d^1$.

4. State and explain with one example of Hund's rule?

Hund's Rule:- Hund's rule states that electron pairing takes place only after all the available degenerate orbitals are occupied by one electron each.

Example:- 1. Consider a carbon atom ($Z=6$). It has six electrons.

2. The first electron goes into the '1s' orbital of the K-shell.

3. The second electron will be paired up with the first in the same '1s' orbital.

4. Similarly the third and fourth electrons occupy the '2s' orbital of the L-shell.

5. The fifth electron goes into one of the three '2p' orbitals of the L-shell. Let it be $2p_x$.

6. Since the three p-orbital's are degenerate (viz. $2p_x, 2p_y, 2p_z$), the sixth electron goes into $2p_y$ or $2p_z$ but not $2p_x$.

7. Thus the electronic configuration of carbon can be written as, $1s^2 2s^2 2p_x^1 2p_y^1$. (or)

5. State and explain Pauli's exclusion principle?

Pauli's exclusion principle:- Pauli's exclusion principle states that no two electrons will have all the four quantum numbers same.

Example:- 1. Consider a Helium atom ($Z=2$). It has two electrons.

2. The electronic configuration of Helium atom is $1s^2$.

3. If n , l , and ml are same for two electrons then ms must be different.

4. In the helium atom the spins must be paired.

5. Electrons with paired spins are denoted by ' $\uparrow\downarrow$ '.

6. One electron has $m_s = +\frac{1}{2}$, the other has $m_s = -\frac{1}{2}$. They have anti-parallel spins.

8. Write the values of Angular momentum Quantum number, Magnetic quantum number, number of electrons present in the orbitals of principal quantum number '2'?

Principal quantum number	Orbital notation	Angular momentum quantum number	Magnetic quantum number(l) $2l + 1$	Number of electrons present in the orbital
2	2s	0	0	2
	2p	1	-1, 0, +1	6

9. Write 'm' and 'l' values, for $n = 1, 2, 3, 4$.

n	l	m
1	0(s)	0
2	0(s)	0
	1(p)	-1, 0, +1
3	0(s)	0
	1(p)	-1, 0, +1
	2(d)	-2, -1, 0, +1, +2
4	0(s)	0
	1(p)	-1, 0, +1
	2(d)	-2, -1, 0, +1, +2
	3(f)	-3, -2, -1, 0, +1, +2, +3

Chapter-9

Classification of Elements - The Periodic Table

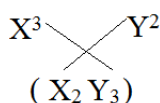
1 Mark Questions

1. How does metallic character change when we move? i. Down a group ii. Across a period. (AS1) (TQ)

- As we move down a group from top to bottom, the metallic character of elements increases.
- As we move across a period, from left to right, metallic character decreases.

2. using the periodic table, predict the formula of compound formed between and element X of group 13 and another element Y of group 16. (AS2) (TQ)

- Element X of group 13 Element Y of group 16
Valency of X = 3 Valency of Y = 18 - 16 = 2
- Formula of the compound formed between X and Y is,



3. Define element according to Robert Boyle(1661)?

Robert Boyle defined an element as any substance that cannot be decomposed into further simple substance by a physical or chemical change.

4. What is meant by a Dobereiner's law of triads?

- A group of three elements in which atomic weight of middle element is the average of first and third elements.
- This statement is called the Dobereiner's law of triads.
Ex:- Li, Na, K and Ca, Sr, Ba

5. Why lanthanides and actinides are placed separately at the bottom of the periodic table?

- The properties of these elements does not coincide with other elements because the valance electron enters in to 4f and 5f orbitals respectively.
- So they are placed separately at the bottom of the periodic table.

6. Define modern periodic law ? How many periods and groups are present in the periodic table?

Modern Periodic Law:- "The physical and chemical properties of elements are the periodic function of the electronic configurations of their atoms".

- The modern periodic table has eighteen vertical columns known as groups and seven horizontal rows known as periods.

7. What is meant by a Newlands' law of Octaves?

- Newlands' law of Octaves:-** 1. When the elements are arranged in the ascending order of their atomic weights, every eighth element starting from a given element resembles the same properties.
- This hypothesis is called Newland's law of octaves.

8. What is the meaning of éka'?

Eka is a Sanskrit word for numeral one.

9. State Mendeleeff's periodic law?

Mendeleev's periodic law:- The properties of elements are the periodic functions of their atomic weights.

10. Name the elements prediction of eka-boron, eka-aluminium and eka-silicon by Mendeleeff's?

1. Mendeleeff's eka-boron is Scandium(Sc).
2. Mendeleeff's eka-aluminium is Gallium(Ga).
3. Mendeleeff's eka-silicon is Germanium(Ge).

11. Mendeleev's said that "If I hold an element in my hand, it will melt". Name that element?

Gallium(Ga). Because the melting point of 'Ga' is 30.2°C and our body temperature 37°C.

12. What is the relation between atomic weight, equivalent weight and valence?

Atomic weight = equivalent weight × valence.

13. Name the element whose atomic number is 10 in the periodic table?

Mendelevium.

14. What is mean by a atomic number?

The number of positive charges (protons) in the atom of an element is called the atomic number of the element.

15. State Modern Periodic Law or Mosley's law?

The Physical and chemical Properties of the elements are the periodic functions of their atomic number or Electronic Configurations of the atoms.

16. What is a chemical family?

Chemical family:- Group of elements is called a chemical family or element family.

17. Define the word valence?

Valency:- Valency of an element was defined as the combining power of an element with another element.

18. What is meant by a groups in a periodic table?

Groups:- 1. The vertical columns in the periodic table are known as groups.
2. There are eighteen groups in long form of periodic table.
3. They are represented by using Roman numeral I through VIII with letters A and B in traditional notation.

19. What is meant by a periods in a periodic table?

Periods:- 1. The horizontal rows in the periodic table are called periods.
2. There are seven periods in the modern periodic table.
3. periods are represented by Arabic numerals 1 through 7.

20. Do you know how the name of Alkali metal family of periodic table derived?

Alkali metal family:- 1. The word alkali means plant ashes.
2. Na, K etc.... were obtained from plant ash.
3. So, group IA elements are called alkali metals family.

21. Do you know how the name of Chalcogen family of periodic table derived?

Chalcogen family:- 1. The word chalcogenous means ore product.
2. As the elements in group 16(VIA) form ores with metals.
3. They are called as chalcogenous family.

22. Do you know how the name of Halogen family(salt family) of periodic table derived?

Halogen family:- 1. Halos means sea salt and genus means produced.
2. As most of the elements in group 17(VIIA) are obtained from nature as sea salt.
3. They are called as halogen family or salt family.

23. Do you know how the name of Noble gases of periodic table derived?

- Noble gases**:- 1. As the elements of group 18(VIIIA) are chemically least active.
2. They are called as noble gases.
3. Their outer shell electronic configurations are basis for octet rule.

24. Which elements are called as Lanthanoids and Actinoids?

- Lanthanoids**:- 1. 4f elements from $_{58}\text{Ce}$ to $_{11}\text{Lu}$ possess almost the same properties as $_{57}\text{La}$.
2. So they were called as Lanthanoids or lanthanides.

- Actinoids**:- 1. 5f elements from $_{90}\text{Th}$ to $_{103}\text{Lr}$ possess almost the same properties as $_{89}\text{Ac}$.
2. So they were called as Actinoids or actinides.

25. What is meant by a metals and non-metals?

Metals:- The elements with three or less electrons in the outer shell are considered to be metals.

Non-Metals:- The elements with five or more electrons in the outer shell are considered to be non-metals.

26. What are transition elements?

Transition elements:- All the d- block elements (except Zn group) are known as transition elements.

27. What are inner-transition elements?

Inner- transition elements:- All the f-block elements (both Lanthanides, Actinides) are known as inner transition elements.

28. What is meant by a metalloids or semi-metals ?

Metalloids or semi-metals:- 1. Metalloids or semi-metals are elements which have properties that are intermediate between the properties of metals and non metals.

2. They possess properties like metals but brittle like non metals.
3. They are generally semi-conductors.

Eg:- B, Si, Ge etc.

29. Define atomic radius?

Atomic radius:- 1. The distance between the nucleus and outermost shell is known as atomic radius.

2. Atomic radius is measured in 'pm' (pico meter) units.

$$1 \text{ pm} = 10^{-12} \text{ m}$$

30. Define covalent radius?

Covalent radius:- half of the distance between the two atoms in covalent molecules is known as covalent radius.

31. Define ionization energy?

Ionization Energy:- 1. The energy required to remove an electron from the outer most orbit or shell of a neutral gaseous atom is called ionization energy.

2. Ionization energy is expressed in kJ/mol (or) k.cal/mol
3. Ionization energy is also called the ionization potential but when we use the term the ionization potential, it is better to write the unit ev .

32. Define electron affinity?

Electron affinity:- 1. Electron affinity of an element is defined as energy liberated when an electron is added to its neutral gaseous atom.

2. Its units are ev (or) kJ/mol (or) k.cal/mol.

33. Define electro negativity?

Electro negativity:- The electro negativity of an element is defined as the tendency of atoms to attract electrons towards itself when it is bonded to the atom of another element.

$$\text{Electronegativity} = \frac{\text{ionization energy} + \text{electron affinity}}{2}$$

34. Name the elements which has most and least electronegativity?

The most electronegative element is 'F' and the least electronegative stable element is 'Cs'.

35. Write the names of Alkaline earth metals?

Beryllium (Be), Magnesium (Mg), Calcium (Ca), Strontium (Sr), Barium (Ba) and Radium (Ra).

36. Why Zero group elements are inert towards any chemical reactions?

Because of fully filled outer most orbital's zero group elements are inert towards chemical reactions.

37. Which group elements has electronic configuration of ns^2 or $ns^2 np^6$?

VIII A group elements (Noble gases) have the configuration of ns^2 or $ns^2 np^6$.

38. How does the metallic character changes in periods and groups?

1. The metallic character increases as we move along a group.
2. The metallic character decreases as we move along a period (from left to right).

39. The Element X Belongs to 4th period and 5th group. Write the no of valence electrons, Valence and state whether it is metal or non-metal?

X element belongs to 4th period and 5th group = Arsenic

Valence = 03

Metallic character = metalloids.

2 Mark Questions

1. Given below is the electronic configuration of elements A, B, C, D (AS1)(TQ)

A. $1s^2 2s^2$ B. $1s^2 2s^2 2p^6 3s^2$ C. $1s^2 2s^2 2p^6 3s^2 3p^3$ D. $1s^2 2s^2 2p^6$

1. Which are the elements coming within the same period?

2. Which are the ones coming within the same group?

3. Which are the noble gas elements?

4. To which group and period does the element 'C' belong?

1. A and D elements belong to same period because their valency shell is same (2).
B and C elements belong to same period because their valency shell is same (3).
2. A and B belong to same group because they have same valency shell configuration.
3. D is the noble gas because it has octet configuration ($ns^2 np^6$).
4. C belongs to third period (valency shell is 3) and VA group (number of valency electron is 5).

2. Write down the characteristics of the elements having atomic number 17. (AS1) (TQ)

1. Electronic configuration.
2. Period number.
3. Group number.
4. Element family.
5. No. of valence electrons.
6. Valence.
7. Metal or nonmetal.

1. Electronic configuration = $1s^2 2s^2 2p^6 3s^2 3p^5$
2. Period number = 3
3. Group number = VII A (or) 17th.
4. Element family = Halogen family.
5. No. of valence electrons = 7
6. Valence = $8 - 7 = 1$
7. Metal or nonmetal = Non-metal.

3. a. State the number of valence electrons, the group number and the period number of each element given in the following table? (AS1) (TQ)

Element	Valence electron	Group Number	Period Number
Sulphur			
Oxygen			
Magnesium			
Hydrogen			
Fluorine			
Aluminum			

Element	Valence electron	Group Number	Period Number
Sulphur	6	16 (or) (VIA)	3
Oxygen	6	16 (or) (VIA)	2
Magnesium	2	2 (or) (IIA)	3
Hydrogen	1	I (or) (IA)	1
Fluorine	7	17 (or) (VIIA)	2
Aluminum	3	13 (or) (IIIA)	3

b. state whether the following elements belong to a group (G), period (P) or neither group nor period (N) (AS1)

Elements	G/P/N
Li, C, O	
Mg, Ca, Ba	
BR, Cl, F	
C, S, Br	
Al, Si, Cl	
LI, NA, K	
C, N, O	
K, Ca, Br	

Elements	G/P/N
Li, C, O	period(P)
Mg, Ca, Ba	Group(G)
BR, Cl, F	Group(G)
C, S, Br	Neither group nor period(N)
Al, Si, Cl	period(P)
LI, NA, K	Group(G)
C, N, O	period(P)
K, Ca, Br	period(P)

4. Elements in a group generally possess similar properties, but elements along a period have different properties. How do you explain this statement?(AS1) (TQ)

1. According to modern periodic law, the physical and chemical properties of elements are the periodic function of their atomic number or electronic configuration.
2. That means, the elements having the similar valence electronic configuration have similar properties.
3. In a group the elements have same valence. So they possess similar chemical properties.
4. But, the valence of the elements in the same period is different.
5. So, the properties of different elements in a period is different.

5. s - block and p - block elements except 18th group elements are sometimes called as 'Representative elements' based on their abundant availability in the nature. Is it justified? Why? (AS1) (TQ)

1. s - block and p - block elements except 18th group elements are called 'Representative elements'.
2. All these elements have incompletely filled outer most shells.
3. So they are chemically reactive to obtain stable electronic configuration of noble gases $ns^2 np^6$.
4. Thus, they are abundant in nature in the form of compounds.
5. So, s - block and p - block elements except 18th group elements are sometimes called as 'Representative elements'.

6. The electronic configuration of the elements X, Y and Z are given below? (AS1) (TQ)

a) X = 2 b) Y = 2, 6 c) Z = 2, 8, 2

i) Which element belongs to second period?

ii) Which element belongs to second group?

iii) Which element belongs to 18th group?

i) Y belongs to second period, since, differentiating electron enter into the second shell.

ii) 'Z' belongs to second group. Because, its valence is 2.

iii) 'X' belongs to 18th (or) VIIIA group because its first shell completely filled with electrons.

7. On the basis of atomic number predict to which block the elements with atomic number 9, 37, 46 and 64 belongs to? (AS2) (TQ)

1. The element with atomic number 9, belongs to Group 17(VIIA). So it belongs to P-block.

2. The element with atomic number 37, belongs to Group 1 (IA). So it belongs to S-block.

3. The element with atomic number 46, belongs to Group 19(VIIIB). So it belongs to d-block.

4. The element with atomic number 64, belongs to lanthanoids. So it belongs to f-block.

8. Name two elements you would expect to chemical reactions similar to Mg. What is the basis for your choice? (AS2)(TQ)

1. The elements which have chemical properties similar to Mg are Beryllium(Be), Calcium(Ca), Strontium(Sr), Barium(Ba) and Radium(Ra).

2. Because they belong to same group(IIA).

3. The outer most shell of these elements consists of 2 electrons.

4. We know the physical and chemical properties of the elements are depends on the number of electrons in the outer most shell.

5. All the elements which are in the same group have same electronic configuration and same chemical properties.

6. Hence we expect that Be, Ca, Sr, Ba and Ra have similar properties with Mg.

9. An element X belongs to 3rd period and group 2 of the periodic table. State (AS2) (TQ)

a) The no. of valence electrons.

b) The valency.

c) Whether it is metal or a non-metal.

An element X belongs to 3rd period and group 2 is Mg.

a) The no. of valence electrons = 2

b) The valency of atom = 2

c) It is a metal.

Explanations:- 1. The element belongs to IIA group element and has two valency electrons.

2. It always try to loss two valency electrons to get octet configuration.

3. More over is present in the left side of the periodic table.

4. So, it is a metal.

10. An element has atomic number 19. Where would you expect this element in the periodic table and why? (AS2) (TQ)

1. Atomic number of the element =19

2. Arrangement of these 19 electrons is 2, 8, 8, 1.

3. So, the differentiating electron enters into 4th shell.

4. So, the element belongs to 4th period.

5. The no. of valence electrons = 1.

6. So it belongs to 1st group

7. Hence the element with atomic number 19 belongs to 4th period and IA group.

11. How do you appreciate the role of electronic configuration of the atoms of elements in periodic classification? (AS6) (TQ)

1. According to modern periodic law, the properties of elements are the periodic function of their atomic number or electronic configuration.
2. So, the modern periodic table is classified depending upon the electronic configuration of an atom.
3. The elements having same outer shell electronic configuration are kept in the same group.
4. The elements have same chemical properties.
5. It is easy to predict the chemical properties of the elements which are in the same group.
6. So, I appreciate the role of electronic configuration of the atoms of elements in periodic classification.

12. Complete the following table by using the periodic table. (AS1)(TQ)

Period Number	Filling up orbital's (Sub-shell)	Maximum number of electrons filled in all the sub-shell	Total number of electrons in the period
1			
2			
3			
4	4S, 3d, 4P	18	18
5			
6			
7	7S, 5f, 6d, 7P	32	Incomplete

Period Number	Filling up orbital's (Sub-shell)	Maximum number of electrons filled in all the sub-shell	Total number of electrons in the period
1	1S	2	2
2	2S, 2P	8	8
3	3S, 3P	8	8
4	4S, 3d, 4P	18	18
5	5S, 4d, 5P	18	18
6	6S, 4f, 5d, 6P	32	32
7	7S, 5f, 6d, 7P	32	Incomplete

13. Complete the following table using the periodic table? (AS1)(TQ)

Period number	Total no. of electrons	Elements		Total number of electrons in			
		From	to	S-block	P-Block	d-block	f-Block
1							
2							
3							
4							
5							
6							
7							

Period number	Total no. of electrons	Elements		Total number of electrons in			
		From	to	S-block	P-Block	d-block	f-Block
1	2	H	He	2	-	-	-
2	8	Li	Ne	2	6	-	-
3	8	Na	Ar	2	6	-	-
4	18	K	Kr	2	6	10	-
5	18	Rb	Xe	2	6	10	-
6	32(18+4)	Cs	Rn	2	6	10	14
7	Incomplete	Fr	---	2	Incomplete	7	14

14. Comment on the position of hydrogen in periodic table? (AS7) (TQ)

- The atomic number of the hydrogen is 1. Its electronic configuration is $1s^1$.
- Hydrogen can lose one electron and behave as electropositive ion (H^+) like alkali metals.
- Hydrogen can gain one electron and behave as electronegative element (H^-) like halogens.
- Its properties resemble with both Alkali metals (IA) and halogens (VIIA) because it can lose one electron like alkali metals as well as gain one electron as halogens.
- So, it is placed at the top of both alkali metals and halogens.

15. Identify the element that has the largest atomic radius in each pair of the following and mark it with a symbol (✓). (AS1) (TQ)

(i) Mg or Ca (ii) Li or Cs (iii) N or P (iv) B or Al

i) Mg or Ca:- Ca (✓) has larger atomic radius than Mg.

Reason:- 1. Since Mg and Ca belong to the same group and the atomic number of Ca is more than Mg in that group.

2. As we move top to bottom in a group, atomic radius increases.

ii) Li or Cs:- Cs (✓) has larger atomic radius than Li.

Reason:- 1. Since Li and Cs belong to the same group and the atomic number of Cs is more than Li in that group.

2. As we move top to bottom in a group, atomic radius increases.

iii) N or P:- P (✓) has larger atomic radius than N.

Reason:- 1. Since N and P belong to the same group and the atomic number of P is more than N in that group.

2. As we move top to bottom in a group, atomic radius increases.

iv) B or Al:- Al (✓) has larger atomic radius than B.

Reason:- 1. Since B and Al belong to the same group and the atomic number of Al is more than B in that group.

2. As we move top to bottom in a group, atomic radius increases.

16. In period 2, element X is to the right of element Y. Then, find which of the elements have:

i) Low nuclear charge (AS1) (TQ)

ii) Low atomic size

iii) High ionization energy

iv) High electronegativity

v) More metallic character

- In a period, nuclear charge increases from left to right so, Y has low nuclear charge than X.
- In a period, atomic radius decreases from left to right so, X has low atomic radius than Y.
- In a period, ionization energy increases from left to right so, X has high ionization energy than Y.
- In a period, electronegativity increases from left to right so, X has high electronegativity value than Y.
- In a period, metallic character decreases from left to right so, Y has more metallic character than X.

17. On the basis of atomic numbers predict to which block the elements with atomic number 9, 37, 46 and 64 belongs to? (AS2) (TQ)

1. The elements with atomic number a, belong to group 17 (VIIA). So, it belongs to p-block.
2. The element with atomic number 37, belongs to Group 1(IA). So, it belongs to s-block.
3. The elements with atomic number 46, belongs to Group10 (vIIB). So, it belongs to d-block.
4. The elements with atomic number 64, belongs to Lanthanides. So, it belongs to f-block.

18. Write the limitations of Dobernier law of triads?

- Limitations:-**
1. All the then known elements could not be arranged in the form of triads.
 2. The law failed for very low mass or for very high mass elements.
 3. In case of F, Cl, Br, the atomic mass of Cl is not an arithmetic mean of atomic masses of F and Br.
 4. As the techniques improved for measuring atomic masses accurately, the law was unable to remain strictly valid.

19. What is ionization energy ? What are the factors influence it?

- Ionization Energy:-**
1. The energy required to remove electron from the outer most orbit or shell of a neutral gaseous atom is called ionization energy.
 2. The following factors are influenced on Ionization energy.
 - a) Nuclear Charge
 - b) Screening Effect
 - c) Penetrating power of the orbitals
 - d) Stable configuration
 - e) Atomic Size

20. Write the Newlands law of octaves and drawbacks of this rule?

1. Newlands law of octaves states that when elements are arranged in the ascending order of their atomic masses they fall into a pattern in which their properties repeat at regular intervals.
2. Every eighth element starting from a given elements resembles in its properties to that of the starting element.
3. Certain elements, totally dissimilar in their properties, were fitted into the same group.
4. The law was not valid for elements that had atomic masses higher than Calcium.
5. Newland's periodic table was restricted to only 56 elements.

21. How do the following properties change in Groups and periods?

a) Ionisation Energy b) Electronic affinity c) metallic and non-metallic nature

a) Ionisation Energy :-

Period : When we move from left to right it does follow a regular trend but generally increases due to increase in atomic number.

Group:- In groups from top to bottom, the ionization energy decrease due to increase in atomic size.

b) Electronic affinity:-

Period:- Electron affinity values increases from left to right in a period.

Group:- Electron affinity values decrease from top to bottom in a group.

c) Metallic and Non-metallic nature:-

Period:- Metallic nature decrease from left to right in a period and increase non-metallic nature.

Group:- Metallic nature increase from top to bottom in a group.

4 Mark Questions

1. Newlands proposed the law of octaves. Mendeleeff suggested eight groups for elements in his table. How do you explain these observations in terms of modern periodic classification? (AS1) (TQ)

1. Newlands proposed the law of octaves. His classification is very well suitable for representative (IA to VIIA) elements up to Calcium.
2. According to Newland's law of octaves, every eighth elements starting from a given one be a repetition of the first with regard to its properties.
3. In Newland's table Hydrogen(1st element), Fluorine(8th element) and chlorine (next coming 8th element) shows a common electronegative valence is 1.
4. Similarly Lithium, Sodium and Potassium shows a common electropositive valence 1 and Beryllium, Magnesium and Calcium shows a common electropositive valency 2.
5. Mendeleeff also classified the elements into eight groups based on their common valency with respect to oxygen.
6. In Mendaleeff's periodic table , group number signifies the valence of the element belongs to that group if Oxygen is taken as standard.

Group	I	II	III	IV	V	VI	VII	VIII
Valency with respect to Oxygen	1	2	3	4	5	6	7	8
Formula of Oxide	R ₂ O	RO	R ₂ O ₃	RO ₂	R ₂ O ₅	RO ₃	R ₂ O ₇	RO ₄

7. Thus, both Newland and Mendanleeff's classify the elements similar to modern periodic classification based on their valence.

2. What are the limitations of Mendeleeff's periodic table? How could the modern periodic table overcome the limitations of Mendeleeff's table? (AS1) (TQ)

Limitations of Mendeleeff's periodic table:-

- 1) Position of Hydrogen:-** 1. Hydrogen is placed in group IA.
2. However, it resembles the elements of group IA(alkalimetals) as well as the elements of group VIIA(Halogens).
3. Therefore the position of Hydrogen is not correctly defined in Mendaleeff's periodic table.
- 2) Anomalous pair of elements:-** 1. In certain pairs of elements, the increasing order of atomic masses was not obeyed.
2. In these cases Mendaleeff placed the elements according to similarities in their properties but not in increasing order of their atomic masses.
3. For example Tellurium (atomic weight 127.6) is placed before Iodine(atomic weight 126.9).
- 3) Dissimilar elements placed together:-** 1. Elements with dissimilar properties were placed in same group as sub-group A and sub-group B.
2. For example, elements of IA such as Li, Na and K were grouped with coinage metal like Cu, Ag and Au, though their properties are quite different.
- 4) Some similar elements are separated:-** Some similar elements like 'copper and mercury' 'Silicon and thallium', etc, are placed in different groups of periodic table.
- 5) Position of Isotopes:-** According to Mendeleeff's classification, isotopes should be placed at different places depending upon their atomic masses.
2. For example, isotopes of Hydrogen ${}_1\text{H}^1$, ${}_1\text{H}^2$, ${}_1\text{H}^3$ should be placed in three different places.

Modern periodic table overcome the limitations of the Mendeleeff's table in the following way:-

1. Hydrogen is placed in IA group according to its electronic configuration.
2. The position of anomalous pairs can justify on the basis of increasing atomic number.
(atomic number of Te is 52 and I is 53).
3. Dissimilar elements were placed in different groups in modern periodic table based on their valence shell configuration.
4. Copper and Mercury come in different groups according their electronic configuration.
5. All the isotopes of same element have same atomic number. So all Isotopes are placed in same group as a single element in modern periodic.

3. Define modern periodic law. Discuss the construction of the long of the periodic table? (AS1) (TQ)

Modern periodic law:- The Physical and chemical Properties of the elements are the periodic functions of their atomic number or electronic configuration.

Discription of long form of the periodic table:-

1. In a modern periodic table, the elements are arranged in increasing order of their atomic number.
2. The modern periodic table has eighteen vertical columns known as groups and seven horizontal rows known as periods.

Groups:-

3. There are 18 groups in the long form of the periodic table. They are represented by Roman numeral I to VIII as A and B groups.
- 4 According to the IUPAC, these groups are numbered from 1 to 18.
5. A group of elements is also called as element family or chemical family.

Group	Name of the family
IA	Alkalimetal family
IIA	Alkaline earth metal family
IIIA	Boron family
IVA	Carbon family
VA	Nitrogen family
VIA	Chalcogen family
VIIA	Halogen family
VIIIA	Noble gas family

6. Depending upon the last coming electron enters in the atom of the given element, the elements are classified as 's' 'p', 'd' and 'f' block elements.
7. s and p block elements are known as representative elements.
8. d- block elements are called Transition elements.
9. f-block elements are called Inner Transition elements.

Periods:-

10. The horizontal rows in the periodic table are called periods. They are seven periods in form of periodic table.
11. These periods are represented by Arabic numerals 1 through 7.
12. They are only two elements in first period e.g., hydrogen (H) and helium (He).
13. They are only Eight elements in Second and Third periods.
14. The fourth and 5th period contains 18 elements.
15. The 6th period contains 32 elements.
16. The seventh period is incomplete period.
17. Lanthanoids and actinoids are placed separately at the bottom of the periodic table.

4. Explain how the elements are classified into s, p, d and f block elements in the periodic table and give the advantages of this kind of classification? (AS1) (TQ)

Depending on the valency shell electronic configuration the elements are classified into s, p, d and f block.

s-block elements:- 1. The elements in which the last electron enters the s-orbital of their outer most energy level is called s-block elements.

2. Its valence shell electronic configuration is ns^1 and ns^2 .
3. The elements of group IA and IIA belongs to s-block.
4. Except hydrogen all the s-block elements are metals.

p-block elements:- 1. The elements in which the last electron enters the p-orbital of their outer most energy level is called p-block elements.

2. Its valence shell electronic configuration is $ns^2 np^{1-6}$.
3. The elements of group IIIA and VIIIA belongs to p-block.
4. p-block contains metals, non-metals and metalloids.

s and p block elements are known as representative elements.

d-block elements:- 1. The elements in which the last electron enters the d-orbital of their outer most energy level is called d-block elements.

2. Its valence shell electronic configuration $ns^{1 \text{ or } 2} (n-1)d^{1-10}$ are called d-block elements.
3. The elements of group IB to VIIIB belongs to d-block.
4. All the d-block elements are metals.
5. d-block elements are placed in between the s-block p-block elements.
6. These are known as Transition elements.

f-block elements:- 1. The elements in which the last electron enters the f-orbital of their outer most energy level is called f-block elements.

2. Its valence shell electronic configuration is $(n-2) f^{1-14} (n-1) d^{0-1} ns^2$.
3. These are known as Inner Transition elements.
4. Lanthanoids and actinoids are belongs to f-block elements.

Advantage:- 1. The division of elements into s, p, d, and f blocks is helpful to study the properties of the elements easily.

Ex:- All s-block elements are soft and reactive metals.

2. Every group has the elements with same valence electronic configuration. So they have similar chemical properties.

5. Why was the basis of classification of elements changed from the atomic mass to the atomic number? (AS1) (TQ)

1. Generally elements are classified into various groups based on their chemical properties.
2. We know that the chemical properties of the elements depending upon the number of valency electrons present in the atom.
3. The elements which have same electrons in their valency shell shows similar chemical properties.
4. The property of different elements can be compared if we know their atomic numbers.
5. On the other hand the elements which have same atomic masses (Ar^{40} , Ca^{40} and Co^{59} and Ni^{59}) shows different chemical properties.
6. This means the chemical properties of the elements do not depending on their atomic masses.
7. Moreover, determination of atomic mass is not accurate.
8. Atomic number is considered as fundamental property of an atom than the atomic mass.
9. Because no two elements will not have same atomic number.
10. So, the basis, of the classification of elements changed from atomic mass to the atomic number.

6. Identify the element that has the lower Ionization energy in each pair of the following and mark it with a symbol (✓). (AS1) (TQ)

(i) Mg or Na (ii) Li or O (iii) Br or F (iv) K or Br

i) **Mg (or) Na**:- Na (✓) has low ionization energy than Mg.

Reason:- 1. Since Na and Mg belongs to same period and Na is present left to Mg in that period.
2. As we move left to right across the period ionization energy increases.

ii) **Li (or) O** – Li (✓) has low ionization energy than O.

Reason:- 1. Since Li and O belongs to same period.
2. As we move left to right across the period ionization energy increases.

iii) **Br (or) F**:- Br (✓) has low ionization energy than F.

Reason:- 1. Since Br and F belongs to same group and the atomic number of Br is more than F in that group.
2. As we move top to bottom in a group ionization energy decreases.

iv) **K (or) Br**:- K (✓) has low ionization energy than Br.

Reason:- 1. Since K and Br belongs to same period and K is present left to Br in that period.
2. As we move left to right across the period ionization energy increases.

7. a) What is a periodic property? How do the following properties change in a group and period? Explain?

a) Atomic radius b) Ionization energy c) Electron affinity d) Electro negativity.

(b) Explain the ionization energy order in the following sets of elements:

a) Na, Al, Cl b) Li, Be, B c) C, N, O d) F, Ne, Na e) Be, Mg, Ca.

Periodic property:- The property of an element which is related and repeated according to electronic configuration of the atoms of elements is known as periodic property.

a) **Atomic radius**:- The distance between the centers of the nucleus to the outermost shell of an atom is called atomic radius.

In a groups:- Atomic radius increases from top to bottom in a group.

In a periods:- Atomic radius decreases from left to right in a period.

b) **Ionization energy**:- The energy required to remove an electron from the outer most orbit of a neutral gaseous is called ionization energy.

In a groups:- Ionization energy decreases as we go, down in a group.

In a periods:- Ionization energy generally increases from left to right in period.

c) **Electron affinity**:- The electron affinity of an element is defined as the energy liberated when an electron is added to its neutral gaseous atom.

In a groups:- Electron affinity decreases as we go down in a group.

In a periods:- Electron affinity increases along a period from left to right.

d) **Electro negativity**:- The electro negativity of an element is defined as the relative tendency of its atom to attract electrons towards it when it is bounded to the atoms of another element.

In a groups:- Electro negativity decreases as we go down in a group.

In a periods:- Electro negativity increases along a period from left to right.

- ii) a) **Na, Al, Cl**:- 1. All these elements belong to same period.
 2. The order of their atomic size is $\text{Na} > \text{Al} > \text{Cl}$.
 3. As we move from left to right in a period Ionization energy increases.
 \therefore The order of ionization energy of these elements are $\text{Cl} > \text{Al} > \text{Na}$.
- b) **Li, Be, B** :- 1. All these elements belong to same period.
 2. The electronic configuration of $\text{Li} - 1s^2 2s^2$; $\text{Be} - 1s^2 2s^2$; $\text{B} - 1s^2 2s^2 2p^1$
 3. The penetration power of 2p is less compared to 2s. So, it is easy to remove electron from 2p.
 \therefore The order of ionization energy of these elements are $\text{Be} > \text{Li} > \text{B}$.
- c) **C, N, O** :- 1. All these elements belong to same period.
 2. The electronic configuration of $\text{C} - 1s^2 2s^2 2p^2$; $\text{N} - 1s^2 2s^2 2p^3$; $\text{O} - 1s^2 2s^2 2p^4$
 3. Nitrogen has half filled configuration in degenerated orbital.
 4. So, it is more stable compare to C & O, so, N has high ionization energy.
 \therefore The order of ionization energy of these elements are $\text{N} > \text{C} > \text{O}$.
- d) **F, Ne, Na**:- 1. Ne is an inert gas, so it has highest ionization energy.
 2. Na has larger size compare to F. So, it has low ionization energy.
 \therefore The order of ionization energy of these elements are $\text{Ne} > \text{F} > \text{Na}$.
- e) **Be, Mg, Ca**:- 1. These elements belongs to same group the atomic size of these elements is in the order of $\text{Ca} > \text{Mg} > \text{Ba}$.
 2. As atomic size increases ionization energy decreases.
 \therefore The order of ionization energy of these elements are $\text{Be} > \text{Mg} > \text{Ca}$.

8. Aluminum does not react with water at room temperature but reacts with both dil. HCl and NaOH solutions. Verify these statements experimentally. Write your observations with chemical equations. From these observations, can we conclude that Al is a metalloid? (AS3) (TQ)

1. Metalloids are elements which resemble both metals and non-metals.
2. The valence shell of metalloids contain 3, 4, 5, 6 elements starting from periods 2 to 5 respectively.
3. Al belongs to 3rd period. It contains 3 valence electrons.
4. So, it is not a metalloid as it contains 3 valence electrons instead of 4.
5. Al doesn't react with water at room temperature. But it reacts with water at high temperature.

$$2\text{Al} + 6\text{H}_2\text{O} \rightarrow 2\text{Al}(\text{OH})_3 + 3\text{H}_2$$
6. Al reacts with dil HCl & liberates Hydrogen gas

$$2\text{Al} + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2 \uparrow$$
7. Al reacts with dil NaOH and liberates hydrogen gas

$$2\text{Al} + 2\text{NaOH} + 6\text{H}_2\text{O} \rightarrow [\text{Na}_2\text{Al}(\text{OH})_4] + 3\text{H}_2 \uparrow$$
8. From the above reactions, we conclude that all react with both acids as well as bases. So, it is amphoteric.

9. Collect the information about reactivity of VIIIA group elements (noble gases) from internet or from your school library and prepare a report on their special character when compared to other elements of periodic table. (AS4) (TQ)

1. Helium(He), Neon(Ne), Argon(Ar), Krypton(Kr), Xenon(Xe) and Radon(Rn) are called VIIIA group elements.
2. The VIIIA group elements are chemically inactive.
3. All of them have stable "octet" in their valence shells except helium.
4. The noble gases have high ionization energy and zero electron affinity values.
5. Consequence to this loosing or gaining an electron or sharing of electrons is difficult.
6. But some compounds of these gases have been prepared under suitable conditions.

7. Xenon (Xe) shows a tendency to lose an electron and exist in a positive oxidation state.
8. Therefore it reacts with highly electronegative elements like F_2 & O_2 only .

Ex:- XeO_3 , XeO_4 ; XeF_2 , XeF_4 .

10. Collect information regarding metallic character of elements of IA group and prepare report to support the idea of metallic character increases in a group as we move from top to bottom?(AS4) (TQ)

1. The tendency of an element to lose electron and form positive ions is called metallic character.
2. The elements to the left of the periodic table i.e., IA group have greater tendency to lose electrons so, they are strong metals.
3. Li, Na, K, Rb, Cs (IA) are strong metals as they lose one electron and possess high reactivity.
4. As we go down in a group the atomic size increases and electrons in the outer shell experience less nuclear attractions and so can lose electron easily thus increased metallic character.
5. Ionization energies decrease from Li to Cs and atomic radius increases from Li to Cs in IA group.
6. So, metallic character increases from Li to Cs in IA group.

11. Without knowing the electronic configurations of the atoms of elements Mendeleev still could arrange the elements nearly close to the arrangements in the Modern periodic table. How can you appreciate this? (AS6) (TQ)

1. Mendeleev arranged the elements known at that time in a chart in a systematic order in the increasing order of their atomic weight.
2. Mendeleev tried to explain the similarities of elements in the same group in terms of their common valency.
3. Elements present in a given vertical column (group) have similar properties.
4. Each group is divided into 2 sub- groups A and B. The elements within any sub group resemble each other to a great extent.
5. A period comprises the entire range of elements after which properties repeat themselves.
6. There are 7 periods in the Mendeleev's periodic table.
7. Based on the arrangements of the elements in the table he predicted that some elements were missing and left blank spaces at the appropriate places in the table.
8. His predicted properties were almost the same as the observed properties of those elements after their discovery.
9. In this way, without knowing the electronic configuration of the atoms of elements Mendeleev still could arrange the elements nearly close to the arrangements in the modern periodic table.
10. Hence, I appreciate the effort of Mendeleev.

12. How the positions of elements in the periodic table help you to predict its chemical properties? Explain with an example? (AS7) (TQ)

Position of elements in the periodic table helps us to predict their chemical properties.

1. The elements which are almost left in the periodic table are metals and highly reactive.
Ex: Li, Na, K, Mg & Ca etc, are left in the periodic table these are metals and highly reactive.
2. The elements which are right in the periodic table are non-metals and gases.
Ex: O, F, Cl, S etc, are right in the periodic table. These are non-metals.
3. The elements which are in the 18th group are noble gases and inert for chemical reactions.
Ex: He, Ne, Ar etc, are noble gases which are in 18th group (VIII A). These are inert for chemical reactions.

13. a) Why the elements are classified :

b) What is the property has to taken for classifying the elements by mendeleeff.

c) In mendeleeffs periodic table some gaps are not filled by the elements ? Why?

- They approximately more than 115 elements. We cannot easily understand chemical and physical properties of it. So there is a necessity to classify the elements.
- Mendeleeff's states that the physical and chemical properties of the elements are a periodic function of their atomic weights".
- Based on the arrangement of the elements in the table he predicted that some elements were missing and left blank spaces at the appropriate places in the table. Mendeleff believed that some new elements wouldbe discovered definitely.

14. How do you appreciate the role of electronic configuration of the atoms of elements in periodic classification ?

- Modern periodic table is based on electronic configuration. So elements are arranged in ascending order of their atomic number.
- The chemical properties of elements depends on valence electrons the elements in same group has same number of valence electrons. So the elements belongs to same group have similar properties.
- So the construction of modern periodic table mainly depends on electronic configuration.
- Certain elements of highest atomic mass precede those with lower atomic mass. This type of Anomalous pair of elements are also rectified in Modern periodic table.
- Hence electronic configuration play a major role in the preparation of Modern periodic table. So it is appreciated.

Periodicity

The simple technique to find out the Periodic Properties is as follows.

The simple technique was READ P-hysics.

- Where,
- R \Rightarrow Stands for Reducing Nature.
 - E \Rightarrow Stands for Electro positivity.
 - A \Rightarrow Stands for Atomic size.
 - D \Rightarrow Stands for Decreases. (In)
 - P \Rightarrow Stands for Periods.

It means the three periodic properties like Reducing nature, Electro positivity and size are decreases in periods, increases in groups.

The remaining periodic properties are opposite to the above properties. I.e.

Ionization energy, Electron affinity, Electro negativity and oxidising nature are increases in periods and decreases in groups.

READ P-hysics.

S.No	Atomic property	Periods (left to right)	Groups (top to bottom)
1	Reducing nature	Decreases	Increases
2	Electro positivity	Decreases	Increases
3	Atomic size	Decreases	Increases
4	Ionization energy	Do not follow any regular trend.	Decreases
5	Electron affinity	Increases	Decreases
6	Electro negativity	Increases	Decreases
7	Oxidising nature	Increases	Decreases

NOTE:- Don't confuse E-stands for Electro positivity but not Electro negativity or Electron affinity.

Chapter-10
CHEMICAL BONDING

1 Mark Questions

1. What is meant by a chemical bond?

Chemical bond:- The force of attraction between any two atoms or a group of atoms that results a stable entity is called a 'chemical bond'.

2. What are the affected and unaffected ones during the bond formation?

1. The nucleus and the electrons in the inner shell remain unaffected when atoms come close together.
2. But the electrons in the outermost shell (valence shell) of atoms get affected.

3. What is meant by Lewis symbol or electron dot structure?

1. The valence electrons in the atom of an element is depicted in a short form by Lewis symbol or electron dot structure.
2. We represent the nucleus and inner shell electrons of the atom by the symbol of the element and electrons in the outer shell by dots or cross marks.

4. Who proposed the electronic theory of valence?

Kossel and Lewis in 1916.

5. What is meant by a Kernel?

Kernel:- Kernel is the nucleus and all other electrons in the atom except the outer most shell electrons.

6. Who proposed the electrostatic bond?

Kossel proposed the ionic bond (electrostatic bond).

7. Define the term ionic bond?

Ionic bond:- Transfer of electrons from one atom to another atom leads to ionic bond.

8. Give example for ionic compounds?

Sodium chloride (NaCl), Magnesium chloride ($MgCl_2$), Aluminium chloride ($AlCl_3$).

9. Define Co-ordination Number?

Co-ordination Number:- Number of ions of opposite charges that surrounds a given ion in a crystal is known as co-ordination number.

10. Why ionic bond is also called as electrostatic bond or electrovalent bond?

1. We know ionic bond is formed between two charged particles known as ions.
2. Sometimes based on the forces being electrostatic, the bond is also called the electrostatic bond.
3. As the valence concept has been explained in terms of electrons, it is also called the electrovalent bond.

11. What is meant by a group number or valence?

Group number:- The number of electrons lost from a metal atom is the valence of its element which is equal to its group number.

Ex:- Na and Mg have valence 1 and 2 respectively.

12. What is the structure of NaCl?

NaCl is said to possess face centred cubic lattice crystal structure.

13. What is meant by a cation and anion?

Cation:- A positively charged ion is called a cation.

Ex:- ${}_{11}\text{Na} \rightarrow 2, 8, 1$; ${}_{11}\text{Na}^+ \rightarrow 2, 8$.

Anion:- A negatively charged ion is called an anion.

Ex:- ${}_{17}\text{Cl} \rightarrow 2, 8, 7$; ${}_{18}\text{Cl}^- \rightarrow 2, 8, 18$.

14. What are the factors that affect the cations and anions?

The tendency of losing electrons to form cations (or) gaining electron to form anions depends on the following factors.

1. Atomic size.
2. Ionisation potential.
3. Electron affinity.
4. Electronegativity.

15. Write the conditions that are favourable for the formation of cations?

The atoms of elements with low ionisation energy, low electron affinity, high atomic size and low electronegativity form cations.

16. Write the conditions that are favourable for the formation of anions?

The atoms of elements with high ionisation potential, high electron affinity, small atomic size and high electronegativity form anions.

17. What is meant by a covalent bond? Who proposed this concept?

Covalent bond:- The sharing of electrons between two atoms leads to covalent bond.

18. Give examples for covalent compounds?

Oxygen molecule (O_2), Nitrogen molecule (N_2), Methane molecule (CH_4), Ammonia molecule (NH_3), water molecule (H_2O).

19. What is meant by a double bond? Give one example?

Double bond:- The sharing of two pairs of electrons between two atoms in a covalent bond is called double bond.

Ex:- Formation of O_2 .

20. What is meant by a triple bond? Give one example?

Triple bond:- The sharing of three pairs of electrons between two atoms in a covalent bond is called triple bond.

Ex:- Formation of N_2 .

21. Explain the difference between the valence electrons and the covalence of an element ?

Valence electrons:- The electrons present in the outer most orbit of an atom are called valence electrons.

Covalency:- The total number of covalent bonds that an atom of an element forms is called its covalency.

22. Write the drawbacks of electronic theory of Valency?

Drawbacks of electronic theory of Valency:- 1. It cannot explain the shapes of molecules.

2. It cannot explain the bond angles of molecules.
3. It explains the reactivity of inert gas elements.

23. Who proposed the quantum mechanical model of an atom (valence bond theory)?

Linus Pauling (1954).

24. What is VSEPR (theory) ? Who proposed it ?

1. To explain the bond angles in the molecules through covalent bonds the valence-shell-electron Pair repulsion theory was proposed.
2. This theory was proposed by Sidgwick and Powell (1940) and improved by Gillespie (రిల్స్పీ) and Nyholm (నైహామ్) (1957).

25. What is meant by an end-on-end overlap or Sigma (σ) bond?

- Sigma (σ) bond:-**
1. In the end-on-end type of overlap, the end part of an orbital overlaps with the end part of another orbital.
 2. The resultant bond formed by such an overlap is called Sigma (σ) bond.
 3. Sigma bond can exist independently. So it is a strong bond.

26. What is meant by a side on overlap or pi (π) bond?

- Pi (π) bond:-**
1. In side on overlap an orbital overlaps with another side ways.
 2. the bond formed by such an overlap is called 'pi' bond designated as ' π '.
 3. Pi (π) bond is a weak bond than sigma (σ) bond.

27. Who proposed hybridization?

Hybridisation of atomic orbital's was proposed by Linus Pauling (1931).

28. What is hybridization?

Hybridization:- The process of mixing of atomic orbital's of nearly same energy to produce a set of entirely new orbital's of equivalent energy is known as hybridisation.

29. Give examples of elements which are stable in their atomic state ?

Helium, Neon, Argon, Krypton, Xenon, Radon are stable in their Atomic state.

30. Why the Noble gases are least reactive?

Except Helium other Noble gases have eight electrons in their outer most shell. i.e., why Noble gases are least reactive.

31. What is octet rule?

Octet rule:- The outer most shell having the eight electrons is called octet rule.

32. Why is the chemical formula of water is H₂O why not HO₂ ?

1. The valence of Hydrogen = 1.
2. The valence of oxygen = 2.
3. So two Hydrogen atoms shares their electron with one oxygen atom.
4. Hence the chemical formula of water is H₂O.

33. Name the bond formed between Alkali metals and Halogens?

Ionic bond is formed between Alkali metals and Halogens.

34. What type of bond is formed in 17th group / VII A group elements?

Covalent bond

35. What is coordination number? Write the coordination number of sodium chloride?

1. The number of ions of opposite charge that surround a given ion of given charge is known as co-ordination number.
2. Co-ordination number of solid sodium chloride is 6.

36. Bond length of F₂ is 1.44 Å. What does it mean?

The equilibrium distance between the nuclei of two fluorine atoms is 1.44 Å.

37. The Bond dissociation energy of H – F molecule (Hydrogen fluoride) molecule is 570 KJ mol⁻¹. What does it mean?

570 KJ mol⁻¹ energy is needed to break the covalent bond of hydrogen fluoride molecule.

38. Why the bond angle reduced in water molecule?

1. In water molecule, the central atom oxygen has two lone pair and two bond pair of electrons.
2. Due to lone pair Lone pair electron repulsions bond angle reduced to minimize the repulsion forces.

39. Why do some elements and compounds reach vigorously while other is inert?

Elements which do not have octet configuration in their valence shell react vigorously with other elements and which have octet in their valence shell chemically inert in nature.

40. Define co – ordination number?

Co – ordination number:- The number of oppositely charged ions covered a given ion of given charge is known as co – ordination number.

41. What is the bond angle in a molecule?

It is the angle subtended by two imaginary lines that pass from the nucleus of two atoms which form the covalent bonds with the central atom through the nucleus of the central atom at the central atom.

2 Mark Questions

1. List the factors that determine the type of bond that will be formed between two atoms? (AS1) (TQ)

The factors that determine the type of bond is as follows. They are,

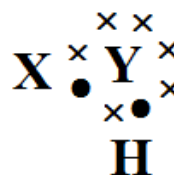
1. The force of attraction or repulsion between the electrons and protons.
2. Number of valence electrons present in the valence shell of the atom
3. Electro negativity.
4. Atomic size
5. Ionization potential
6. Electron affinity.

2. Explain the difference between valence and covalence? (AS1) (TQ)

Valence electrons	Covalence
1. Number of electrons present in the valence shell is known as valence electrons.	1. The capacity of atoms to neither gain, nor lose or share electrons is known as covalence.
2. Number of valence electrons is equal to the group number of the atom.	2. Covalence is equal to the number of electrons participate in the bonding.
3. Valence electrons number is always a positive integer	3. Covalence may be positive or negative.
4. Ex:- The valence of Sodium is 1.	4. Ex:- The covalence of Hydrogen is 1.

3. A chemical compound has the following Lewis notation:

- a) How many valence electrons does element Y have?
- b) What is the valence of element Y?
- c) What is the valence of element X?
- d) How many covalent bonds are there in the molecule?
- e) Suggest a name for the elements X and Y.



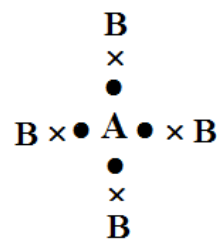
- a) Six (6)
- b) Two (2)
- c) One (1)

- d) Two (2)
 e) Element X = hydrogen (${}_{1}\text{H}^1$)
 Element Y = Oxygen (${}_{8}\text{O}^{16}$)

The formed molecule may be H_2O .

4. A chemical compound has the following Lewis notation:-

- A) Write the valence electrons of A.
 B) Write the valence electrons of B.
 C) How many covalent bonds are there in the molecule?
 D) Suggest a name for the elements A and B.



- A) 4
 B) 1
 C) 4
 D) CH_4

5. Why do only valence electrons involve in bond formation? Why not electron of inner shell?

Explain? (AS1) (TQ)

- The electrons present in the outermost orbital of an atom are known as valence electrons.
- They are very active.
- They are weakly attracted to the nucleus. So that involves a chemical bond formation
- Electrons present in the inner shells cannot participate in bond formation.
- Because the electrons present in the inner shells are strongly attracted by nucleus .
- The electrons present in the inner shells are stable.

6. A,B and C are three elements with atomic number 6, 11 and 17 respectively?(AS1) (TQ)

- i) Which of these cannot form ionic bond? Why?
 ii) Which of these cannot form covalent bond?
 iii) Which of these can form ionic as well as covalent bonds?

Here given elements are,
 A – Carbon (${}_{6}\text{C}^{12}$)
 B – Sodium (${}_{11}\text{Na}^{23}$)
 C – Chlorine (${}_{17}\text{Cl}^{34}$)

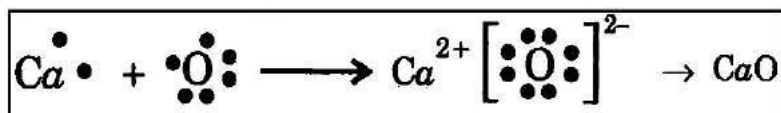
- i) 1. A – Carbon (${}_{6}\text{C}^{12}$) forms covalent bonds and cannot form ionic bond.
 2. Because its valence is 4. So, it is difficult to lose or gain 4 electrons to get octet configuration.
 3. But it forms a covalent bond by sharing of electrons.
- ii) 1. B – Sodium (${}_{11}\text{Na}^{23}$) forms ionic bond and cannot form covalent bonds.
 2. Its valence is 1. So, it is easy to donate that one electron to get noble gas configuration.
 3. So, it can form ionic bond by losing of one electron.
- iii). The atomic number of Chlorine is 17. i.e. ‘C’ can form ionic as well as covalent bond.

7. Predict the reasons for low melting point for covalent compounds when compared with ionic compounds? (AS2) (TQ)

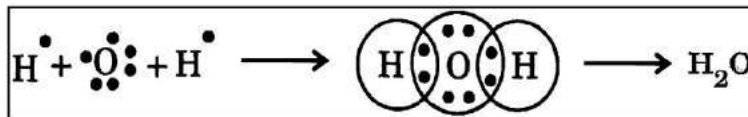
- In ionic compounds the ions are bounded by strong electrostatic force of attractions.
- Therefore they are strong solids with high melting points and boiling points.
- In covalent compounds the atoms are bounded by weak forces.
- Therefore covalent compounds are gases and liquids at room temperature.
- Hence covalent compounds have low melting and boiling points.

8. Draw simple diagrams to show how electrons are arranged in the following covalent molecules:
a. Calcium oxide (CaO) b. Water (H₂O) c. Chlorine (Cl₂) (AS5) (TQ)

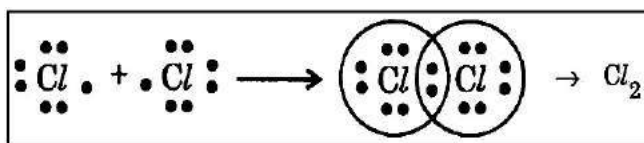
a. Calcium oxide (CaO): Calcium atom has two valence electrons and Oxygen has six valence electrons.



b. Water (H₂O):- Each Hydrogen atom has one valence electron and Oxygen has six valence electrons.

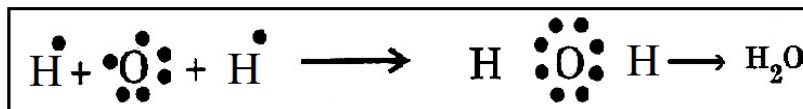


c. Chlorine (Cl₂): Each Chlorine atom has seven electrons in their valence shell.



9. Represent the molecule H₂O using Lewis notation? (AS5) (TQ)

1. One atom has six valence electrons.
2. So it can achieve the electronic configuration of Neon by sharing two electrons, one with each Hydrogen atom.



10. Represent each of the following atoms using Lewis notation: a. Beryllium b. Calcium c. Lithium (AS5) (TQ)

a. Beryllium: Beryllium has two valence electrons. $\text{Be} \cdot \cdot$

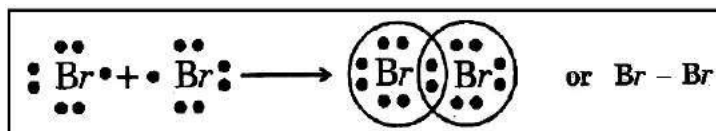
b. Calcium: Calcium has two valence electrons. $\text{Ca} \cdot \cdot$

c. Lithium: Lithium has one valence electrons. $\text{Li} \cdot$

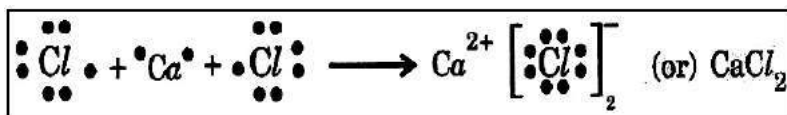
11. Represent each of the following molecules using Lewis notation: (AS5) (TQ)

- (a) Bromine gas (Br₂)
- (b) Calcium chloride (CaCl₂)
- (c) Carbon dioxide (CO₂)
- (d) Which of the three molecules listed above contains a double bond?

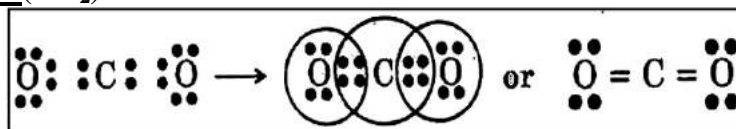
(a) Bromine gas (Br₂):-



(b) Calcium chloride(CaCl₂):-



(c) Carbon dioxide(CO₂):-



(d) Which of the three molecules listed above contains a double bond?

Carbon dioxide (CO₂) contains double bond.

12. Two chemical reactions are described below.

(AS5) (TQ)

i) Nitrogen and hydrogen react to form ammonia (NH₃)

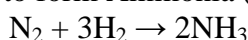
ii) Carbon and hydrogen bond to form a molecule of methane (CH₄).

For each reaction, give:

a) The valence of each of the atoms involved in the reaction.

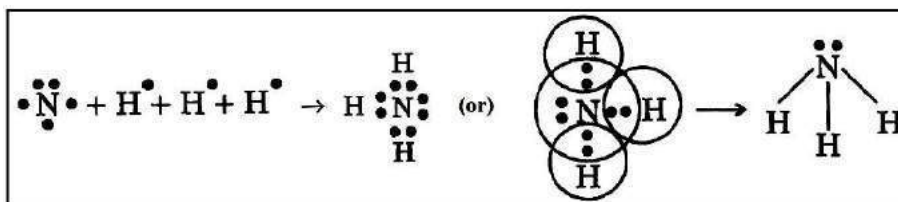
b) The Lewis structure of the product that is formed.

i) Nitrogen combines with hydrogen to form Ammonia (NH₃).

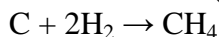


a) Valence of Nitrogen is 3 and hydrogen is 1.

b) The Lewis structure of NH₃ is,

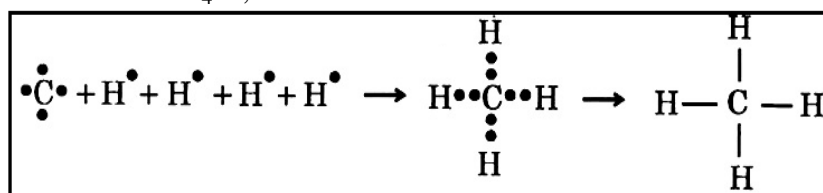


ii) Carbon combines with hydrogen to form methane (CH₄).



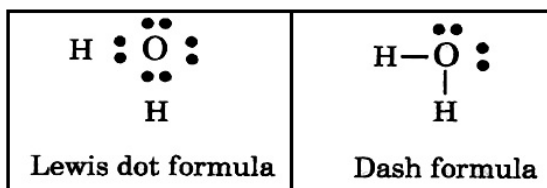
a) Valence of carbon is 4 and hydrogen is 1.

b) The Lewis structure of CH₄ is,



13. How Lewis dot structure helps in understanding bond formation between atoms? (AS6) (TQ)

1. Lewis dot structure of molecule or ion shows how atoms are bonded with each other.
2. Bonding electrons are indicated either by two dots or by a dash.
3. For example, a water molecule can be represented by either of the following two diagrams.
4. Lewis dot formulae show only the number of valence electrons, the number and kind of bonds.



14. What is octet rule? How do you appreciate role of the octet rule in explaining the chemical Properties of elements? (AS6) (TQ)

Octet rule:- The tendency of atoms to achieve eight electrons in their outermost shell is known as octet rule.

1. The atoms of all elements try to attain either 2 or 8 electrons in their outermost energy level which is of maximum stability and hence of minimum energy.
2. If the compounds or elements satisfies octet rule that they became most stable.
3. Hence, they have high melting and boiling points.
4. So I appreciate the role of octet rule in explaining the chemical properties of elements.
5. But some compounds like BF_3 , PCl_5 violates octet rule.

15. Write the difference between ionic and covalent compounds?

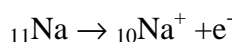
Ionic compound	Covalent compound
1. They are formed by the transfer of electrons between two atoms.	1. These are formed by the mutual sharing of electrons between the atoms.
2. These are having high melting and boiling points.	2. These are having low melting and boiling points.
3. These are soluble in polar solvents like water.	3. These are soluble in non-polar solvents like benzene and CCl_4 .
4. These are highly reactive in polar solvents.	4. These are less reactive in polar solvents.
5. These posses ionic reactions and reactions are instantaneous.	5. These possess molecular and are slow at room temperature.

4 Mark Questions

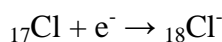
1. Explain the formation of sodium chloride and calcium oxide on the basis of the concept of electron transfer from one atom to another atom? (AS1) (TQ)

Formation of sodium chloride (NaCl):- Sodium chloride is formed from the elements sodium (Na) and chlorine (Cl).

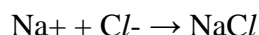
Cation formation:- 1. The atomic number of sodium is 11. Its electronic configuration is 2, 8, 1.
2. Sodium loss one electron, it forms a cation (Na^+) and gets Neon (Ne) electronic configuration.



Anion formation:- 1. The atomic number of Chlorine is 17. Its electronic configuration is 2, 8, 7.
2. Chlorine receives one electron, it forms an anion (Cl^-) and gets Argon(Ar) electronic configuration.



These two oppositely charged ions Na^+ and Cl^- gets attracted each other due to electrostatic forces and forms the compound Sodium chloride (NaCl).

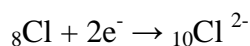


Formation of Calcium Oxide (CaO):- Calcium Oxide(CaO) is formed from the elements Calcium (Ca) and Oxygen (O).

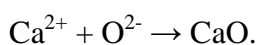
Cation formation:- 1. The atomic number of Calcium is 20. Its electronic configuration is 2,8,10.
2. Calcium losses two electrons, it forms a cation(Ca^{2+}) and gets Argon(Ar) electronic configuration.



- Anion formation:-** 1. The atomic number of Oxygen is 8. Its electronic configuration is 2, 6.
2. Oxygen receives two electrons, it forms an anion (O^{2-}) and gets a Neon (Ne) electronic configuration.



These two oppositely charged ions Ca^{2+} and Cl^{2-} get attracted to each other due to electrostatic forces and form the compound calcium Oxide (CaO).



2. How bond energies and bond lengths of molecule help us in predicting their chemical properties? Explain with examples? (AS1) (TQ)

- Bond length:-** It is defined as the distance between the 2 nuclei of the atoms which are involved in bonding.
- Bond Energy:-** It is defined as the energy required to break the bond between 2 atoms of a di-atomic covalent compound in its gaseous state.
- Generally, bond energies and bond lengths of molecule help us in predicting their chemical properties.
- If a molecule is having low bond energy and high bond length values, it is a very active one.
- They are having polar nature. They actively participate in chemical reactions.
- For example:-** In Iodine molecule, as the bond length between the atoms is high due to its large sized atoms.
- So, amount of energy required for bond breakage is low. So, it is highly reactive in reactions.
i.e Bond energy $\propto \frac{1}{\text{Bond length}}$.
- So, higher the bond energy, more stable and less reactive in case of chemical reactions.
- Similarly, Melting and Boiling points of a substance can also be determined by this bond energies and bond lengths.

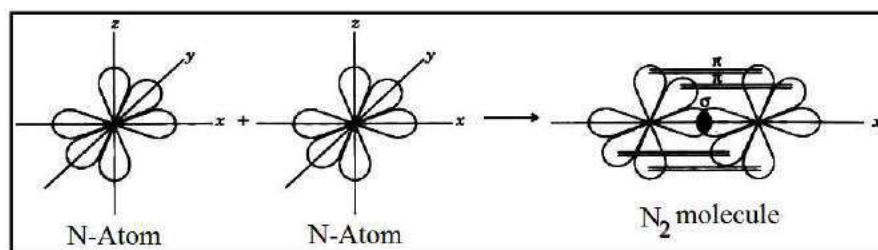
3. Explain the formation of the following molecules using valence bond theory. (AS1) (TQ)
a) N_2 molecule b) O_2 molecule.

a) **Formation of N_2 molecule:-** 1. The atomic number of Nitrogen is 7.

2. Its electronic configuration is $1s^2 2s^2 2p_x^1 2p_y^1 2p_z^1$ (or)

↑↓	↑↓	↑	↑	↑
$1s^2$	$2s^2$	$2p_x^1$	$2p_y^1$	$2p_z^1$

- Suppose that $2p_x$ orbital of one 'N' atom overlaps the ' $2p_x$ ' orbital of the other 'N' atom giving $\sigma_{p_x} - p_x$ bond, along the inter-nuclear axis.
- Similarly $2p_y$ and $2p_z$ orbitals of one 'N' atom, overlap with $2p_y$ and $2p_z$ orbital of other 'N' atom laterally, respectively perpendicular to inter nuclear axis given $\pi_{p_y} - p_y$ and $\pi_{p_z} - p_z$ bonds.
- So, N_2 molecule has a triple bond between two Nitrogen atoms.

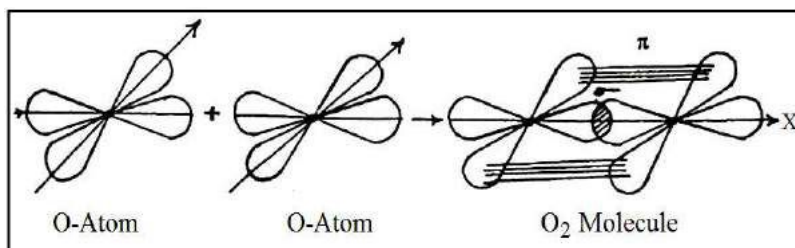


b) **Formation of O_2 molecule:-** 1. The atomic number of oxygen is 8.

2. Its electronic configuration is $1s^2 2s^2 2p_x^2 2p_y^1 2p_z^1$ (or)

↑↓	↑↓	↑↓	↑	↑
$1s^2$	$2s^2$	$2p_x^2$	$2p_y^1$	$2p_z^1$

- If the $2p_y$ orbital of one Oxygen atom overlaps with $2p_y$ orbital of another Oxygen atom and forms a $\sigma_{p_y-p_y}$ bond is formed.
- Similarly $2p_z$ orbital of 'O' atom overlaps with $2p_z$ orbital of other 'O' atom laterally, perpendicular to the inter nuclear axis giving a $\pi_{p_z-p_z}$ bond.
- O_2 molecule has a double bond between two Oxygen atoms.



4. What is hybridization? Explain the formation of the following molecules using hybridization.

a) $BeCl_2$

b) BF_3

(AS1 (TQ))

Hybridization:- The process of mixing of atomic orbital's of nearly same energy to produce a set of entirely new orbital's of equivalent energy is known as hybridisation.

a) **Formation of $BeCl_2$** :- 1. The atomic number of Beryllium = 4.

2. Its electronic configuration is $1s^2 2s^2$. Since there are no unpaired electrons in the valence shell.

3. In excited state $2s$ -orbital is first unpaired and an electron is shifted to $2p$ -orbital.

4. Ground state electronic configuration of 'Be' is,

$\uparrow\downarrow$	$\uparrow\downarrow$	\square	\square	\square
$1s^2$	$2s^2$	$2p_x^0$	$2p_y^0$	$2p_z^0$

5. Excited state electronic configuration of 'Be' is,

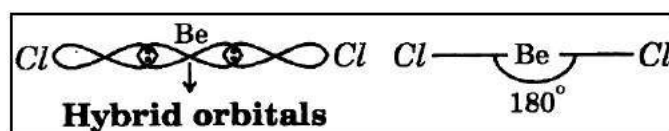
$\uparrow\downarrow$	\uparrow	\uparrow	\square	\square
$1s^2$	$2s^1$	$2p_x^1$	$2p_y^0$	$2p_z^0$

6. Now there is hybridization between one 's' and p-orbital.

7. Two orbital's of same shape and energy come into existence.

8. The overlap with p-orbital each of two chlorine atoms forming two sigma (σ) bonds.

9. The molecule formed is linear with a bond angle 180° .



b) **Formation of Boron Trichloride (BCl_3)**:- 1. The atomic number of Boron is 5.

2. Its electronic configuration is $1s^2 2s^2 2p^1$.

3. In ground state, it has one unpaired orbital which can form only covalent bond.

4. To get trivalency, the $2s$ -orbital is unpaired and the electron is shifted to $2p$ -orbital.

5. Now in excited state the three unpaired orbitals undergo hybridisation giving rise to three hybrid orbitals which are 120° apart.

6. Ground state electronic configuration of 'B' is,

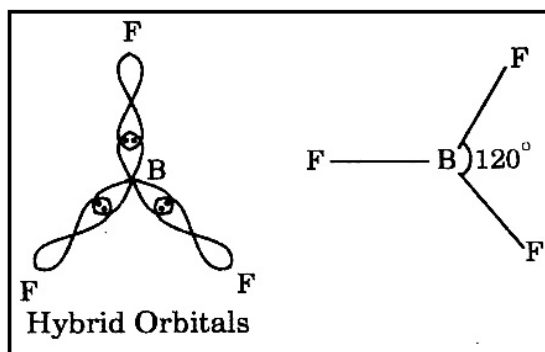
$\uparrow\downarrow$	$\uparrow\downarrow$	\uparrow	\square	\square
$1s^2$	$2s^2$	$2p_x^1$	$2p_y^0$	$2p_z^0$

7. Excited state electronic configuration of 'B' is,

$\uparrow\downarrow$	\uparrow	\uparrow	\uparrow	\square
$1s^2$	$2s^1$	$2p_x^1$	$2p_y^1$	$2p_z^0$

8. The three hybrid orbitals overlap with three p-orbitals from three Fluorine atoms forming three sigma bonds.

9. The molecule formed is triangular planar.



5. Collect the information about properties and uses of covalent compounds and prepare a report?
(AS4) (TQ)

Properties of covalent compounds:-

1. Covalent compounds exist as gases (or) liquids of low boiling (or) melting points.
2. In general, covalent substances are bad conductors of electricity.
3. These are freely soluble in non polar solvents like benzene, carbon tetrachloride, but soluble in polar solvents like water.
4. These are bad conductors of electricity.
5. They undergo molecular reactions.
6. Rate of reactions are low.

Uses of covalent compounds:-

1. 99% of our body, was made up of covalent compounds
2. Water is a covalent compound. We know its many uses.
3. Methane gas is used for cooking purpose.
4. Some covalent compounds are used for polyesters.
5. Covalent compound like Naphthalene balls are used for household purpose.
6. They are used for laboratory purpose and medicinal purpose.

6. Write the properties of Ionic and Covalent compounds?

- Ionic Compounds:-**
1. Ionic compounds are solids in state.
 2. They have high MP and BP's due to strong electrostatic of attractions.
 3. They soluble in polar solvents.
 4. Their chemical reactivity is mole because of no bond making and bond breaking.

- Covalent compounds:-**
1. They are liquid and gases at room temperature
 2. They have low MP and BP's due to weak force of attraction.
 3. They soluble in both polar as well as non polar solvents.
 4. They are less or moderate reactive because of bond making and bond breaking involved in chemical reactions.

7. Write the postulates of valence shell electrons pair repulsion (VSEPR) theory?

VSEPR was proposed by Sidgwick and Powell (1940). It was further improved by Gillespie and Nyholm (1957).

- Postulates:-**
1. Every central atom in a molecule may possess two types of electron pairs bond pair and lone pair of electrons.
 2. Lone pair of electrons may or may not present in a molecules.
 3. There are repulsive forces among these pair of electrons. This follows,
Lone pair – Lone pair > Lone pair – bond pair > bond pair – bond pair
 4. The presence of lone pairs of electrons on central atom causes slight distortion of bond angles.
 5. Hence the molecules deviate from their original shape, to reduce the repulsive forces.
 6. A multiple bond is treated as if it is a single electron pair and the two or three electron pairs of a multiple bond are treated as a single super pair.

Note :- The shapes of the molecules are depends on bonding electrons and lone pair of electrons. Observe the following table for an idea to know about the shape of the molecules.

S.No	No. of bond pairs	No. of loan pairs	Bond angle	Shape of the molecule	Example
1	2	---	180^0	Linear	BeCl_2
2	3	---	120^0	Trigonal-planar.	BF_3
3	4	---	109^028^1	Tetrahedron	CH_4
4	3	1	107^048^1	Triagonal pyramidal	NH_3
5	2	2	104^031^1	V-Shape	H_2O

Chapter-11
ELECTRIC CURRENT

1 Mark Questions

1. Give one live example which provides evidence for the motion of charge in the atmosphere?

Lightning.

2. Define conductors?

Conductors:- The material which allow the current passes through them is called conductors.

Ex:- All metals.

3. Define Insulators or non-conductors?

Insulators:- The material which do not allow the current passes through them is called insulators.

Ex:- Plastic, rubber, wood etc.

4. Define Semiconductors?

Semiconductors:- The material which allow the current partially passes through them is called semiconductors.

Ex:- Silicon and Germanium.

5. What is Electric current? Write their units?

Electric current:- 1. Electric current is defined as the amount of charge crossing any cross section of the conductor in one second.

$$\text{Electric current(I)} = \frac{\text{electric charge(Q)}}{\text{time interval(t)}}$$

2. The SI unit of electric current is ampere denoted by A.

6. Define Ampere?

Ampere:- 1. If one coulomb of charge crosses any cross section of the conductor in one second, then the electric current flows through that conductor is "1 Ampere".

2. It is denoted with the letter A.

3. 1 Ampere = $\frac{1 \text{ Coloumb}}{1 \text{ Second}}$ i.e 1 A = 1 C/s

7. Write the value of magnitude of electric charge?

The magnitude of electric charge 'e' is $1.602 \times 10^{-19} \text{C}$.

8. What is the value of drift speed or drift velocity of the electrons in a conductors?

$v_d = 7 \times 10^{-5} \text{ m/s} = 0.07 \text{ mm/s}$.

9. How can we measure electric current?

1. Generally an ammeter is used to measure electric current.

2. It is always connected in series to the circuit.

10. What is electric potential difference or voltage?

Potential difference:- The work done to move a unit positive charge from one point to another it is called as potential difference or voltage.

2. It is denoted with the letter 'V'.

$$\text{voltage (v)} = \frac{\text{Workdone(W)}}{\text{charge(Q)}}$$

3. Its SI unit is Volt'.

11. Define the word emf?

emf:- emf is defined as the work done by the chemical force to move unit positive charge from negative terminal to positive terminal of the battery.

12. Define volt?

Volt:- If 1 Joule work is done to move 1 coulomb of positive charge from one point to another, then the electric potential difference between those two points is 1 'volt'.

$$1 \text{ volt} = \frac{1 \text{ Joule}}{1 \text{ Coulomb}}$$

13. How can we measure potential difference or emf?

1. Generally a volt meter is used to measure potential difference or emf across an electric device.
2. It is always connected in parallel to the electric circuit.

14. Why does a bulb glow immediately when we switch on ?

When we switch on any electric circuit, irrespective of length of the connecting wire an electric field is set up throughout the conductor instantaneously due to the potential difference of the source connected to the circuit.

15. State the ohm's Law ?

Ohm's Law:- The potential difference between the ends of a conductor is directly proportional to the electric current passing through it at constant temperature.

$$\text{i.e } V \propto I$$

$$\Rightarrow V = IR$$

Where R is called resistance of the conductor.

16. What is resistance ?

Resistance:- 1. The resistance of a conductor is defined as the obstruction to the motion of the electrons in a conductor.

2. The SI unit of resistance is ohm(Ω).

17. Define Ohm?

Ohm(Ω):- If 1 Ampere of electric current passes between two points of potential differences 1 volt, then the resistance between them said to be 1 ohm.

$$1 \text{ Ohm} = \frac{1 \text{ Volt}}{1 \text{ Ampere}} \quad (\text{or}) \quad 1 \Omega = \frac{1V}{1A}$$

18. What is resistor ?

Resistor:- The material which offers resistance to the motion of electrons is called resistor.

19. What are ohmic and non-ohmic conductors?

Ohmic conductors:- The material which obey the ohm's law is called ohmic conductors.

Ex:- All metals.

Non-ohmic conductors:- The material which do not obey the ohm's law is called non-ohmic conductors.

Ex:- LED.

20. What happens to our body if we touch live wire of 240V?

1. The current passing through our body when we touch a live wire of 240V is given by,
 $I = \frac{240}{100000} = 0.0024A$.
2. When this quantity of current flows through the body the functioning of organs inside the body gets disturbed.
3. This disturbance inside the body is felt as electric shock.

21. What is meant by a electric shock?

Electric shock:- The potential difference exists between one part of the body and another part is called an electric shock.

(or) The electric shock is a combined effect of potential difference, electric current and resistance of the human body.

22. What is multi meter?

Multi meter:- A multi meter is an electronic measuring instrument that combines several measurement functions like electric current, electric voltage, electric resistance in one unit.

23. Name the instrument used to measure both electric current and potential difference ?

Multimeter.

24. Why doesn't a bird get a shock when it stands on a high voltage wire?

1. When the bird stands on a high voltage wire, there is no potential difference between the legs of the bird because it stands on a single wire.
2. So no current passes through the bird.
3. Hence, it doesn't feel any electric shock.

25. What are the factors that affecting the resistance of a material ?

The factors affecting the resistance of a material are,

1. Temperature.
2. Nature of a material.
3. Length of a conductor.
4. Area of a crosssection.

26. Define resistivity (or) specific resistance of a material? What is its S.I unit?

- Resistivity**:-
1. It is the resistance per unit length of a unit cross section of the material.
 2. It is denoted with the letter 'ρ'.
 3. The S.I unit of resistivity is ohm meter (Ω-m).

27. Define conductivity and write their units?

- Conductivity**:-
1. The reciprocal of resistivity is called conductivity (σ).
 2. Its units are mho-m.

28. What is meant by a electric circuit?

Electric circuit:- A closed path created by the connecting wires through a battery along which electrons can flow is called a circuit.

29. When kirchhoff's rules are applicable in Electric current ?

The kirchhoff's rules are applicable to any DC circuit containing batteries and resistors connected in any way.

30. Name the two kirchhoff's laws ?

1. Junction Law
2. Loop Law

31. What is meant by a Kirchoff's junction law?

The junction law:- At any junction point in a circuit where the current can divide, the sum of the currents into the junction must equal the sum of the currents leaving the junction.

32. What is meant by a Kirchoff's loop law?

The loop law:- The algebraic sum of the increases and decreases in potential difference across various components of a closed circuit loop must be zero.

33. What is electric power ? Write the S.I unit of electric power ?

Electric power:- 1. Electric power is the product of potential difference and the current.

$$P = \epsilon I$$

2. The S.I unit of electric power is watt.

34. Which type of charge flows through an electric wire when it is connected in an electric circuit ?

Negative.

35. What is electrical energy? Write the S.I unit of electrical energy?

Electrical energy:- 1. Electrical energy is the product of power and time.

$$\text{Electrical energy} = \text{Power} \times \text{time.}$$

2. Units of electrical energy is W-s and KWH.

36. How should we connect the fuse in house wiring circuit ? In series parallel ? Why?

The fuse wire in house wiring circuit is connected in series. When the current exceeds the safely limit, the fuse wire melts and breaks the circuit. The electric installations are thus saved from getting damaged.

37. Why do we use fuses in house hold circuits?

To prevent damages due to over loading and high power supply, we connect an electric fuse to the house hold circuits.

38. What is a value of 1KWh in joules (AS1) (TQ)

$$\begin{aligned} 1\text{KWh} &= 1000 \text{ w} \times 1 \text{ hour} \\ &= 1000 \times 3600 \text{ sec} \text{ (1W= 1Joule/ sec)} \\ &= 36 \times 10^5 \text{ Joules} \\ &= 3.6 \times 10^6 \text{ Joules.} \end{aligned}$$

39. Silver is a better conductor of electricity than copper. Why do we use copper wire for conduction for electricity? (AS1) (TQ)

1. Silver is a better conductor of electricity than copper.
2. But silver is a costly metal than copper.
3. Hence copper is widely used for conduction for electricity.

40. Why do we consider tungsten as suitable material for making the filament of a bulb? (AS2) (TQ)

Tungsten is a suitable material for making filament of the bulb because,

1. It has high resistance($5.56 \times 10^{-8} \Omega\text{-m}$).
2. High melting point(3422°C).
3. High temperature coefficient of resistance.
4. It emits bright light.

41. Are the headlights of a car connected in series or parallel? Why? (AS2) (TQ)

Head lights of the car are connected in parallel because one of the lights in the parallel combination fuses are fails other head light keeps working.

2 Mark Questions

1. Write the difference between potential difference and emf? (AS1) (TQ)

Potential difference	emf
1. The work done by the electric force on one unit positive charge to move it through a distance 'l' from one point to another is called potential difference.	1. The work done by the chemical force to move unit positive charge from negative terminal to positive terminal of the battery is called emf.
2. Potential difference is calculated for any two points in the circuit.	2. EMF is calculated for the battery.
3. Potential difference, $v = \frac{W}{q} = \frac{F_e}{q}$	3. emf, $\epsilon = \frac{W}{q} = \frac{F_c}{q}$.
4. The SI unit of potential difference is 'Volt'.	4. The SI unit of emf is 'Volt'.
5. Potential difference is measured by using the voltmeter.	5. emf is measured by using the voltmeter.

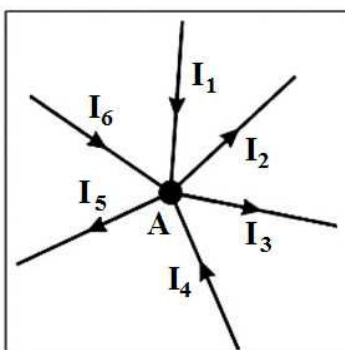
2. What are the factors on which the resistance of conductor depends? Give the corresponding relation? (OR) Derive $R = \rho \frac{l}{A}$. (AS1) (TQ)

- The resistance of a conductor is directly proportional to the length of the conductor.
i.e., $R \propto l$ (1)
- The resistance of a conductor is inversely proportional to the area of a cross section of the conductor.
i.e., $R \propto \frac{1}{A}$ (2)
- From (1) and (2), we get $R \propto \frac{l}{A} \Rightarrow R = \rho \frac{l}{A}$.
Where 'ρ' is a constant called specific resistance or resistivity.
- The S.I unit of resistivity is Ω - m.

3. Explain Kirchhoff's laws with examples? (AS1) (TQ)

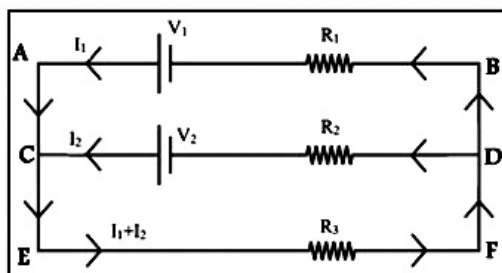
Kirchhoff's laws: - Kirchhoff, in 1842, gave two general laws which are extremely useful in analyzing electric circuits. They are 1. The Junction law 2. The Loop law.

1. The Junction Law: - At any junction point in a circuit where the current can divide, the sum of the currents into the junction must equal the sum of the currents leaving the junction.



Example:- 1. In the figure A is called junction.
2. From the figure, we have Therefore, $I_1 + I_4 + I_6 = I_2 + I_3 + I_5$.

2. The Loop Law: - The algebraic sum of increments and decrements in potential differences across various components of a closed circuit loop must be zero.



- Example:-** 1. Let us apply Kirchoff's second law to the above figure, for the loop ACDBA,

$$-V_2 + I_2R_2 - I_1R_1 + V_1 = 0.$$
 2. For the loop EFDCE, $-(I_1+I_2) R_3 - I_2R_2 + V_2 = 0.$
 3. For the loop EFBAE, $-(I_1+I_2) R_3 - I_1R_1 + V_1 = 0.$

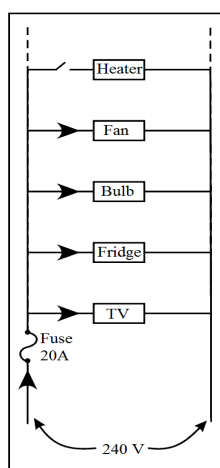
4. Explain over loading of household circuits? (AS1) (TQ)

Over loading:- 1. Generally we observe the values noted on the digital meters fixed at home as follows.

Potential difference = 240V.

Electric current = 5A – 20A.

2. This means the line wires that are entering the meter have a potential difference of 240 V.
3. The minimum and maximum limit of current that can be drawn from the mains is 5A to 20A.
4. If the current drawn from the mains is more than 20A then over heating may occur and causes fire.
5. This is called over loading of household circuit.



5. Why do we use fuses in household circuits? (AS1) (TQ)

1. The fuses are consists of a thin wire of low melting point.
2. The minimum and maximum limit of current that can be drawn from the mains is 5A to 20A.
3. When the current in the fuse exceeds 20A, the wire will heat up and melt.
4. If fuse melts the circuit is open and no current passing through the home appliances.
5. Hence all the electric devices are saved from damage that could be caused by overloading.
6. So, a fuse is a safety device that does not allow any unduly high electric current to flow through an electric circuit.

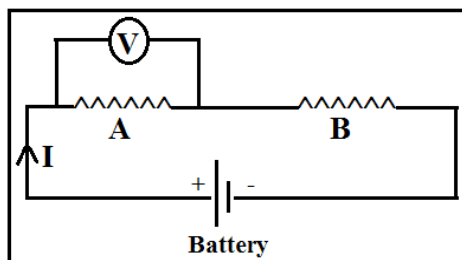
6. Why don't we use series arrangement of electrical appliances like bulb, television, fan and others in domestic circuits? (AS1) (TQ)

1. If the electrical appliance are connected in series combination then same amount of current passes through them.
2. All the appliances start working all the time.
3. We cannot operate them individually.
4. If one of appliances is damaged, all the appliances are stopped working.
5. Hence we don't connect series arrangement of electrical appliances like bulb, television, fan etc.
6. So, the appliances are connected in parallel which gives same potential difference.

7. a) Take a battery and measure the potential difference make a circuit and measure the potential difference when the battery is connected in a circuit. Is there any difference in potential difference in battery? (AS4) (TQ)
- b) Measure the resistance of a bulb (filament) in open circuit with a millimeter. Make a circuit with elements such as bulb, battery of 12v and key in series. Close the key. Then again measure the resistance of same bulb for every 30 seconds. Record the observations in a proper table. What can you conclude from above results?

- a). We do not find any change in potential difference of the battery.
 b). The resistance of the bulb increases due to increase in temperature of the bulb.

8. Draw a circuit diagram for a circuit in which two resistors A and B are connected to measure the potential difference across the resistor A? (AS5) (TQ)

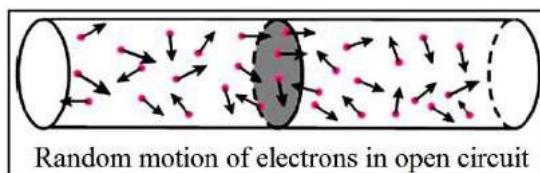


A, B – Resistors.
 V – Voltmeter.

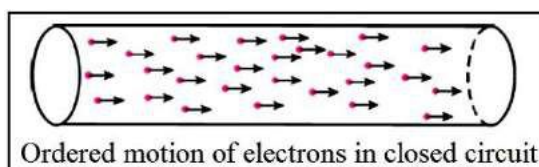
4 Mark Questions

1. Explain how electron flow causes electric current with Lorentz – Drude theory of electrons? (AS1) (TQ)

1. Drude and Lorentz, scientists of 19th century, proposed that conductors like metals contain large number of free electrons as while the positive ions are fixed in their locations.
2. The arrangement of the positive ions are called lattice.
3. When the conductor is in an open circuit. The electrons move randomly in lattice space as shown in the figure.



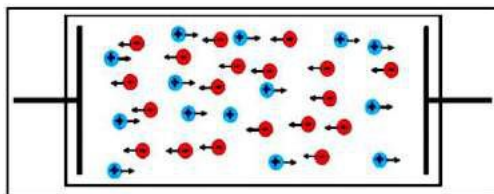
4. If we imagine any cross section, the number of electrons, crossing the cross section from left to right in one second is equal to that of electrons passing the cross section from right to left in one second.
5. Hence the net charge moving along a conductor through any cross section is zero.
6. When the ends of the conductor are connected to the battery through a bulb, the bulb glows because energy flow takes place from battery to the bulb.
7. This is because the orderly motion of electrons.
8. When the electrons are in ordered motion, there will be a net charge crossing through any cross section of the conductor as shown in the figure.



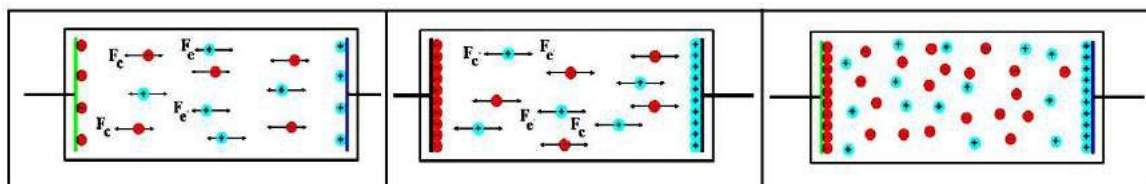
9. This ordered motion of electrons is called electric current.

2. How does a battery work? Explain ? (AS1) (TQ)

1. A battery consists of two metal plates (electrodes) and a chemical (electrolyte).
2. The electrolyte consists of positive and negative ions which move in opposite directions.
3. This electrolyte exerts a force called chemical force (F_c) to make ions move in a specified direction.
4. Positive ions move towards one plate and accumulate on that, as a result this plate becomes positively charged (Anode).
5. Negative ions move to another plate and accumulate on that. As a result this plate becomes negatively charged.
6. This accumulation continues till both plates are sufficiently charged.



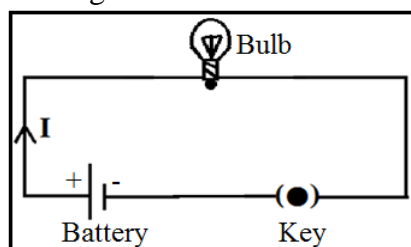
7. But the ions experience another force called electric force (F_e), when sufficiently number of charges accumulated on the plates.
8. The direction of F_e is opposite to F_c and magnitude depends on the amount of charges accumulated on plates.
9. The accumulation of charges on plates is continuous till F_e becomes equal to F_c . Now there will not be any motion due to balance of F_e and F_c .
10. The new battery that we buy from the shop is under the influence of balanced forces. This is the reason for constant potential difference between the terminals of battery.
11. When a conducting wire is connected to terminals of the battery, a potential difference is created between the ends of the conductor which sets up an electric field throughout the conductor.



12. The large number of electrons in the conductor near the positive terminal of battery is attracted by it and start to move towards positive terminal.
13. As a result the amount of positive charge on this plate decreases.
14. So F_e becomes weaker than F_c and F_c pulls negative ions from anode towards cathode.
15. The negative terminal pushes one electron into the conductor because of stronger repulsion between negative terminal and negative ion.
16. Hence, total number of electrons in a conductor remains constant during current flow.

3. How can you verify that resistance of conductor is temperature dependent? (AS1) (TQ)

1. Measure the resistance of the bulb when it is in open circuit, using a multimeter.
2. Note the reading in your book.
3. Connect the circuit as shown in figure.



4. Switch on the circuit after a few minutes switch off the circuit and measure the resistance of bulb using multimeter.

- Note this reading in your note book.
- The value of resistance in second instance is more than the resistance bulb in open circuit.
- When bulb is connected in a circuit and current is passed through it, the bulb gets heated. This is responsible for increase in the resistance of bulb.
- Hence the value of resistance of conductor depends on temperature for constant potential difference between the ends of conductor.

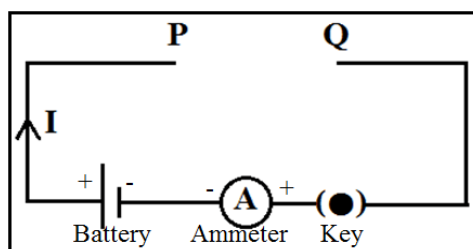
4. What do you mean by electric shock? Explain how it takes place? (AS1) (TQ)

- If we touch a line wire of 240V, 0.0024A current flows through our body.
- Due to this functioning of organs inside our body get disturbed.
- This disturbance inside our body is felt as electric shock.
- If the current reaches 0.07 A, it effects the functioning of the heart and if this much current passes through the heart for more than one second it could be fatal.
- This can be experienced if there is a potential difference between one part of the body and another part.
- The electric shock is a combined effect of potential difference, electric current and resistance of the human body.

5. How do you verify that resistance of a conductor is proportional to the length of the conductor for constant cross section area and temperature? (AS1) (TQ)

Aim:- To verify the resistance of a conductor is proportional to the length of the conductor.

Appratus:- A cell, an ammeter, iron spokes of different lengths but same area.



- Procedure:-**
1. Make the circuit or shown in the figure.
 2. Then connect one of the iron spokes between P and Q.
 3. Measure the value of current using the ammeter connected to circuit and note it in your note book.
 4. Repeat this experiment for other lengths of iron spokes.
 5. Note the corresponding values of currents in your note book as shown below.

S.No	Length of spoke	Current
1		
2		
3		
4		

6. We observe that current decreases as the length of spoke increases.
7. We know that resistance increases as current decreases.
8. Hence we resistance of iron spoke increases as its length increases.
9. Hence we conclude that the resistance of conductor is directly proportional to length.

$$\text{i.e } R \propto l$$

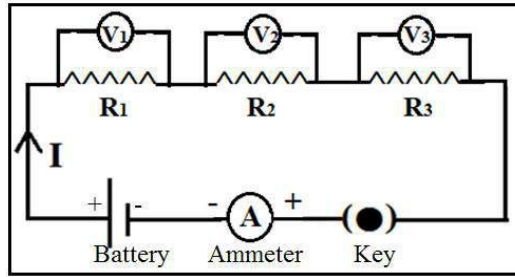
6. Deduce the expression for equivalent resistance of three resistors connected in series? (AS1) (TQ)

When an end of one resistor is connected to the beginning of the next resistor and so forth, the resistors are said to be connected in series.

1. In series combination, the total potential difference across the series combination of resistor is equal to sum of voltage across the individual resistors.

$$\text{i.e } V = V_1 + V_2 + V_3 \text{ -----(1)}$$

2. Connect the circuit as shown in figure.



- The cell connected across the series combination of three resistors maintains a potential difference (V) across the combination.
- Let us replace the combination of resistors of three resistors by a single resistor R_{eq} , such that current doesn't change.

R_{eq} is given by,

$$R_{eq} = \frac{V}{I} \Rightarrow V = I R_{eq} \text{-----}(2)$$

- The potential differences V_1, V_2, V_3 across the resistors R_1, R_2, R_3 respectively are given by,
 $V_1 = IR_1; V_2 = IR_2; V_3 = IR_3$ (Since from Ohm's law)

- Since resistors connected in series combination. So,

$$\begin{aligned} V &= V_1 + V_2 + V_3 \\ &= IR_1 + IR_2 + IR_3 \\ &= I(R_1 + R_2 + R_3) \end{aligned}$$

$$I R_{eq} = I(R_1 + R_2 + R_3) \quad (\text{Since } V = I R_{eq})$$

$$R_{eq} = R_1 + R_2 + R_3$$

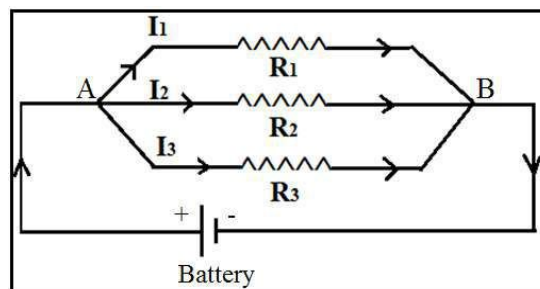
The equivalent resistance of the combination is equal to sum of the individual resistances.

7. Deduce the expression for equivalent resistance for three resistors connected in parallel? (AS1) (TQ)

When two or more resistors are connected between two common points whose end will be at higher potential and other at lower potential in a circuit, the resistors are said to be in parallel.

For parallel combination, we know that

- The total current (I) flowing into the combination is equal to the sum of currents passing through the individual resistors.
- The potential difference is same in all resistors connect the circuit as shown.



- The cell connected across three resistors maintains the same potential difference across each resistor.
- The current (I) divided into I_1, I_2, I_3 which flows through resistors R_1, R_2, R_3 Respectively.
- Let replace the all resistors with equivalent resistance R_{eq} .

$$\text{Equivalent resistance, } R_{eq} = \frac{V}{I} \Rightarrow I = \frac{V}{R_{eq}} \text{-----}(1)$$

- Similarly, $I_1 = \frac{V}{R_1}, I_2 = \frac{V}{R_2}$ and $I_3 = \frac{V}{R_3}$.

- Since Resistance in parallel combination. So, $I = I_1 + I_2 + I_3$

$$\frac{V}{R_{eq}} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

$$\Rightarrow \frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$(or) R = \frac{R_1 R_2 R_3}{R_1 R_2 + R_2 R_3 + R_3 R_1}$$

When resistors are connected in parallel, the reciprocal of their equivalent resistance is equal to the sum of the reciprocals of the individual resistances.

8. Why should we connect electric appliances in parallel in household circuit? What happens if they are connected in series? (AS2) (TQ)

- Advantages of parallel circuit:-**
1. In one of the components is switched off, others work properly.
 2. Each appliance gets same voltage.
 3. Total resistance of the circuit decreases on increasing number of output devices.
 4. So the circuit draws more current from the mains supply.

- Disadvantages of series circuit:-**
1. More the components in the circuit, the greater will be its resistance.
 2. All the appliances start working all the time. We cannot operate them individually.
 3. If one of the appliances is damaged, all the appliances stop working.
 4. The electrical appliances need current of widely different values to operate properly. But in series, the same current flows through each device.

9. State Ohm's law? Suggest an experiment to verify it and explain the procedure? (AS3) (TQ)

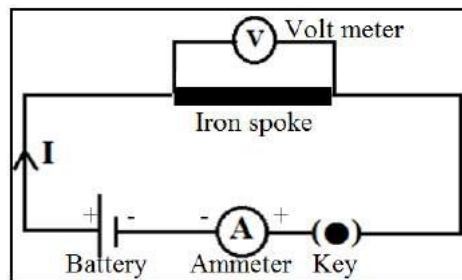
Ohm's law:- At constant temperature, the potential difference between the ends of a conductor is directly proportional to the electric current passing through it.

Verification:-

Aim:- To verify Ohm's law. To show that the ratio $\frac{V}{I}$ is a constant for a conductor.

Apparatus:- Five dry cells, of 1.5V each, conducting wires, an ammeter, thin iron spoke, a voltmeter, LED and key.

Procedure:- 1. Connect a circuit as shown in figure.



2. Solder the connecting wires to the ends of the iron spoke. Close the key.
3. Note the readings of current from the ammeter and voltmeter reading in the following table.

S.No	Potential difference (V)	Current (I)	$\frac{V}{I} = \text{Constant}$
1			
2			
3			
4			

4. Now connect two cells instead of one cell in the circuit. Note the values of the ammeter and voltmeter and record them in the above table.
5. Repeat the same for three cells, four cells and five cells respectively.
6. Record the values of V and I respectively to each case in the table.
7. Find $\frac{V}{I}$ for each set of values.

9. We notice that $\frac{V}{I}$ is constant.

$$\text{i.e } V \propto I \Rightarrow \frac{V}{I} = \text{Constant.}$$

10. This constant value is known as resistance. So $\frac{V}{I} = R \Rightarrow V = IR$.

Hence Ohm's law is verified.

10. How can you appreciate the role of a small fuse in house wiring circuit in preventing damage to various electrical appliances connected in a circuit? (AS7) (TQ)

1. A fuse wire is a thin wire made up of a high resistance material and has low melting point.
2. The fuse wire should be connected in series with electrical device.
3. So, the entire current from mains must pass through the fuse.
4. When the current in the fuse overloaded, the wire get heated and melted.
5. Now the circuit becomes open and prevents the flow of current.
6. Hence, all the electrical appliances are saved from damage that could be caused by overload.
7. So, I appreciate the role of small fuse in house wiring circuit in preventing damage to various electrical appliances.

Problems

1. Two bulbs have ratings 100W, 220V and 60W, 220V. Which one has the greatest resistance? (AS1)

1. We know that, $P = \frac{v^2}{R} \Rightarrow R = \frac{v^2}{P}$

2. For the first bulb, $P = \frac{v^2}{R} = \frac{(220)^2}{100} = \frac{48400}{100} = 484\Omega$

3. For the second bulb, $P = \frac{v^2}{R} = \frac{(220)^2}{60} = \frac{48400}{60} = 806.6\Omega$

4. The second bulb having the 60W, 220W has the greater resistance.

2. A wire of length 1m and radius 0.1mm has a resistance of 100Ω. Find resistivity of the material? (AS1) (TQ)

Given:- $l = 1\text{m}, r = 0.1 \text{ mm} = 10^{-4} \text{ m}, R = 100\Omega$

Resistivity, $\rho = ?$

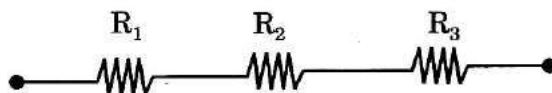
Area of cross section of the wire, $A = \pi r^2 = 3.14 \times (10^{-4})^2 = 3.14 \times 10^{-8} \text{ m}^2$.

Restivity, $\rho = \frac{RA}{l} = \frac{100 \times 3.14 \times 10^{-8}}{1} = 3.14 \times 10^{-6} \text{ Ohm-meter.}$

3. Suppose that you have three resistors each of value 30Ω. How many resistors can you obtain by various combinations of these three resistors? Draw diagrams in support of your predictions. (AS2)

Given:- $R_1 = R_2 = R_3 = 30 \Omega$.

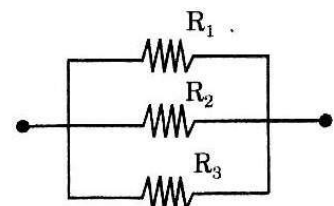
1. If the resistors are connected in series, effective resistance is 90Ω.



$$R = R_1 + R_2 + R_3 = 30 + 30 + 30 = 90\Omega.$$

2. If the resistors are connected in parallel, effective resistance is 10 Ω.

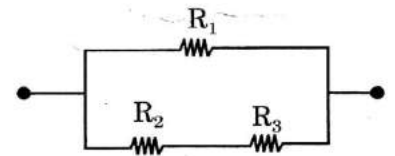
$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{30} + \frac{1}{30} + \frac{1}{30} = \frac{1+1+1}{30} = \frac{3}{30} = \frac{1}{10} \Rightarrow \frac{1}{R} = \frac{1}{10} \Rightarrow R = 10 \Omega.$$



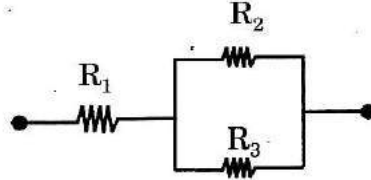
3. If two resistors are in series and other one is in parallel then effective resistance is 20 Ω.

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2 + R_3} = \frac{1}{30} + \frac{1}{30+30} = \frac{1}{30} + \frac{1}{60} = \frac{3+1}{60} = \frac{4}{60} = \frac{1}{15}$$

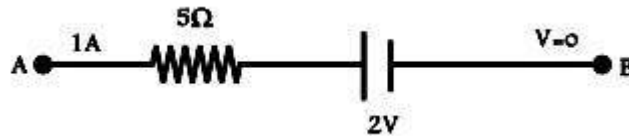
$$\frac{1}{R} = \frac{1}{20} \Rightarrow R = 20 \Omega.$$



4. If two resistors are in parallel and other one is in series then effective resistance is 60Ω.



4. In the figure below the potential at A is _____ when the potential at B is zero. (AS7) (TQ)



Applying Kirchhoff's law,

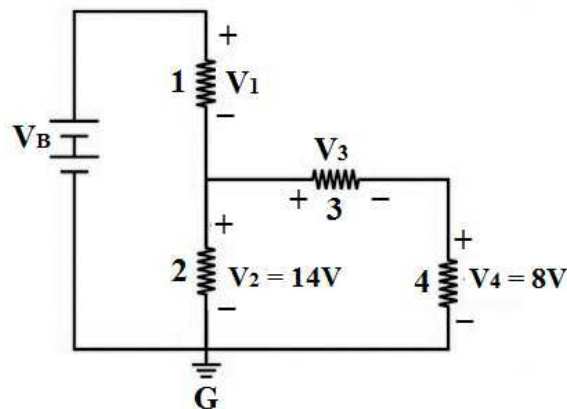
$$V_A - (1 \times 5) - 2 = V_B$$

$$\Rightarrow V_A - 5 - 2 = 0$$

$$\Rightarrow V_A - 7 = 0$$

$$\Rightarrow V_A = 7V.$$

5. Observe the circuit and answer the questions given below. (AS7) (TQ)



Q1. Are resistors 3 and 4 in series?

Yes, resistors 3 and 4 are in series because end to end connection is possible.

Q2. Are resistors 1 and 2 in series?

No, 1 and 2 are not in series because different values of current flow.

Q3. Is the battery in series with any resistors?

Yes it is in series for V_1 and V_2 .

Q4. What is the potential drop across the resistor?

The potential drop across the resistor '3' is $V_3 = 6V$.

Because 3 and 4 are in series. So the potential drop is, $V_4 + V_3 = 8 + V_3$.

Combination of 3 and 4 is parallel to 2. So $V_2 = V_3 + V_4$

$$\Rightarrow 14 = V_3 + 8 \Rightarrow V_3 = 14 - 8 \Rightarrow V_3 = 6V.$$

Q5. What is the total emf in the circuit if the potential drop across the resistor 1 is 6V?

The total emf in the circuit, $\varepsilon = V_1 + V_2 = 6 + 14 = 20V$.

5. If the resistance of your body is 100000Ω what would be the current that flow in your body when you touch the terminals of a 12V battery? (AS7) (TQ)

Given: - $V = 12V$
 $R = 1,00,000\Omega$
 $i = ?$

From Ohm's law, $i = \frac{V}{R} = \frac{12}{1,00,000} = 0.00012$ Ampere.

\therefore Current flows in body = 0.00012A.

6. A uniform wire of resistance 100Ω is melted and recasts into wire of length double that of the original. What would be resistance of the new wire formed? (AS7) (TQ)

Given: - $R_1 = 100\Omega$ $l_1 = 'l'$ (Say)
 $R_2 = ?$ $l_2 = 2l$

Formula:- $\frac{R_1}{R_2} = \frac{l_1^2}{l_2^2} \Rightarrow \frac{100}{R_2} = \frac{l^2}{(2l)^2} \Rightarrow \frac{100}{R_2} = \frac{1}{4} \Rightarrow R_2 = 400\Omega$

7. A house has 3 tube lights, two fans and a Television. Each tube light draws 40W. The fan draws 80W and the Television draw 60W. On the average, if all the tube lights are kept on for five hours, two fans for 12 hours and the television for five hours every day. Find the cost of electric energy used in 30 days at the rate of Rs. 3.00 per KWH? (AS7) (TQ)

Energy consumed by 3 tube lights in a day $E_1 = p \times t = 3 \times 40W \times 5h = 600$ Wh.

Energy consumed by 2 fans in a day $E_2 = p \times t = 2 \times 80W \times 12h = 1920$ Wh.

Energy consumed by television in a day $E_3 = p \times t = 60W \times 5h = 300$ Wh.

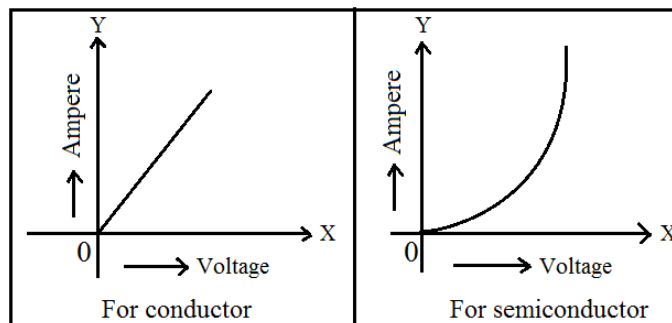
Total energy consumed in a day = $600 + 1920 + 300 = 2820$ Wh.

Total energy per month = 2820 Wh $\times 30 = 84600$ Wh = 84.6 KWh.

Cost of 1 unit charge = Rs. 3.00/-

\therefore Cost of 84.6 Watts = $84.6 \times 3 =$ Rs. 253.8/-

8. Draw a graph between V and I where V is the potential difference between the ends of the wire and 'I' is the current through it? What is the shape of the graph? (AS5)



Chapter-12
Electromagnetism

1 Mark Questions

1. What is meant by an electromagnetism?

Electromagnetism:- The branch of science which deals with the electromagnetic phenomena i.e. magnetism produced by an electric current.

2. What is meant by a magnetic flux? Write their units?

Magnetic flux (Φ):- 1. The number of magnetic lines passing through the plane of area 'A' perpendicular to the field is called magnetic flux.

2. It is denoted by ' Φ '.

3. Its units are 'Weber'.

3. Define Magnetic Flux density or magnetic field induction?

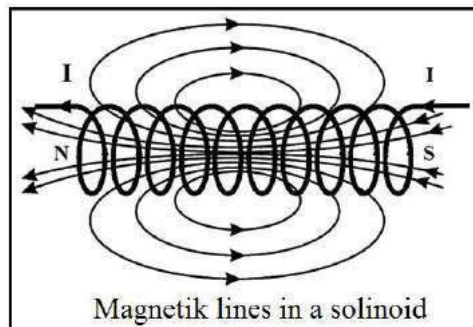
Magnetic flux density (B):- Magnetic flux density is defined as the ratio of flux passing through a plane perpendicular to field and the area of the plane.

$$\text{Magnetic flux, } B = \frac{\text{Magnetic flux } (\phi)}{\text{Area } (A)}$$

2. Its units are Weber/ m².

4. What is meant by a solenoid?

Solenoid:- A solenoid is a long wire wound in a close packed helix.

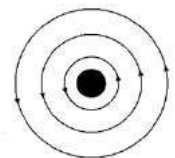


5. See figure, magnetic lines are shown. In what direction does the current through wire flow?

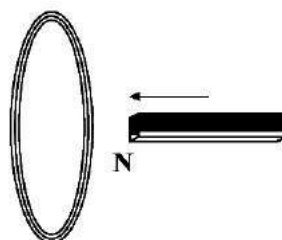
(AS1) (TQ)

1. In the diagram the magnetic lines are in anti-clock wise direction.

2. According Ampere right hand rule the direction of current is vertically upwards.

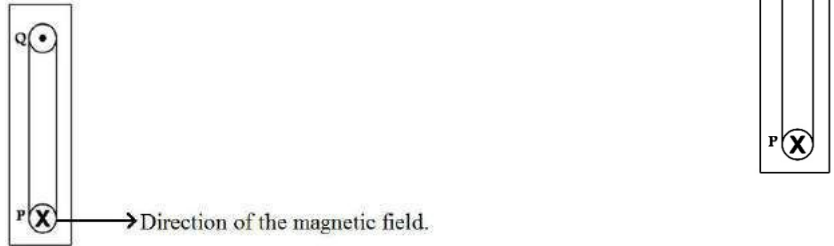


6. A bar magnet with North Pole facing towards coil moves as shown in fig.-3. What happens to magnetic flux passing through the coil? (AS1) (TQ)



When the north pole of a bar magnet is moved towards the coil, magnetic flux of the coil increases. This gives induced current in the coil.

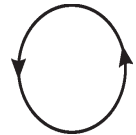
7. A coil is kept perpendicular to page. At P, current flows into the page and at Q it comes out of the page as shown in figure Q-4. What is the direction of magnetic field due to coil? (AS1)(TQ)



According to right hand rule, the direction of the magnetic field due to coil at its center is from right to left.

8. The direction of current flowing in a coil is shown in figure. What type of magnetic pole is formed at the face that has flow of current as shown in figure? (AS1) (TQ)

1. North Pole is forms at the face that has flow of current as shown in the figure.
2. Here the current is in anti clockwise direction.



9. State the Faraday's Law?

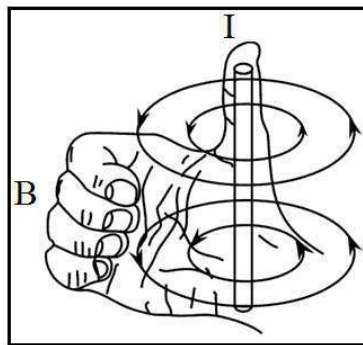
Faraday's Law:- The induced EMF generated in a closed loop is equal to the rate of change of magnetic flux passing through it.

10. State the Lenz's Law?

Lenz's Law:- The induced current set up in the coil is in such a direction that it opposes the changes in the flux.

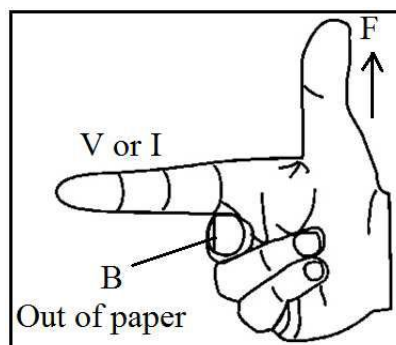
11. What is right hand thumb rule?

Right hand thumb rule:- If you hold the current carrying wire with your right hand in such a way that the thumb is in the direction of current and then the curled fingers show the direction of magnetic field produced around the wire.



12. State Fleming's right hand rule?

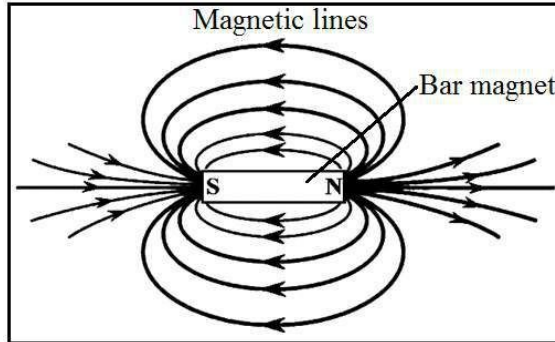
Fleming's right hand rule:- Stretch the forefinger, middle finger and thumb mutually perpendicular to each other, the fore finger gives the direction of velocity of charge or current (I), middle finger points to the direction of field (B) then the thumb gives the direction force.



1 Mark Questions

1. Are the magnetic lines closed? Explain? (AS1) (TQ)

1. Yes, magnetic lines are always forms closed loops and any two field lines can never intersect each other.
2. Inside the magnet the direction of magnetic lines of force is from South Pole to its north pole.
3. Outside the magnet each line comes out from North Pole and goes into the South Pole.
4. Thus, the magnetic lines of force are closed loops.



2. Why do the picture appear distorted when a bar magnet is brought close to the screen of a television? Explain (AS1) (TQ)

1. Television has a picture tube which produces a motion of electrons on the screen.
2. These electrons are affected by magnetic field of a bar magnet.
3. Because the magnetic field exerts a force on the electrons reaching the screen.
4. So the picture destroyed when a bar magnet is brought close to the screen of a television.

3. Symbol 'X' indicates the direction of a magnetic field into the page. A straight long wire carrying current along its length is kept perpendicular to the magnetic field. What is the magnitude of force experienced by the wire by the magnetic field? In what direction does it act? (AS1) (TQ)

1. The force experienced by the wire due to magnetic field, $F=BIL$.

Where B = Magnetic field induction.

I = Electric current through wire.

L = Length of the wire.

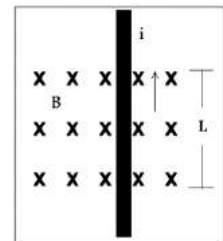
2. Applying the Fleming left hand rule,

B = Into the plane.

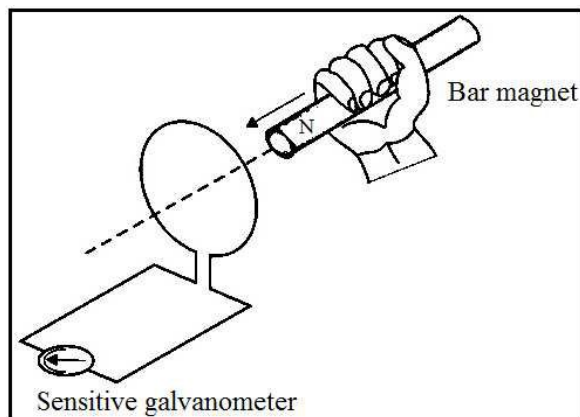
I = Along the wire from Q to P .

L = Towards left.

3. So, the direction of force is towards left side.



4. Explain Faraday's law of induction with the help of activity? (AS1) (TQ)



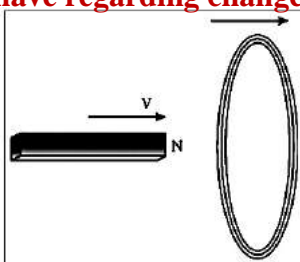
1. Connect the two terminals of a coil to sensitive galvanometer as shown in the figure.

2. Push a bar magnet towards the coil whose north pole is facing towards the coil.
3. While the magnet is moving towards the coil, the needle in galvanometer deflects, showing that a current has been set up in the coil,
4. If the magnet is moved away from the coil, the needle in the galvanometer again deflects but in the opposite direction.
5. Which means that a current is set up in the coil in the opposite direction.
6. Whenever there is a continuous change of magnetic flux linked with closed coil, the current is generated in the coil.
7. This is one of the form of Faraday's law.

5. Rajkumar said to you that the magnetic field lines are open and they start at North Pole of bar magnet and end at South Pole. What questions do you ask Rajkumar to correct him by saying "field lines are closed"? (AS2) (TQ)

1. Are these magnetic field lines are closed or open loops?
2. How do the magnetic field lines behave inside the magnet?
3. What is field lines indicate?
4. What is the direction of the magnetic field lines inside the magnet?
5. Are the direction of field lines is from its South Pole or North Pole?
6. Why the magnetic compass needle following a curved path from one pole to another?
7. Can you say now, the magnetic field lines are open or closed?

6. As shown in figure both coil and bar magnet moves in the same direction. Your friend is arguing that there is no change influx. Do you agree with his statement? If not what doubts you have? Frame questions about doubts you have regarding change in flu? (AS2) (TQ)



1. Yes, I will agree.
2. The induced EMF will not produce when the coil and magnet are moving in the same direction with same velocity.
3. Hence my friend's argument is correct.

- I have the following doubts:-**
1. What happened if both magnet and coil move in same direction?
 2. What happens if both magnet and coil move in opposite direction?
 3. Does the coil changes its orientation?
 4. What is the direction of current in the coil?
 5. Is the coil moving with same velocity of that of the magnet?
 6. If both move in same direction, is there any linkage of flux with the coil?
 7. When North pole is moved towards the coil what is the direction of current?
 8. If the magnet is reversed, what is the direction of current in the coil?

7. Collect information about generation of current by using faraday's law? (AS4) (TQ)

1. Faraday's law is change in magnetic flux induces EMF in the coil.
2. Electric current can be generated by moving a coil through a magnetic field.
3. This is applicable to both alternate current (AC) and direct current (DC).
4. Transformer also works on principle of electromagnetic induction, which used to transmit the current.
5. If the wire is made into a loop in the magnetic field, we can get the continuous current.
6. The more loops of wire passing through the magnetic field, then higher the voltage that is created.

8. How do you appreciate the Faraday's law, which is the consequence of conservation of energy? (AS6) (TQ)

1. Law of conservation of energy says energy neither be created nor be destroyed but can be converted from one form to another.
2. Faraday's Law says whenever there is a continuous change of magnetic flu linked with a closed coil, a current is generated in the coil.
3. This induced emf is equal to the rate of change of magnetic flux passing through it.
4. We have to do some work to move the magnet through a cell. This work produced energy.
5. This energy is converted into electrical energy in the coil.
6. So conservation of energy takes place in electromagnetic induction.
7. So, I appreciate the Faraday's law, which is the consequence of conservation of energy.

9. Give a few applications of faraday's law of induction in daily life? (AS7) (TQ)

Applications of faraday's law:-

1. During the security check, people made to walk through a large upright coil which produces a weak Ac magnetic field.
2. If we are carrying any significant quantities of iron, the magnetic flux changes and the induced current generated in the coil triggers an alarm.
3. The tape recorder which we use to listen to songs (or) record voices works on the principle of electromagnetic induction.
4. The principle of electromagnetic induction in the case of using ATM card when it's magnetic strip is swiped through a scanner.
5. An induction stove works on the principle of electromagnetic induction.
6. Transformers, electrical generators work on the principle of electromagnetic induction.

10. What are the differences between electric motor and a generator?

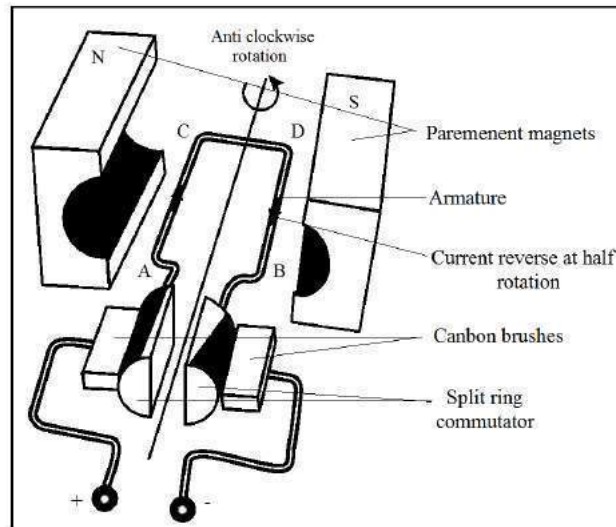
Electric motor	Generator
1. Motor converts electrical energy into mechanical energy.	1. Generator converts mechanical energy into electrical energy.
2. It works on the principle of Fleming's left hand rule.	2. It works on the principle of Fleming's right hand rule.

4 Mark Questions

1. Explain the working of electric motor with a neat diagram? (AS1) (TQ)

Electric motor:- It is a device which converts the electrical energy into mechanical energy.

Principle:- When a current carrying conductor placed in a magnetic field experiences a force, the direction of force is given by Fleming's left hand rule.

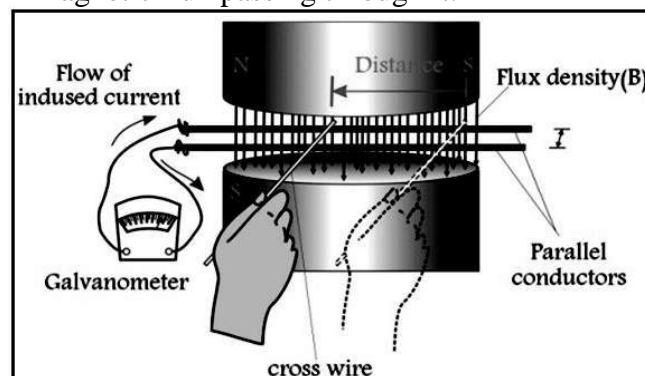


Working of electric motor:- 1. An electric motor consists of a rectangular coil ABCD is called armature.

2. The armature is kept in between the permanent magnets as shown in the figure.
3. When electric current is passed through the rectangular coil, this current produces a magnetic field around the coil.
4. The magnetic field of horse shoe type magnet then interacts with the magnetic field of the coil and causes the coil to rotate continuously.
5. If ABCD is in horizontal position current from battery enters the coil through brush B_1 , and commutator half ring C_1 .
6. The current flows in the direction ABCD and leaves ring and brush B_2 .
7. The direction of current is from A to B, the direction of current is from C to D.
8. Whereas the force on the side C of the coil is in the upward direction. ABCD rotates in anti-clockwise direction.
9. While rotating, the coil reaches vertical position then the brushes B_1 and B_2 will touch the gap between the commutator rings and current to the coil is cut off.
10. The coil CD comes on the left side and AB comes to the right side. Again they come in contact with brush B_1 , current direction is reversed.
11. The reversing of current in the coil is repeated after every half rotation.
12. So the coil continue to rotate as long as current from the battery is passed through it.

2. Derive Faraday's law of induction from conservation of energy. (AS1) (TQ)

Faraday's law:- The induced emf generated in the closed loop is equal to the rate of change of magnetic flux passing through it.



1. Let us arrange the apparatus as shown in the figure.
2. It consists of a pair of parallel bare conductors which are spaced one meter apart in uniform magnetic field 'B'.
3. We can hold another bare conductor in such a way that it is in contact with the two parallel conductors to complete an electric circuit.
4. Suppose that the cross wire is moved to the right to a distance of 'S' in a time of 'Δt'.
5. The work done by the applied force, $W = F \times S$.
 $W = BIL \times S$ (Since force on the conductor, $F = BIL$)
 $W = (BLS) \times I$ -----(1)
6. As we move the cross wire to the left, the area of the circuit decreases and the flux through the loop also decreases.

The decrease in flux, $\Delta\phi = BLS$ -----(2)

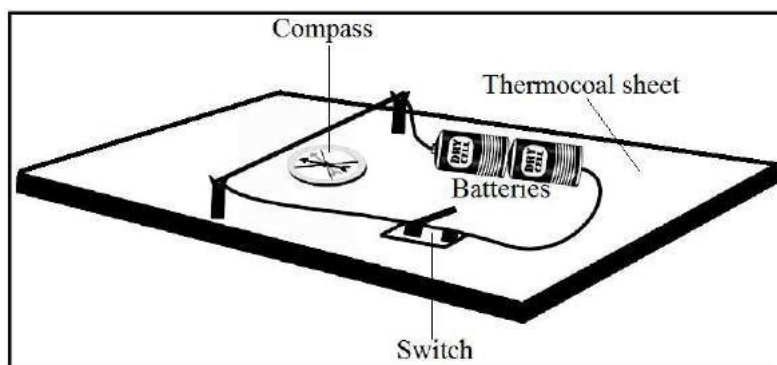
7. Substitute $\Delta\phi = BLS$ in equation (1). We have $W = \Delta\phi \times I$ -----(3)

8. We know electrical power, $P =$ Rate of work done.

$$\begin{aligned} \text{i.e } P &= \frac{W}{t} \\ &= \frac{\Delta\phi \times I}{t} \\ &= \left(\frac{\Delta\phi}{\Delta t} \right) \times I. \\ P &= \epsilon \times I \quad \left(\text{Since } \epsilon = \frac{\Delta\phi}{\Delta t} \right) \end{aligned}$$

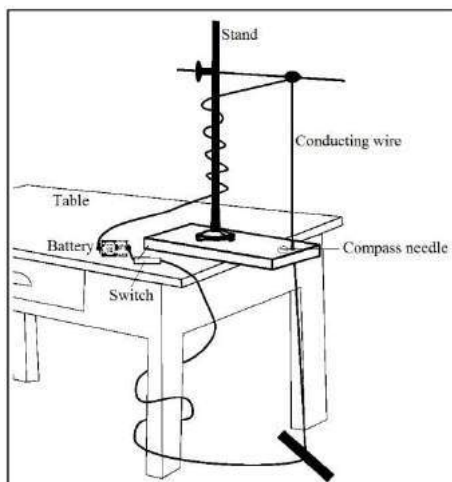
9. Thus the mechanical energy used to move the cross wire to a distance 'S' in one second is converted into electrical energy $\left(\frac{\Delta\phi}{\Delta t} \right)$.
10. Therefore it leads to conservation of energy.

3. Explain with the help of two activities that current carrying wire produces magnetic field? (AS1)(TQ)



- Activity-1:-**
1. Take a thermocol sheet and fix two thin wooden sticks of height 1Cm which have small slit at the top of their ends.
 2. Arrange of copper wire of 24 gauge so that it passes through these slits and make a circuit.
 3. The circuit of 3 or 9v battery, key and copper wire which is connected in series as shown in figure.
 4. Now, keep a magnetic compass below the wire and bring a bar magnet close the compass.
 5. The needle in the compass deflects. This deflection is due to magnetic field produced by bar magnet.
 6. Take the bar magnet far away from the circuit and switch on the circuit.
 7. Observe the changes in compass. The compass needle deflects.
 8. This deflection is due to magnetic field produced by current carrying conductor (wire).

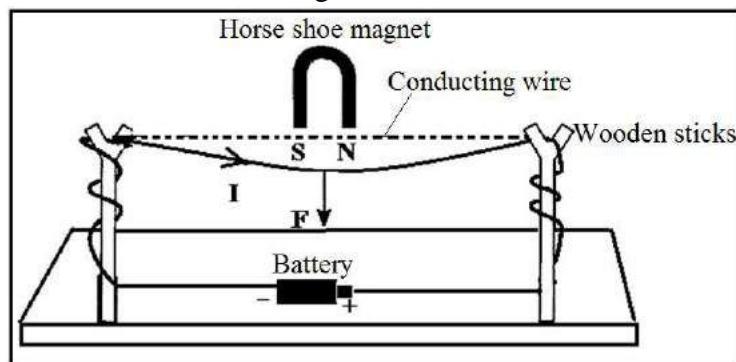
- Activity-2:-**
1. Take a wooden plank and make a hole as shown in figure.
 2. Place this plank on a table. Now place a retort stand on the plank.
 3. Pass a 24 gauge copper wire through a hole of the plank and rubber knob of the retort stand in such a way that the wire be arranged in a vertical position and doesn't touch the stand.
 4. Connect the two ends of wire to a battery via switch.
 5. Place 6 to 10 compass needles in a circular path around the hole so that its centre coincides with the hole.
 6. Use 3 or 9 volts battery in a circuit. Now switch on, the current flows through the wire.
 7. The compass needle deflects in a particular direction.
 8. The deflection is due to magnetic field produced by current carrying wire.



4. How do you verify experimentally that the current carrying conductor experiences a force when it is kept in magnetic field? (AS1) (TQ)

Aim:- To verify the existence of force on current carrying conductor in a magnetic field.

Required apparatus:- Strong horse-shoe magnet, wooden plank, battery, plug key, vertical stand and connecting wires.



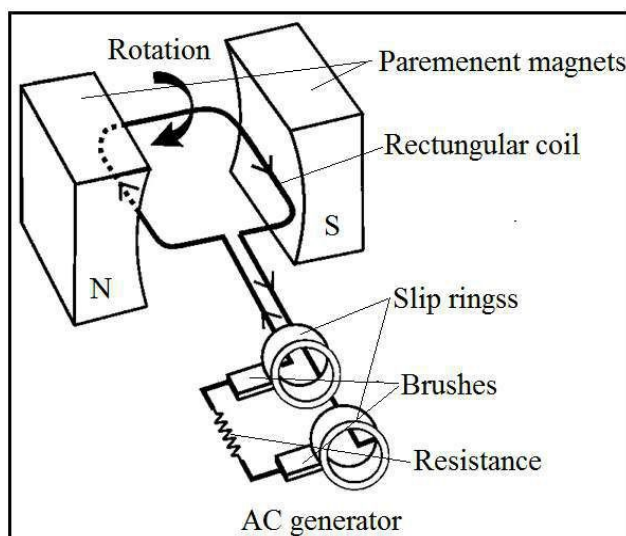
- Procedure:-**
1. Take a wooden plank. Fix two long wooden sticks on it.
 2. These wooden sticks are split at their top ends.
 3. A copper wire is passed through these splits and the ends of the wire are connected to battery of 3 volt, through a switch.
 4. Close the switch to make the circuit. Current passes through the wire.
 5. Now bring a horseshoe magnet near the copper wire.
 6. Then a force experienced on wire.
 7. Reverse the polarities of magnet and then the direction of force is also reversed.
 8. The right hand rule helps the direction of flow of current.

Conclusion:- The current carrying conductor experiences a force when it is kept in magnetic field.

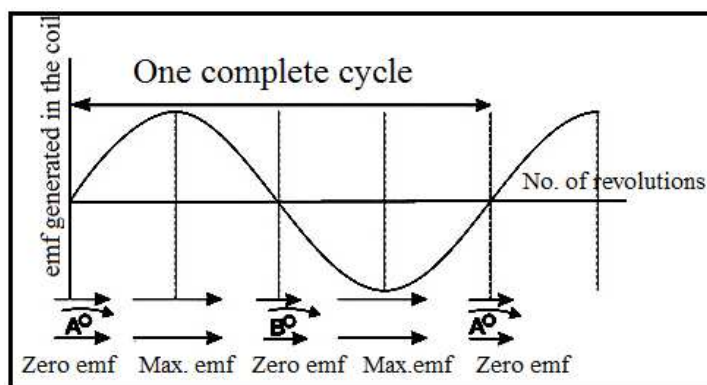
5. Explain the working of AC electric generator with a neat diagram? (AS1) (TQ)

AC electric generator:- Electrical generator is a device which converts the mechanical energy into electrical energy.

Principle:- It works on the principle of electromagnetic induction.



- Working:-**
1. Consider the rectangular coil is held between the poles of curve-shaped permanent magnet as shown in the figure.
 2. When the coil is at rest in vertical position, with side (A) of coil at top position and side (B) at bottom position, no current will be induced in it.
 3. Thus current in the coil is zero at this position.
 4. When the coil is rotated in clockwise direction, current will be induced in it and it flows from A to B.
 5. During the first quarter of rotation, the current increases from zero to a maximum and reaches peak value.
 6. If we continue the rotation of coil, current decreases during the second quarter of the rotation and once again becomes zero.
 7. When the coil comes to vertical position with side B at top (A) at bottom position.
 8. During the second part of the rotation, current generated follows the same pattern as that in the first half except that the direction of current is reversed.



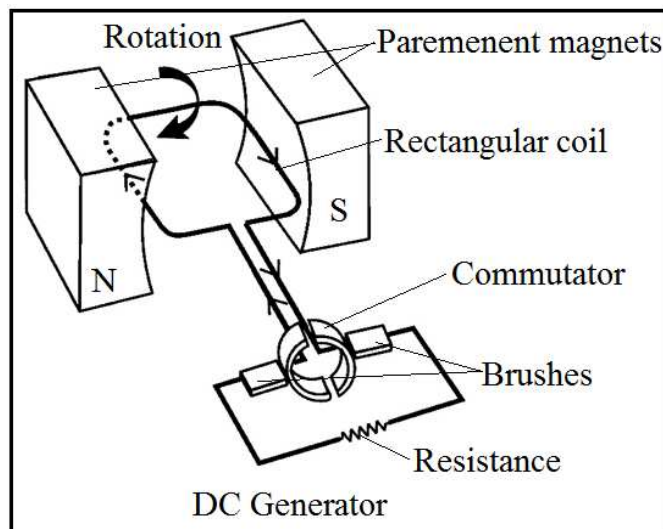
Usage of induced current produced:-

1. The ends of the coil are connected to two slip rings and two carbon brushes are arranged in such a way that they press the slip rings to obtain current from the coil.
2. When these brushes are connected to external devices like T.V, bulb etc. we can make them work with the current supplied from ends of carbon brushes.
3. This current is known as alternating current (AC).

6. Explain the working of DC generator with a neat diagram. (AS1) (TQ)

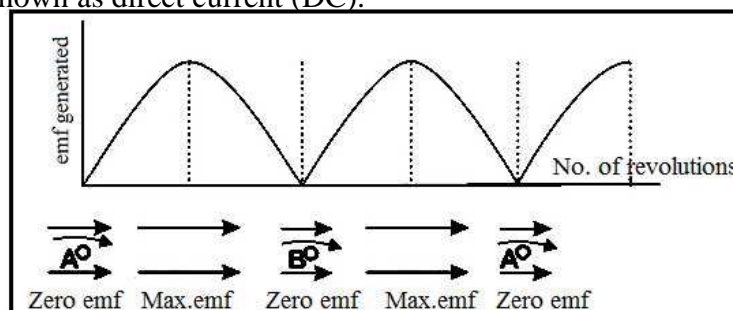
DC electric generator:- Electrical generator is a device which converts the mechanical energy into electrical energy.

Principle:- It works on the principle of electromagnetic induction.



Working:- 1. Consider the rectangular coil is held between the poles of curve-shaped permanent magnet as shown in the figure.

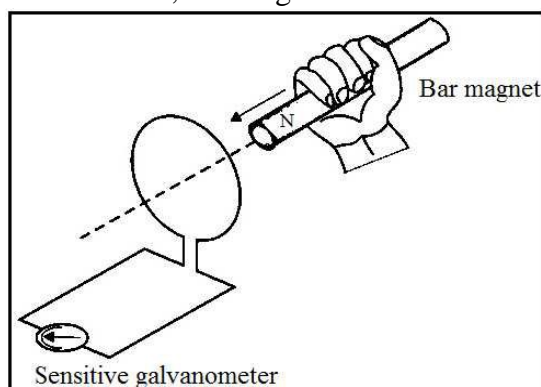
2. When the coil is in vertical position the induced current generated during the first half rotation, rises from zero to maximum and falls to zero again.
3. As the coil moves further from this position, the ends of the coil go to other slip rings.
4. Hence, during the second half rotation, the current is reversed in the coil itself.
5. The current is generated in the second half rotation of the coil is identical with that during the first half of the direct current for one revolution.
6. This current is known as direct current (DC).



7. What experiment do you suggest to understand faraday's law? What material is required? What suggestions do you give to get good results of the experiment? Give precautions? (AS3) (TQ)

Aim:- To understand Faraday's law of induction.

Material Required:- Galvanometer, bar magnet and a coil of wire.



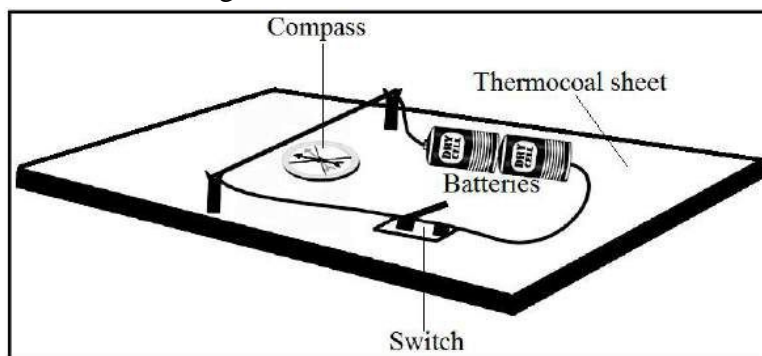
- Procedure:-**
1. Connect the terminals of a coil to sensitive galvanometer as shown in the figure.
 2. Push a bar magnet towards the coil whose north pole is facing towards the coil.
 3. While the magnet is moving towards the coil, the needle in galvanometer deflects, showing that a current has been set up in the coil,
 4. If the magnet is moved away from the coil, the needle in the galvanometer again deflects but in the opposite direction.
 5. Which means that a current is set up in the coil in the opposite direction.
 6. If we use the end of the South Pole instead of North Pole, the results i.e., the deflection of galvanometer is exactly opposite to each other.
 7. Whenever there is a continuous change of magnetic flux linked with closed coil, the current is generated in the coil.

- Precautions:-**
1. The coil should be kept on an insulating surface.
 2. The bar magnet should be a strong magnet.
 3. The area of the coil should be more.
 4. The number of turns in the coil should be more.
 5. The centre of galvanometer scale must be zero.

8. How can you verify that current carrying wire produces magnetic field with the help of experiment? (AS3) (TQ)

Aim:- To verify that current carrying wire produces magnetic field.

Required Apparatus:- Thermocol sheet, battery, key, wooden sticks, compass needle, bar magnet etc.



- Procedure:-**
1. Take a thermocol sheet and fix two thin wooden sticks of height 1cm which have small slit at the top of their ends.
 2. Arrange of copper wire of 24 gauges so that it passes through these slits and make a circuit.
 3. The circuit of 3 or 9v battery, key and copper wire which is connected in series as shown in figure.
 4. Now, keep a magnetic compass below the wire and bring a bar magnet close the compass.
 5. The needle in the compass deflects. This deflection is due to magnetic field produced by bar magnet.
 6. Take the bar magnet far away from the circuit and switch on the circuit.
 7. Observe the changes in compass. The compass needle deflects.
 8. This deflection is due to magnetic field produced by current carrying conductor (wire).

9. Collect information of experiments done by Faraday? (AS4) (TQ)

1. Connect the terminals of a coil to sensitive galvanometer as shown in the figure.
2. Push a bar magnet towards the coil whose north pole is facing towards the coil.
3. While the magnet is moving towards the coil, the needle in galvanometer deflects, showing that a current has been set up in the coil,
4. If the magnet is moved away from the coil, the needle in the galvanometer again deflects but in the opposite direction.
5. Which means that a current is set up in the coil in the opposite direction.

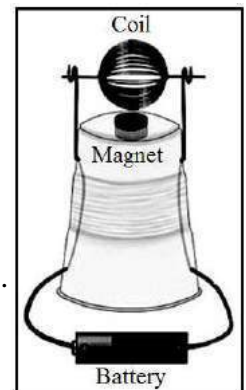
6. If we use the end of the South Pole instead of North Pole, the results i.e., the deflection of galvanometer is exactly opposite to each other.
7. Whenever there is a continuous change of magnetic flux linked with closed coil, the current is generated in the coil.

10. Collect information about material required and procedure making simple electric motor from internet and make a simple motor on your own? (AS4) (TQ)

Aim:- To prepare a simple electric motor.

Material Required:- 1.5m copper wire (about 25 gauge), 2 safety pins, 1.5 battery, magnets, and rubber bands.

- Procedure:-**
1. Wind the copper wire nearly 10-15 turns to make a coil.
 2. Copper coil is arranged in between the two safety pins as shown in the figure.
 3. The other ends of the pins are fixing vertically to a battery as shown in the figure.
 4. This completes the simple electric motor.
 5. We can observe the rotation of the coil.



11. How do you appreciate the relation between magnetic field and electricity that changed the lifestyle of mankind? (AS6) (TQ)

1. The idea of Oersted is, current carrying conductor behaves like a magnet.
2. Faraday law is, continuous change of magnetic flux linked with closed coil produces the current.
3. The relation between magnetic field and electricity enables us to use electric motors, generators, fans grinders and induction stoves etc.
4. Life style of man has been enhanced socio economically, in transportation, jobs and leisure time.
5. We are able to construct motors to convert electrical energy into mechanical energy.
6. We are able to construct generators to convert mechanical energy into electrical energy.
7. All these are possible with the relation between magnetic field and electricity.
8. So I appreciate the relation between magnetic field and electricity that changed the lifestyle of mankind.

12. Which of the various methods of current generation protects the nature well? Give examples to support your answer? (AS7) (TQ)

There are so many reasons the world is looking towards alternative energy sources in an effort to reduce the pollutants and green house gasses. They are,

1. **Tidal Energy:-** 1.Ocean waves can be used to generate the wave power.
2. The kinetic and potential energy of high and low tidal energies are converted into electrical energy.
3. The ocean is an example of a natural resource.
2. **Hydro electrical energy:-** Hydro electrical power comes from the potential energy of dammed water driving a water turbine and generator.
3. **Wind energy:-** Wind energy comes from the wind to propel the blades of wind turbines.
4. **Solar energy:-** 1. Solar energy comes from hot sun rays.
2. But it has some limitations like, non-availability at all times, more production cost and less storage capacity.
5. **Nuclear energy:-** 1. Nuclear energy is comes from Uranium isotopes by controlling the chain reactions.
2. Nuclear reactor is used for this purpose.
6. **Geothermal energy:-** Geothermal energy is to be improved and it has to be brought into the wide useas.

13. The value of magnetic induction of uniform field is 2T. What is the flux passing through the surface of area 1.5 m² perpendiculars to field? (AS1) (TQ)

Given:- Magnetic field induction, $B = 2\text{T}$
 Surface area, $A = 1.5 \text{ m}^2$
 Magnetic flux, $\Phi = ?$

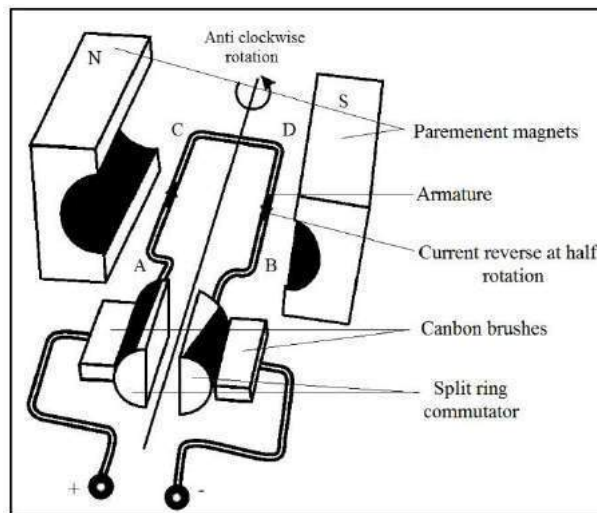
Formula:- Magnetic flux, $\Phi = BA = 2 \times 1.5 = 3 \text{ Weber}$.

14. An 8N force acts on a rectilinear conductor 20cm long placed perpendicular to magnetic field. Determine the magnetic field induction if the current in the conductor is 40A? (AS1) (TQ)

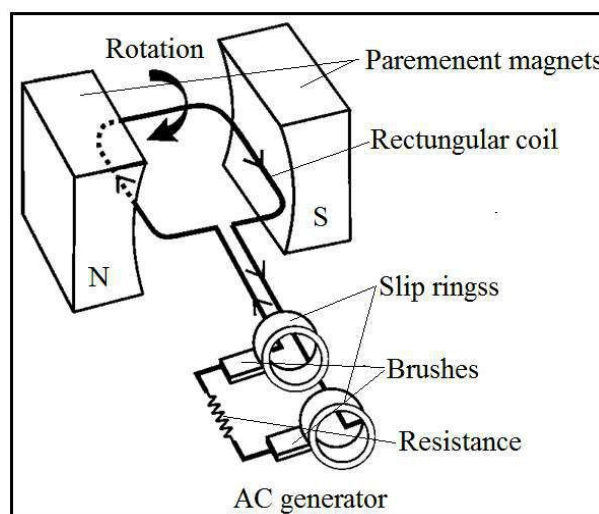
Given:- $F = 8\text{N}$
 $l = 20 \text{ cm or } 20 \times 10^{-2} \text{ m}$
 $i = 40 \text{ A}$
 $B = ?$

Formula:- $B = \frac{F}{il} = \frac{8}{40 \times 20 \times 10^{-2}} = \frac{8 \times 10^2}{40 \times 20} = \frac{800}{800} = 1 \text{ Tesla}$.

15. Draw a neat diagram of electric motor. Name the parts? (AS5) (TQ)



16. Draw a neat diagram of AC generator? (AS5) (TQ)



Chapter 13
Metallurgy

1 Mark Questions

1. What is metallurgy?

Metallurgy:- The process of extraction of metals from their ores is called metallurgy.

2. What are minerals?

Minerals:- The elements (or) compounds of the metals that occur in nature in earth crust are called as Minerals.

3. Define the term ores?

Ores:- The minerals from which metals are extracted profitably are known as ores.

Ex:- Aluminium ore is "Bauxite" ($\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$)

4. Do you agree with the statement "All ores are minerals but all minerals need not be ores?" Why?

Yes I agree with the statement because ore is a mineral from which the metals are extracted with out economical loss.

5. What are the metals present in the Bronze Alloy?

Copper and Tin (Cu + Sn).

6. List three metals that are found in nature in uncombined form? (AS1) (TQ)

1. Gold(Au) 2. Silver(Ag) 3. Copper(Cu)

7. Write the names of any two ores of iron? (AS1) (TQ)

1. Haematite - Fe_2O_3 .
2. Magnetite – Fe_3O_4 .

8. Which metals exist in the nature in free state?

Gold (Au), Silver(Ag), Platinum (Pt).

9. Write the stages involved in the extraction of metals from the ores?

The extraction of a metal from its ore involves three stages. They are,

1. Concentration or Dressing.
2. Extraction of crude metal.
3. Refining (or) purification of the metal.

10. Which method do you suggest for the dressing of a ore containing magnetic and non magnetic and substances?

1. I suggest Magnetic separation method.
2. Because in magnetic separation method electro magnets are used to separate the magnetic and non-magnetic substances.

12. Name two metals which corrode easily and two metals which do not corrode readily?

1. Iron, and copper corrode easily.
2. Gold and platinum do not corrode.

13. Which purification method is used if the impurities have high boiling point ?

Distillation process is used if the impurities have high boiling point. In this method the extracted metal in the molten state is distilled to obtain the pure metal as distillate.

14. Define the terms 1. Gangue 2. Slag. (AS1) (TQ)

Gangue:- The impurities like clay, sand present in the ore is called a Gangue.

Slag:- The impurities obtained during the poling process get oxidized to form slag(scum) over the surface of the molten metal.

Ex:- CaSiO_3 , FeSiO_3 .

15. What is flux? Give an example?

Flux:- The new substance added to ore for remove gangue is called a flux.

Ex:- SiO_2 (Acidified flux), CaO (Base flux)

16. Which method is used to extract magnesium from its ore carnalite ?

1. The formula of carnalite is $\text{KCl} \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O}$.
2. Electrolytic reduction method is used to extract magnesium from its ore Carnalite.

17. What is activity series?

Activity series:- Arrangement of the metals in decreasing order of their activity is known as activity series.

18. What is the use of adding impurities to the ore?

Suitable impurities are added to the ore to decrease its melting point.

19. What is meant by a refining of metal?

The process of obtaining the pure metal from the impure metal is called refining of the metal.

20. What are the stages involved in the refining of metal?

Refining of the metal involves several types of processes. They are,

1. Distillation.
2. Poling.
3. Liquefaction.
4. Electrolysis.

21. Does the reactivity of a metal and form of its ore has any relation with process of extraction?

1. Yes, they have relation.
2. Metals like K, Na, Ca, Mg and Al are so reactive and exists in all forms.
3. Moderate reactive metals like Zn, Fe, Pb exists as oxides, sulphides and carbonates.
4. Least reactive metals Au, Ag found in free state.

22. Magnesium is an active metal if it occurs as a chloride in nature, which method of reduction is suitable for its extraction?

1. Magnesium is an active metal. It occurs in chloride form as MgCl_2 .
2. Hence electrolysis is suitable method for its reduction.

23. Mention two methods which produce very pure metals?

Electrolysis and reduction are the two methods that produce pure metals.

24. In nature, Ag, Au, Cu available in free state. Justify the statement?

In nature, Ag, Au and Cu are available in free state due to their least reactive nature with their surroundings.

25. Define the process of refining of metal?

The process of obtaining of pure metal from the impure metal is known as refining of metal.

26. Is the VI group were known as chalcogens? Justify your answer?

1. VI group was known as chalcogens, Since, most of the ores are in the form of oxides (or) sulphides and so on.
2. These are called as chalcogens which means ore forming elements.

27. What is the use of a Bisphenol?

Bisphenol is a chemical used for prevention of corrosion of metals.

28. Write a chemical name of rusting of iron and mention its formula?

The rusting of Iron is a Iron Oxide. Its formula is Fe_2O_3 .

29. Write the chemical formula for hydrated ferric oxide(Rust)?

$Fe_2O_3 \cdot X H_2O$.

30. What is a poling?

Poling:- The molten metal is stirred with poles of green wood. The impurities are removed either as gases or they get oxidized and form slag over the surface of the molten metal the process is called a poling.

31. What is Liquation ?

Liquation:- A low melting metal can be made to flow on a slopy surface to separate it from high melting impurity.

Ex:- Tin.

32. What is a stainless steel?

Stainless steel is an alloy of Iron, Nickel and Chromium.

33. What are the cathode and Anode used for electrolytic refining process?

In the electrolytic refining process the impure metal used as a Anode and a pure metal used as a cathode.

2 Mark Questions

1. List three metals that are found in nature as Oxide ores. (AS1) (TQ)

S.No	Name of the Metal	Ore	Chemical Formula
1	Zinc(Zn)	Zincate	ZnO
2	Iron(Fe)	Haematite	Fe_2O_3
3	Lead(Pb)	Galena	PbS

2. Write a note on ore dressing in metallurgy? (AS1) (TQ)

Ore that are mined from the earth are usually contaminated with large amount of impurities such as soil and sand etc.

1. Dressing or concentration means, simply getting rid of as much of the unwanted rocky materials as possible before the ore is converted into the metal.
2. The impurities are known as “gangue”.
3. The Physical methods like hand picking, washing, froth floatation and magnetic separation are used to enrich the ore depending on the physical properties of ore and gangue.

3. What is an ore? On what basis a mineral is chosen as an ore? (AS1) (TQ)

Ore:- The mineral from which the metals are extracted without economical loss are called ores.

A mineral is chosen as an ore based on the following conditions.

1. The percentage of the metal in that mineral.
2. Economically profitable while extracting the metal from the mineral.
3. Convenience of extraction of metal.

4. How do metals occur in nature? Give examples to any two types of minerals? (AS1) (TQ)

1. The earth crust is the major sources of metals.
2. Some metals are available in nature in free state as they are least reactive.
Ex:- Gold(Au), Silver(Ag) and Copper(Cu).
3. Most of the metals are found in nature in the combined form due to their more reactivity.
4. The elements or compounds of the metals which occur in nature in the earth's crust are called minerals.
5. They are many types of minerals or ores . They are as follows.

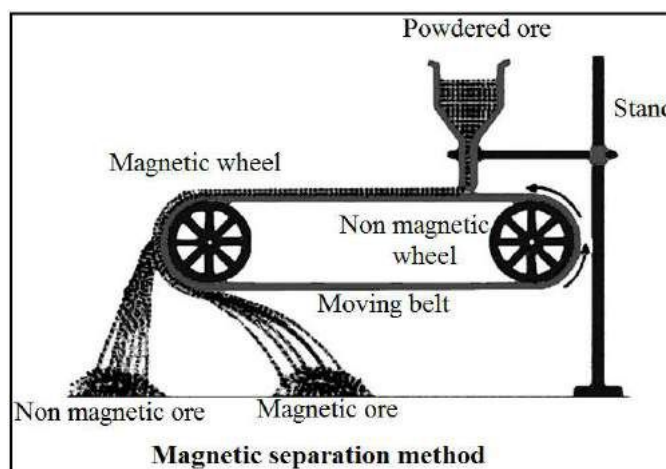
S.No	Type of the mineral	Name of the mineral
1	Oxide mineral	1. Bauxite ($\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$) 2. Hematite (Fe_2O_3) 3. Zincite(ZnO)
2	Sulphide mineral	1. Zinc Blende(ZnS) 2. Cinnabar (HgS) 3. Galena (PbS)
3	Chloride mineral	1. Horn silver (AgCl) 2. Rock salt(NaCl)
4	Carbonate mineral	1. Magnesite (MgCO_3) 2. Lime stone(CaCO_3)

5. When do you use magnetic separation method for concentration of an ore? Explain with an example? (AS1) (TQ)

In the ore or impurity, one of them is magnetic substance and the other non-magnetic substance, they are separated by electromagnetic separation method.

Ex:- 1. The magnetic ores like iron pyrites (FeS) and magnetite (Fe_3O_4) are concentrated by this method.

2. The crushed ore is allowed to pass through electromagnetic belts.
3. The mineral particles are retained and gangue particles are thrown away.

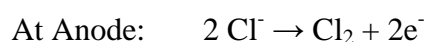


6. What is the difference between roasting and calcinations? Give one example for each? (AS1) (TQ)

Roasting	Calcination
1. Roasting is a pyrochemical process in which the ore is heated in the presence of air.	1. Calcination is a pyrochemical process in which the ore is heated in the absence of air.
2. The product obtained in this process are in solid state.	2. The ore generally decomposed in this process.
3. It is used for sulphide ores	It is used for carbonate ores
4. $2\text{ZnS(s)} + 3\text{O}_2\text{(g)} \rightarrow 2\text{ZnO(s)} + 2\text{SO}_2\text{(g)}$	4. $\text{MgCO}_3\text{(s)} \xrightarrow{\Delta} \text{MgO(s)} + \text{CO}_2\text{(g)}$

7. Magnesium is an active metal if it occurs as a chloride in nature, which method of reduction is suitable for its extraction? (AS2) (TQ)

1. Magnesium is an active metal. It occurs in chloride form as MgCl_2 .
2. Hence electrolysis is suitable method for its reeducation.
3. During the electrolysis the following chemical reactions are takes place.



8. Mention two methods which produce very pure metals? (AS2) (TQ)

The process of obtaining the pure metal from the impure is called refining of the metal.

1. Distillation:- 1. This method is very much useful for purification of low boiling metals like Zinc and Mercury.

2. Because they have high boiling point containing substances as impurities.

2. Liquation:- In this method a low melting metal like Tin can be made to flow on a slopy surface to separate it from high melting impurities.

9. Which method do you suggest for extraction of highly reactive metals? Why? (AS2) (TQ)

High reactivity metals like K, Ca, Mg, Ca etc, can be extracted by electrolysis.

Reason:- 1. Simple reduction methods like heating with C, Co, etc. to reduce the ores of these metals are not feasible.

2. The temperature required for the reduction is too high and more expensive.

3. Hence electrolysis is the suggestible method to extract high reactive metals.

Ex:- 1. To extract Na from NaCl, fused NaCl is electrolysed with steel cathode(-) and graphite anode(+).

2. The metal (Na) will be deposited at cathode and chlorine liberated at the anode.

3. **At Cathode:-** $2\text{Na}^+ + 2\text{e}^- \rightarrow 2\text{Na}$

At Anode:- $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$.

4. For this process a large quantity of electricity is required to keep the ore in molten state.

10. Which method is used to purify Blister (copper copper obtained from its sulphide ore) Explain?

1. Blister copper is purified by poling.

2. In this method the motten metal is stirred with logs (Pores) of green.

3. The impurities are removed either as gases or they ge oxidized and form slag over the motten metal.

4. The reducing gases evolved from the wood prevents the oxidation of copper.

11. Where do we use handpicking and washing methods in our daily life? Give examples. How do you correlate examples with enrichment of ore? (AS7) (TQ)

Hand picking:- If the ore particles and the impurities are different in one of the properties like colour, size etc. are separated by hand picking.

Ex:- Separating mud particles and stones from rice, Wheat etc.

Washing:- 1. Ore particles are crushed and kept on a slopy surface.

2. They are washed with controlled flow of water.

3. Less dense impurities are carried away by water flow, leaving the more dense ore particle behind.

Ex:- Washing of clothes in daily life.

12. Give examples for the metals undergo corrosion? Why do they corrode? How to prevent corrosion?

1. Iron, silver, copper. Generally undergo corrosion.

2. In metallic corrosion a metal is oxidised by loss of electron's generally to oxygen and results in the formation of oxides.

Prevention:- Covering the surface with paint or some chemicals.

Ex:- 1. Bisphenol.

2. Electroplating.

13. What is the main difference in Blast furnace and Reverberatory furnace regarding fire box and hearth ?

1. In Blast Furnace both fire box and hearth are combined in big chamber which accommodates both ore and fuel.

2. In Reverberatory Furnace fire box and hearth are separated, but the vapours obtained due to the burning of the fuel touch the ore in the hearth and heat it.

4 Mark Questions

1. Write short notes on froth floatation process? (AS1) (TQ)

Froth floatation process:- 1. Froth Flotation method is used for dressing the sulphide ore.

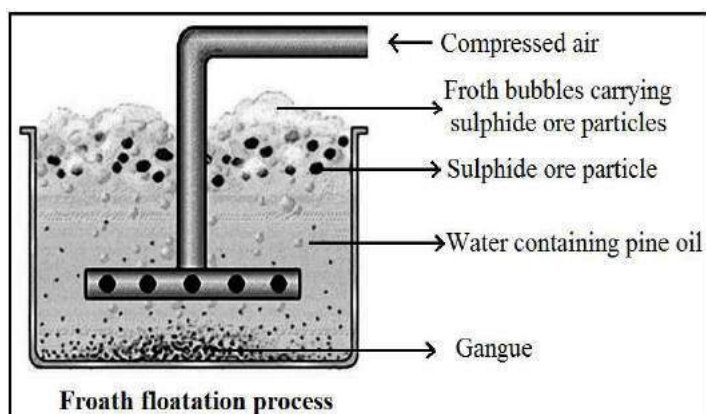
2. The ore with impurities is finely powdered and kept in water, containing pine oil taken in a floatation cell.

3. Air under pressure is blown to produce froth in water.

4. Froth so produced, takes the ore particles to the surface.

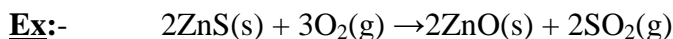
5. The impurities settle at the bottom.

6. Froth is separated and washed to get ore particles.

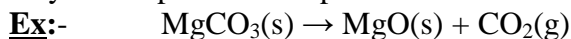


2. Write short notes on each of the following: 1. Roasting 2. Calcination 3. Smelting. (AS1) (TQ)

- 1. Roasting:-** 1. Roasting is a pyrochemical process in which the ore is heating in the presence of Oxygen (or) air below its melting point.
2. The products obtained in the process are also in solid state.
3. Generally reverberatory furnance is used for roasting.

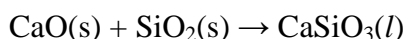
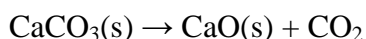
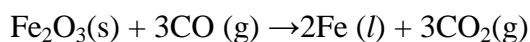
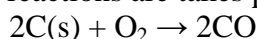


- 2. Calcination:-** 1. Calcination is a pyrochemical process in which the ore is heated in the absence of air.
2. The ore is generally decomposed in the process.



- 3. Smelting:-** 1. Smelting is a pyrochemical process, in which the ore is mixed with flux and fuel, and then it is strongly heated.
2. During smelting, the impurities (gangue) in the ore react with flux to form slag which is removed.
3. For haematite ore, coke is used as fuel and lime stone is used as flux.

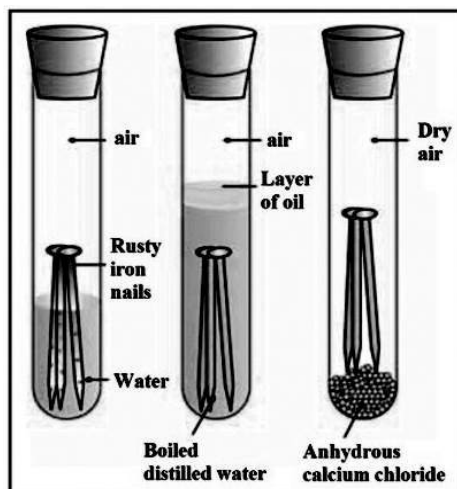
Ex:- The following reactions are takes place inside the furnace.



3. Suggest an experiment to prove that presence of air and water is essential occurrences of corrosion and explain the procedure? (AS3) (TQ)

Aim:- To prove that the presence of air and water are essential occurrences of corrosion.

Apparatus:- Three test tubes, three corks, Distilled water, anhydrous calcium chloride, clean iron nails and oil etc.



Procedure:-

1. Take 3 test tubes and place clean iron nails in each of them. Label the test tubes A, B and C.
2. Pour some water in test tube A and cork it.
3. Pour boiled distilled water in test tube B, and about 1ml of oil and cork it.
4. Put some anhydrous calcium chloride in test tube C and cork it.
5. Leave these test tubes for a few days and then observe.
6. After a few days, we will observe that iron nails rust in test tube A, but they do not rust in test tubes B and C.

Reason:- 1. In test tube A, the nails are exposed to air and water. Hence the nails rusted.

- In test tube B, the nails are exposed only to water, but not to air, because the oil float on water and prevent the air not rested.
- In test tube C, the nails are exposed to dry air, because anhydrous CaCl_2 will absorb the moisture, if any from the air. Hence the nails are not rusted.

Conclusion:- From the above experiment, we can prove that air and water are essential for corrosion.

4. What is the activity series? How it helps in extraction of metals? (AS6) (TQ)

Activity Series:- 1. Arrangement of the metals in descending order of their reactivity is known as activity series.

2. The activity series of metal is $\frac{\text{K,Na,Ca,Mg,Al}}{\text{High reactivity}}$, $\frac{\text{Zn,Fe,Pb,Cu}}{\text{Moderate reactivity}}$, $\frac{\text{Ag,Cu}}{\text{Low reactivity}}$.

The advantage of activity series in extraction of metals:-

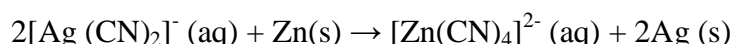
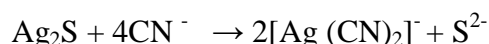
It is very useful to judge the nature of metal and how it exists.

- The metals at the top of the activity series (highly reactive) can be extracted by electrolysis.
- The metals at the middle of the activity series can be extracted by,
 - Reduction of metal oxide with carbon
 - Reduction of oxide ores with co(Carbon monoxide)
 - Self reduction of sulphide ores
 - Reduction of ores with more reactive metals (thermite process)
- The metals at the bottom of the activity series (less reactive) can be extracted by heating alone, because they are often found in free state.

5. Collect information about extraction of metals of low reactivity Silver, Platinum and Gold and prepare a report? (AS4) (TQ)

Extraction of Silver:- 1. Silver can be extracted from Ag_2S by displacement from their aqueous solution.

2. If we get the Silver the following reactions takes place.



Extraction of Platinum: 1. Platinum is rarely found on its own, but in combination with other base and precious metals.

- The extraction process of platinum is quite complex, which includes milling the ore and smelting it at high temperatures.
- This removes the base metals, iron and sulphur and concentrate platinum.
- In this way, Platinum is extracted from its ore.

Extraction of Gold: 1. Gold is extracted from gold ore like electrum.

- In all methods of gold ore refining, the ore is usually washed and filtered at the mine, then sent to the mill.
- At the mill, the ore is ground into smaller particles with water, then ground again in a ball mill to further pulverize the ore.
- Several processes can be used to separate the gold from its ore. They are,

a. Cyanide process:-

- The ground ore is put in a tank containing a weak cyanide solution and then zinc is added.
- The zinc causes a chemical reaction which separates the gold from the ore.
- The gold is then removed from the solution with a filter press.

b. Carbon-in-pulp Method:-

1. In this method, the ground ore is mixed with water before cyanide is added.
2. Then carbon is added to bond with the gold.
3. The carbon-gold particles are put into caustic carbon solution, separating out in the gold.

c. Heap leaching:-

1. The ore is placed on open-air pads and cyanide is sprayed over them, taking several weeks to leach down to an imperious base.
2. The solution then poured and pad into a pound and is pumped from there to a recovery plant, where the gold is recovered.
3. Heap-leaching helps recover gold from ore that would be otherwise too expensive to process.

6. What is thermite process? Mention its applications in daily life? (AS7) (TQ)

Termite process:-

1. When highly reactive metals such as Na, Ca, Al are used as reducing agents they displace metals of lower reactivity from their compounds.
2. These displacement reactions are highly exothermic.
3. The amount of heat evolved is so large that the metals produced in molten state.
4. The reaction of Iron Oxide (Fe_2O_3) with aluminium is used to join reaction is known as the thermite reaction.

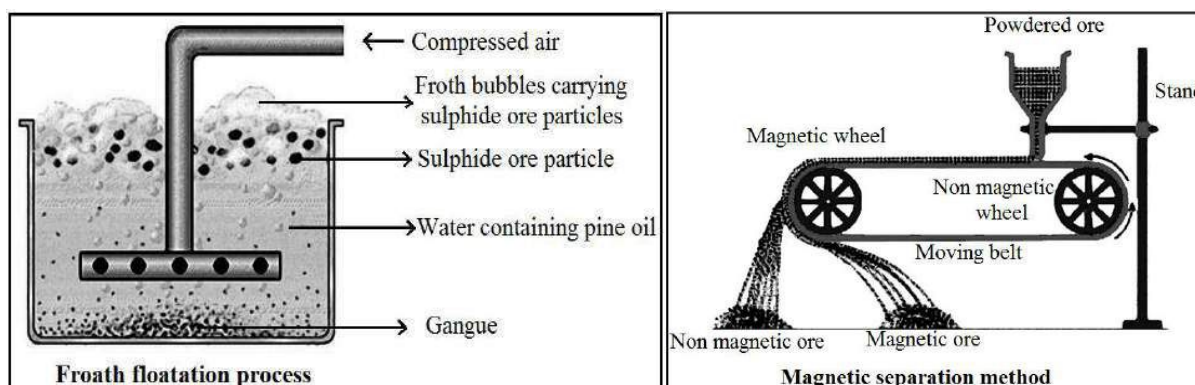


5. This reaction is known as thermite process.

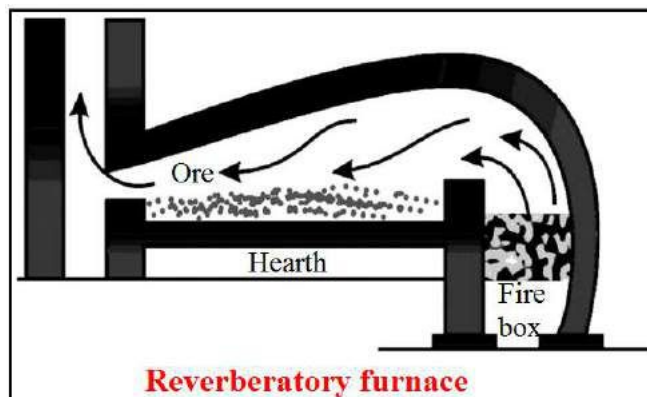
Applications:- 1. Terminate process used for join railing of railway tracks

2. It is used to join cracked machine parts.

7. Draw the diagram showing (i) Froth flotation (ii) Magnetic separation? (AS5) (TQ)



8. Draw a neat diagram of Reverberatory furnace and label it neatly? (AS5) (TQ)



Chapter 14
Carbon and its Compounds
1 Mark Questions

1. Name the simplest hydrocarbon? (AS1) (TQ)

Methane (**CH₄**) is the simplest hydrocarbon.

2. Name the carboxylic acid used as a preservative? (AS1) (TQ)

Acetic acid (or) Ethanoic acid (**CH₃COOH**) is used as a preservative.

3. Name the product other than water formed on burning of ethanol in air? (AS1) (TQ)

When ethanol is burnt in air the product formed other than water is carbon dioxide (**CO₂**).



5. What do we call the Self linking property of carbon? (AS1) (TQ)

1. The self linking property of carbon is catenation.
2. Catenation is the phenomenon in which atoms of same elements join together to form a long chain.

6. Name the simplest ketone and write its molecular formula? (AS1) (TQ)

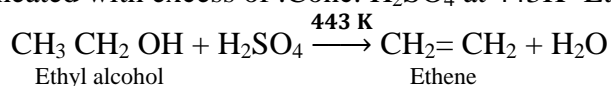
The simplest ketone is acetone.



IUPAC Name:- 2 – propanone.

7. Name the compound formed by heating ethanol at 443 K with excess of conc.H₂SO₄? (AS1) (TQ)

1. When ethanol is heated with excess of .Conc. H₂SO₄ at 443K ‘Ethane’ is formed.



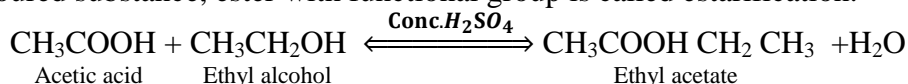
2. H₂SO₄ is an dehydrating agent and removes H₂O.
3. So it is a dehydration reaction.

8. Name the acid present in vinegar? (AS1) (TQ)

1. The acid present in vinegar is as 5 - 8% ethanoic acid (or) Acetic acid.
2. Its chemical formula is **CH₃COOH**.

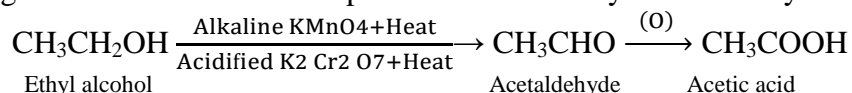
9. Give an example for esterification reaction? (AS1) (TQ)

The reaction between carboxylic acid and alcohol in the presence of conc. H₂SO₄ to form a sweet odoured substance, ester with functional group is called esterification.



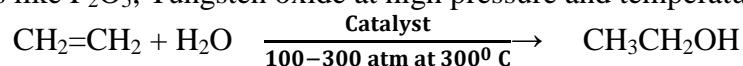
10. Name the product obtained when ethanol is oxidized by either chromic anhydride or alkaline potassium permanganate? (AS1) (TQ)

Ethanol undergoes oxidation to form the product of acetaldehyde and finally acetic acid.



11. Write the chemical equation represent the reaction of preparation of ethanol from ethane?(AS1) (TQ)

Ethanol is prepared on large scale from ethane by the addition of water vapor to it in the presence of catalysts like P_2O_5 , Tungsten oxide at high pressure and temperature.



12. Write the IUPAC name of the next homologous of $CH_3OHCH_2CH_3$? (AS1) (TQ)

$CH_3CH_2CH_2CH_2OH \rightarrow$ 1-butanol.

13. Give the name functional group (i) $-CHO$ (ii) $-C=O$? (AS1) (TQ)

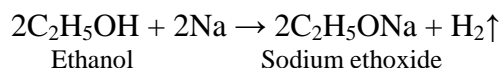
i. $-CHO$ is Aldehyde. ii. $-C=O$ is Ketone.

14. Name the acid present in the vinegar? (AS1) (TQ)

Acetic acid(CH_3COOH) is present in the vinegar.

15. What happens when a small piece of sodium is dropped into ethanol? (AS2) (TQ)

When a small piece of sodium is dropped into ethanol, it shows brisk effervescence and liberates hydrogen gas and forms sodium ethoxide.



16. What is the position of the carbon in modern periodic table?

1. Carbon is a non-metal.
2. It belongs to the fourteenth group or IV A group in the modern periodical table.

17. Who introduced the concept of hybridization?

Linus Pauling (1931).

18. What is meant by a SP^3 hybridization?

- SP³ hybridization:**- 1. In the excited carbon atom its one s-orbital (2s) and three p-orbitals ($2p_x, 2p_y, 2p_z$) intermix and reshuffle into four identical orbitals known as sp^3 orbitals.
2. Thus, carbon atom undergoes sp^3 hybridisation.

Example:- Formation of methane(CH_4).

19. What is meant by a SP^2 hybridization?

- SP² hybridization:**- 1. In the excited carbon atom its one s-orbital (2s) and two p-orbitals ($2p_x, 2p_y$) intermix and reshuffle into three identical orbitals known as sp^2 orbitals.
2. Thus, carbon atom undergoes sp^2 hybridisation.

Example:- Formation of ethylene($H_2C = CH_2$).

20. What is meant by a SP hybridization?

- SP² hybridization:**- 1. In the excited carbon atom its one s-orbital (2s) and one p-orbital ($2p_x$) intermix and reshuffle into two identical orbitals known as sp orbitals.
2. Thus, carbon atom undergoes sp hybridization.

Example:- Formation of ethyne($HC \equiv CH$).

21. What is allotropy? What are the allotropy forms of carbon?

- Allotropy:**- 1. The occurrence of same element in two or more different forms is known as allotropy.
2. The different forms of the element are called allotropes.
 3. The allotropy forms of carbon are,
 - i. Amorphous forms.
 - ii. Crystalline forms.

22. Write the names of Amorphous forms of carbon?

Amorphous forms of carbon:- Coal, Coke, Wood Charcoal, Animal charcoal, Lamp black, Gas carbon, Petroleum coke, Sugar charcoal.

23. Write the names of crystalline allotropic forms of carbon?

Allotropic forms of carbon:- Diamond, graphite and buckminsterfullerene.

24. How are Allotropes formed?

Allotropes are formed due to difference in arrangement of atoms in the molecule.

25. Who discovered the buckminsterfullerene?

Robert F. Curl, Harold W. Kroto and Richard E. Smalley from Rice in 1985.

26. What is meant by a buckyballs?

Buckyballs:- Spherical fullerenes are also called buckyballs.

27. Who discovered the nanotubes?

Sumio Iijima in 1991.

28. What is meant by a catination?

Catination:- Catination is the phenomenon in which atoms of same elements join together to form a long chain.

29. What are hydro carbons?

The compounds containing only carbon and hydrogen in their molecules are called hydrocarbons.

30. How many types of Hydrocarbons are there? What are they?

Hydrocarbons are two types. They are,

1. Saturated hydrocarbons (alkanes).
2. Unsaturated Hydrocarbons (alkenes and Alkynes).

31. What is meant by a functional group in carbon compound?

Functional group:- The characteristic properties of an organic compound depend mainly on an atom or group of atoms in its molecule known as the functional group.

32. What is meant by a isomerism?

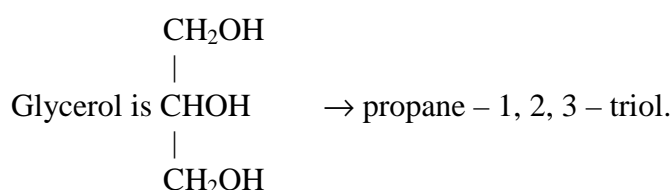
- Isomerism:-**
1. Molecules having the same molecular formula but different structures are called isomers.
 2. This phenomenon is called isomerism.

33. What is meant by a soap?

- Soap:-**
1. Soap is a sodium or potassium salt of a higher fatty acid like palmitic acid ($C_{15}H_{31}COOH$), stearic acid ($C_{17}H_{35}COOH$), oleic acid ($C_{17}H_{33}COOH$) etc.
 2. The formula of a soap in general is $RCOONa$ or $RCOOK$, where $R = C_{15}H_{31}$; $C_{17}H_{35}$ etc.

34. What is meant by a glycerol?

Glycerol:- Fats are esters of higher fatty acids and the trihydroxy alcohol known as glycerol.



35. What is meant by a saponification?

Saponification:- Alkaline hydrolysis of tristers of higher fatty acids producing soaps is called saponification.

36. What is a true solution?

True solution:- A true solution is that in which the solute particles dispersed in the solvent are less than 1nm in diameter.

37. What is a colloidal solution?

Colloidal solution:- A colloidal solution contains the solute known as 'dispersed phase' with its particles with diameters greater than 1nm but lesser than 1000 nm in the solvent known as 'dispersion medium'.

38. What is meant by a CMC?

CMC:- The particular concentration of a true solution is known as critical micelle concentration.

39. What is micelles or associated colloids?

Micelles:- The soap particles get aggregated and these aggregated particles are of colloidal size known as micelles or associated colloids.

40. Give the electronic configurations of carbon in both group state and excited states.

Electronic configuration of carbon atom,

In ground states $\rightarrow 1s^2 2s^2 2p^2$

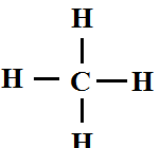
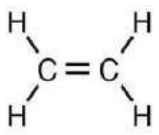
In excited state $\rightarrow 1s^2 2s^1 2p^3$

41. Mention the bond angles between H-C-H in, a) CH₄ b) C₂H₄ c) C₂H₂

a) The bond angle of CH₄ is 109° 28'.

b) The bond angle of C₂H₄ is 120°.

c) The bond angle of C₂H₂ is 180°.

S.No	Molecule	Structure	Bond Angle
1	CH ₄		109°28'
2	C ₂ H ₄		120°
3	C ₂ H ₂	H - C ≡ C - H	180°

42. Mention the structure of each carbon atom in diamond & graphite?

Diamond – Tetrahedral arrangement.

Graphite – Trigonal arrangement.

43. What is meant by homologous?

The individual compound in a homologous series is known as homologous.

44. Define combustion reaction?

Combustion reaction:- The process of burning of carbon (or) carbon compounds in excess of Oxygen to give heat & light is known as combustion reaction.

45. What is hybridisation? What are hybrid orbitals?

Hybridisation:- the redistribution of orbitals of almost equal energy in individual atoms to give equal number of new orbitals with identical properties like energy and shape is called "Hybridisation" The newly formed orbitals are called as "hybrid orbitals."

46. What are Aldehydes and Ketones?

Aldehydes:- The hydrocarbons with functional group of $-\text{CHO}$ are called aldehydes.
Ex : Formaldehyde, Acetaldehyde.

Ketones:- The hydrocarbons with $-\text{C}=\text{O}$ group are called ketones.
Ex : Acetone, Methyl ketone

47. What is Isomerism? And what is Isomers?

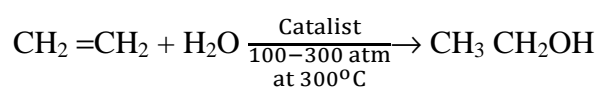
Isomerism:- 1. The phenomenon of possessing same molecular formula but different properties by the compounds is known as Isomerism.
2. The compound that exhibit isomerism is called Isomers.

48. What are substitution reactions ?

Substitution reactions:- A reaction in which an atom or a group of atoms in a given compound is replaced by other atom or group of atoms is called a substitution reaction.

49. How ethyl alcohol is prepared from ethane ?

Ethanol is prepared on large scale from ethane by the addition of water vapour to it in the presence of catalysts P_2O_5 , tungsten Oxide at high pressure and temperature.



50. What is $\text{P}k^a$?

$\text{P}k^a$:- $\text{P}k^a$ is the negative value of logarithm of dissociation constant of an acid.
 $\text{P}k^a = \log_{10} K^a$

51. What is Micelle?

Micelle:- A spherical aggregated of soap molecules in water is called micelle.

52. What is saponification reaction?

Saponification reaction:- The sodium salts of these higher fatty acids being soaps the reaction is the soaps the reaction is the soap formation reaction which is generally called as "Saponification reaction".

(or) Alkaline hydrolysis of esters of higher fatty acids producing soaps is called saponification.

53. What are hydrophilic and hydrophobic parts in soaps ?

1. The polar end in soap with carboxy is called hydrophilic end.
2. The non-polar end in soap with hydrocarbon chain is called hydrophobic end.

2 Mark Questions

1. What are the general molecular formula of alkanes, alkenes and alkynes? (AS1) (TQ)

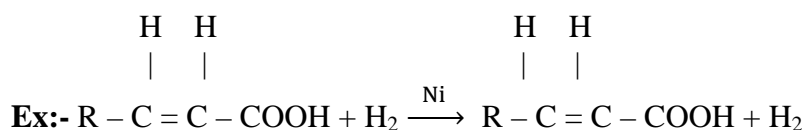
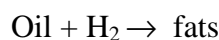
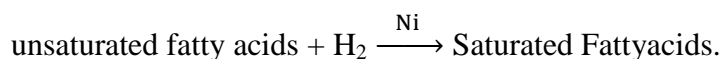
S.No	Hydrocarbon	Formula
1	Alkanes	$C_n H_{2n+2}$
2	Alkenes	$C_n H_{2n}$
3	Alkynes	$C_n H_{2n-2}$

2. A mixture of oxygen and ethyne is burnt for welding; can you tell why a mixture of ethyne and air is not used? (AS1) (TQ)

- The heat and temperature is produced by an acetylene flame depend upon the amount of oxygen used to burn it.
- Air- Acetylene(ethyne) produces a flame temperature around $4000^{\circ}F$.
- This heat is not enough to weld a metals like iron and steel.
- When acetylene is burned in the presence of pure oxygen, the flame temperature may be as high as $5730^{\circ}C$ or $3166^{\circ}C$.
- This heat is enough to weld a metals or solder aluminum work glass.
- Hence the mixture of Ethyne and Oxygen burnt is used for welding.

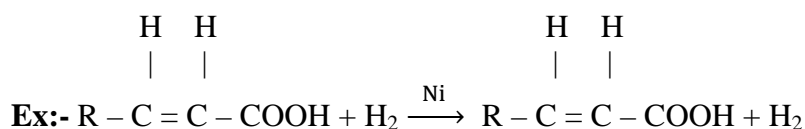
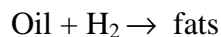
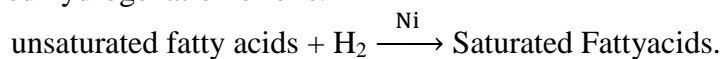
3. How an addition reaction is used in vegetable ghee industry? Explain with the help of a chemical equation? (AS1) (TQ)

- Hydrogenation of oils converts fats in vegetable ghee industry.
- During this addition reaction, unsaturated fatty acids (contain double bond) are converted into saturated fatty acids (contain single bond).



4. Explain with the help of a chemical equation, how an addition reaction is used in vegetable ghee industry? (AS1) (TQ)

- Vegetable oils are unsaturated fats having double bonds between some of their carbon atoms.
- When a vegetable oil is heated t $400-500^{\circ}C$ with hydrogen in the presence of Nickel as catalyst, then saturated oil called vegetable ghee is formed.
- This reaction is called hydrogenation of oils.



5. Why does carbon form compounds mainly by covalent bonding? (AS1) (TQ)

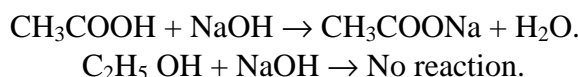
- The atomic number of carbon is 6, its electronic configuration is $1S^2 2S^2 2P^2$.
- Carbon has 4 electrons in its valence shell.
- The formation of C^{4+} ions by losing '4' electrons or the formation of C^{4-} ions by gain of '4' electrons is very difficult process.

11. How do you appreciate the role of esters in everyday life? (AS6)

1. Esters are sweet or pleasant smell substances.
2. Esters are used in preparing artificial perfumes due to the fact that most of the esters have a pleasant smell.
3. The alkaline hydrolysis of esters is known as saponification to produce soaps.
4. These are used in the making of perfumes.
5. Hence, I appreciate the role of esters in everyday life.

12. Suggest a chemical test to distinguish between ethanol and ethanoic acid and explain the procedure? (AS3) (TQ)

1. Take ethanol and ethanoic acid in two different test tubes.
2. Add few ml. of sodium hydroxide (NaOH) solution in each test tube.
3. Ethanoic acid reacts with sodium hydroxide to form salt and water where as ethanol does not react with sodium hydroxide.



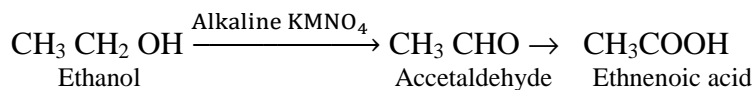
13. An organic compound 'X' with a molecular formula C₂H₆O undergoes oxidation in the presence of alkaline KMnO₄ and forms the compound 'Y', that has molecular formula C₂H₄O₂. (AS3) (TQ)

a. Identify 'X' and 'Y'

b. Write your observation regarding the product when the compound 'X' is made to react with compound 'Y' which is used as a preservative for pickles.

- a. X = Ethanol (C₂H₆O).
Y = Ethanoic acid (C₂H₄O₂).

b. Ethyl alcohol undergoes oxidation to form the product acetaldehyde and finally Acetic acid.



Here CH₃COOH is used as preservative for pickles.

14. Mention the hybridization of carbon in the following compounds.

a) C₂H₄; b) CH₄; c) C₂H₂

S.No	Compound	Type of hybridization
1	C ₂ H ₄	sp ²
2	CH ₄	sp ³
3	C ₂ H ₂	sp

15. Why we are advised not to use animal fats for cooking?

1. Animal fats contain saturated fatty acids. They are harmful to human health.
2. They are not eatable.

Ex:- Palmitic acid (C₁₅ H₃₁COOH)

16. Which oil is recommended for cooking? Why?

1. Natural oil like sun-flower oil, groundnut oil, coconut oils are obtained from natural plants.
2. They are eatable and they contain proteins.
3. They are healthy for human beings.
4. They contain unsaturated fatty acids.

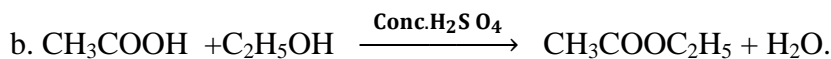
Ex:- Stearic acid (C₁₇ H₃₅COOH).

17. 1ml of acetic acid and 1ml of ethanol are mixed together in a test tube. Few drops of concentrated sulphuric acid is added in the mixture are warmed in a water bath for 5 min.

Answer the following:

- Name the resultant compound formed.
- Represent the above change by a chemical equation.
- What term is given to such a reactions.
- What are the special characteristics of the compound formed?

a. Ethyl acetate(CH₃COOC₂H₅).



c. Esterification.

d. It has fruit (or) pleasant smell.

18. Carbon is versatile in nature. Justify the statement?

The ability of carbon to form bonds in so many ways made it as versatile in nature i.e.,

- To form largest carbon compounds.
- Catenation.
- To form various types of bonds.

19. Define alkanes, alkenes and alkynes ?

Alkanes:- The saturated hydro carbons containing single bonds between carbon atoms are called alkanes.

Alkenes:- The unsaturated hydro carbons containing atleast one double bond between carbon atoms are called Alkenes.

Alkynes:- The unsaturated hydro carbons containing atleast one triple bond between carbon atoms are called Alkynes.

4 Mark Questions

1. Give the IUPAC name of the following compounds. If more than one compound is possible name all of them? (AS1) (TQ)

i. An aldehyde derived from ethane.

ii. A ketone derived from butane.

iii. A chloride derived from propane.

iv. An alcohol derived from pentane.

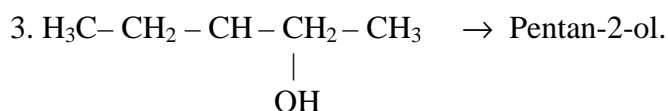
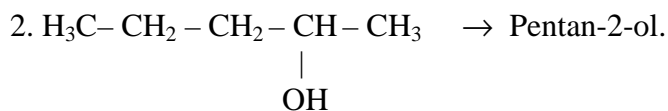
i. $\text{CH}_3\text{CHO} \rightarrow$ Ethanal.

ii. $\text{CH}_3 - \overset{\text{O}}{\parallel}{\text{C}} - \text{CH}_2 - \text{CH}_2 \rightarrow$ 2-Butanone.

iii 1. $\text{H}_3\text{C} - \underset{\text{Cl}}{\text{CH}} - \text{CH}_3 \rightarrow$ 2-Chloro propane.

2. $\text{H}_3\text{C} - \text{CH}_2 - \underset{\text{Cl}}{\text{CH}_2} \rightarrow$ 1-Chloro propane.

iv. 1. $\text{H}_3\text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{OH} \rightarrow$ Pentan-1-ol.



2. a. What are the various possible structure formulae of a compound having molecular formula $\text{C}_3\text{H}_6\text{O}$?

b. Give the IUPAC names of the above possible compounds and represent them in structures?(AS1)

c. What is the similarity in these compounds? (AS1) (TQ)

- a. $\text{C}_3\text{H}_6\text{O}$:-
1. CH_3COCH_3
 2. $\text{CH}_3\text{CH}_2\text{CHO}$
 3. $\text{CH}_2 = \text{CH} - \text{CH}_2\text{OH}$
 4. $\text{CH}_2 - \text{CH} - \text{CH}_3$
 5.
$$\begin{array}{c} \text{OH} \\ | \\ \text{CH} \\ | \\ \text{H}_2\text{C} \quad \text{CH}_2 \end{array}$$
 6. $\text{CH}_2 = \text{CH} - \text{OCH}_3$

- b.
1. $\text{H}_3\text{C} - \underset{\substack{|| \\ \text{O}}}{\text{C}} - \text{CH}_3 \rightarrow \text{Propanone.}$
 2. $\text{H}_3\text{C} - \text{CH}_2 - \underset{\substack{| \\ \text{H}}}{\text{C}} = \text{O} \rightarrow \text{Propanal}$
 3. $\text{CH}_2 - \text{CH} - \text{CH}_2\text{OH} \rightarrow \text{Prop-2-en-1-ol.}$
 4. $\text{CH}_2 - \text{CH} - \text{CH}_3 \rightarrow 1,2\text{-epoxy propane.}$
 5. $\text{CH}_2 = \text{CH} - \text{OCH}_3 \rightarrow \text{Methoxy ethane.}$
 6.
$$\begin{array}{c} \text{OH} \\ | \\ \text{CH} \\ | \\ \text{H}_2\text{C} \quad \text{CH}_2 \end{array} \rightarrow \text{Cyclo propanol}$$

- c. **Similarities:-**
1. The six compounds are derivatives of hydrocarbons i.e., organic compounds.
 2. All are having same molecular formula.
 3. All are functional isomers.

3. Define homologous series of carbon compounds? Mention any two characteristics of homologous series? (AS1) (TQ)

Homologous series:- the series of carbon compounds in which two successive compounds differ by $-\text{CH}_2$ unit is called homologous series.

Characteristics:- 1. They have general formula.

EX:-

S.No	Hydrocarbon	Formula
1	Alkanes	$\text{C}_n \text{H}_{2n+2}$
2	Alkenes	$\text{C}_n \text{H}_{2n}$
3	Alkynes	$\text{C}_n \text{H}_{2n-2}$

- Successive compounds in the series possess a difference of $(-\text{CH}_2)$ unit.
- They possess similar chemical properties due to same functional group.
- They show a regular gradation in their physical properties.

4. Explain the cleansing action of Soap? (AS1) (TQ)

- Suppose that we put dirty cloth in the soap solution. Dirt is mainly greasy matter.

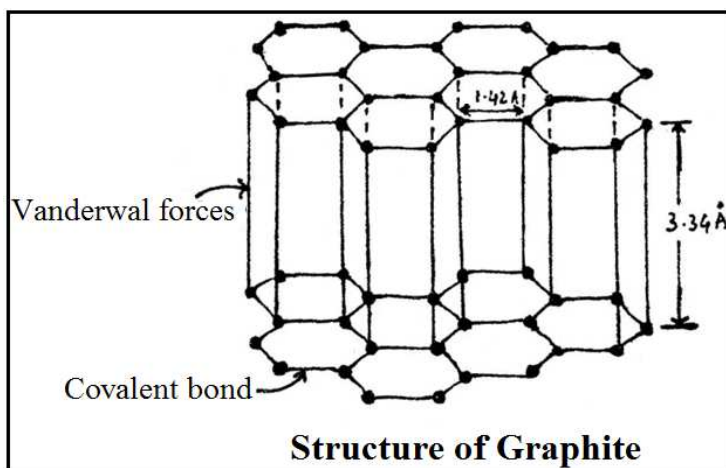


- Soap has one polar end (the end with $-\text{C}-\text{OH}$ carboxyl) and one non-polar end (the end with hydrocarbon chain) as shown here.
- The polar end is hydrophilic in nature and attracted towards water.
- The non-polar end is hydrophobic in nature and attracted towards grease or oil on the cloth, but not towards water.
- When soap dissolves in water, its hydrophobic ends attach themselves to dirt and remove it from cloth, as shown sequentially in the figure.
- The hydrophobic end of the soap molecules move towards the dirt or grease particle.
- The hydrophobic ends attach themselves to dirt particle and try to pull out.
- The molecule of soap surrounds the dirt particles at the centre of the cluster and forms a spherical structure called micelle.
- These micelles remain suspended in water-like particles in a colloidal solution.
- The various micelles present in water do not come together to form a precipitate as each micelle repels. The other because of the ion-ion repulsion.
- Thus, the dirt particles remain trapped in micelles and are easily rinsed away with water. Hence, soap micelles remove dirt by dissolving in water.

5. Distinguish between esterification and saponification reactions of organic compounds? (AS1) (TQ)

Esterification	Saponification
1. The reaction between carboxylic acid and alcohol in the presence of conc. H_2SO_4 to form a sweet odoured substance ester and this process is called esterification.	1. The process of making soap by the hydrolysis of fats and oils with alkalies is called saponification.
2. Alcohol reacts with carboxylic acids to produce esters.	2. Higher fatty acids react with bases to form soaps.
3. $\text{CH}_3\text{COOH} + \text{CH}_3\text{CH}_2\text{OH} \xrightleftharpoons{\text{Conc. H}_2\text{SO}_4} \text{CH}_3\text{COOCH}_2\text{CH}_3 + \text{H}_2\text{O}$	3. $(\text{C}_{17}\text{H}_{33}\text{COO})_3\text{C}_3\text{H}_5 + 3\text{NaOH} \rightarrow 3\text{C}_{17}\text{H}_{33}\text{COONa} + \text{CH}_2\text{OH}-\text{CH}(\text{OH})-\text{CH}_2\text{OH}$
4. Water is byproduct in esterification reaction.	4. Glycerol is byproduct in esterification reaction.
5. This reaction is example for dehydration reaction.	5. This reaction is example for hydrolysis.
5. This reaction is slow and reversible.	5. This reaction is irreversible.
6. This process is used for preparation of different esters.	6. This is used for the preparation of soaps.

6. Explain the structure of Graphite in terms of bonding and give one property based on this structure? (AS1) (TQ)



- Graphite:-**
1. Graphite is a grayish block coloured crystalline solid.
 2. In a graphite the carbon atoms are in hexagonal arrangement.
 3. It has a metallic luster and soapy to touch. So, it is used as a lubricant.
 4. It is a good conductor of electricity.
 5. It has a density of 2.25 gm/cm^3 .
 6. The C-C bond length is 1.42 \AA , and bond angle is 120° .
 7. Two successive graphite layers are separated by a distance of 3.35 \AA .
 8. The layers of carbon can slide one over to the another because there is no strong covalent bonds between the atoms in the two adjacent layers.

7. Suggest a test to find the hardness of water and explain the procedure? (AS3) (TQ)

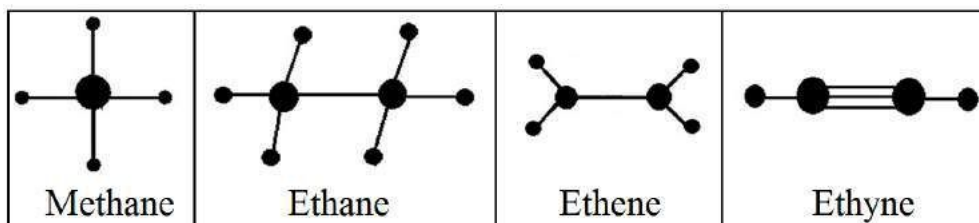
Hard water:- A sample of water which does not give good lather with soap but forms stickly scum(precipitate) is called hard water.

Test:- Hardness of water can be tested with the help of good quality soap.

Procedure:- 1. Take 50ml of water from different sources i.e., tap water, well water, lake water, pond water, river water, etc, in different test tubes and label them as A, B, C, D etc.

2. Add 1gm of good quality soap to each test tube.
3. Close the each test tube with rubber corks.
4. Shake test tube A for 15 seconds and keep it. Undisturbed for 30 seconds.
5. Measure the height of the foam formed. Note the height of form in our notebook.
6. Repeat the process for each test tube and record your observation in your note book.
7. The water which gives less foam is considered as hard water.

8. Prepare a model of methane, ethane, ethene and ethyne molecules using clay balls and match sticks? (AS4) (TQ)



9. How do you condemn the use of alcohol as a social practice? (AS7) (TQ)

- Negative Effects of alcohol:-**
1. Alcohols slow down the activity of nervous system and the brain.
 2. Drinking of alcohol causes the blurred vision, dizziness and vomiting.
 3. Heavy drinking of alcohol makes a person alcoholic.
 4. Heavy drinking of alcohol over a long period of time can damage the stomach, liver and heart.

So, we may condemn the use of alcohols by,

1. Educate people on negative effects of alcohol that would help them to avoid alcohol.
2. Take the initiative of developing by a law that will debar the drinking bar keepers from selling alcoholic beverages.

10. An organic compound with molecular formula $C_2H_4O_2$ produces brisk effervescence on addition of sodium carbonate/bicarbonate. Answer the following? (TQ)

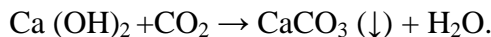
- a. Identify the carbon compound? (AS1)
- b. Name the gas evolved? (AS1)
- c. How will you test the gas evolved? (AS2)
- d. Write the chemical equation for the above reaction? (AS3)
- e. List two important uses of the above compound? (AS1)

a. The organic compound is Ethanoic acid or acetic acid (CH_3COOH).

b. **Chemical Equation:-** $CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + CO_2 + H_2O$

c. The gas evolved is carbon dioxide (CO_2).

d. **Test:-** Pass the evolved gas in to the lime water then it turns to milky white.



e. **Uses:-** 1. It is used as Preservation for pickles.

2. esters are used as solvent in industry.

3. It is used in the Preparation of dyes, drugs.

4. It is used in the cooking of dishes like meat, fish etc.

11. Draw the isomers of C_5H_{12} and C_6H_{14} ?

1. C_5H_{12} :-

a). $CH_3 - CH_2 - CH_2 - CH_3 \rightarrow n - pentane.$

b). $CH_3 - CH - CH_2 - CH_3 \rightarrow 2 - methyl butane.$



c). $CH_3 - C - CH_3 \rightarrow 2, 2 - di methyl pentane.$



2. C_6H_{14} :-

a). $CH_3 - CH_2 - CH_2 - CH_2 - CH_3 \rightarrow n - hexane.$

b). $CH_3 - CH_2 - CH_2 - CH - CH_3 \rightarrow 2 - methyl pentane.$



c). $CH_3 - CH_2 - CH - CH_2 - CH_3 \rightarrow 3 - methyl pentane.$



d). $CH_3 - CH - CH - CH_3 \rightarrow 2,3 - dimethyl butane.$

