Exercise

DIRECTIONS : This section contains multiple choice questions. Each question has 4 choices (a), (b), (c) and (d) out of which only one is correct.

1. The enzyme involved in the oxidation of ethanol to form vinegar is
   (a) zymase
   (b) oxidase
   (c) acetobacter
   (d) invertase
2. Glacial acetic acid is
   (a) 100% acetic acid free of water
   (b) solidified acetic acid
   (c) gaseous acetic acid
   (d) frozen acetic acid
3. Which of the following statements is not correct?
   (a) Graphite is much less dense than diamond
   (b) Graphite is black and soft
   (c) Graphite has low melting point
   (d) Graphite feels smooth and slippery
4. Alkenes are characterized by
   (a) C – C bonds
   (b) C = C bonds
   (c) C ≡ C bonds
   (d) Cyclic structure
5. Ethyl alcohol is used
   (a) as a solvent
   (b) as a fuel in spirit lamps
   (c) as an alcoholic beverage
   (d) All the above are correct
6. A colourless liquid sample was tested with universal pH paper strip. The colour of the strip is changed to reddish pink. The sample would be
   (a) tap water
   (b) sodium hydroxide solution
   (c) distilled water
   (d) ethanoic acid solution
7. Vinegar is a solution of
   (a) 50-60% acetic acid in alcohol
   (b) 5-8% acetic acid in alcohol

(c) 5-8% acetic acid in water
(d) 50-60% acetic acid in water

8. Soaps are
(a) sodium salts of sulphuric acids containing carbon atoms 10 to 16
(b) sodium salts of fatty acids containing carbon atoms 16 to 18
(c) sodium salts of trihydroxy alcohols
(d) None of the above

9. The amount of oxygen used in combustion of 1 mol of ethene is
(a) 1 mol
(b) 2 mol
(c) 2.5 mol
(d) 3 mol

10. Soaps are sodium salts of fatty acids. Which of the following fatty acid does not form soap?
(a) Butyric acid
(b) Oleic acid
(c) Palmitic acid
(d) Stearic acid

11. The oxide of which of the following elements is used as a coolant?
(a) Silicon
(b) Nitrogen
(c) Carbon
(d) Phosphorus

12. Which one of the following is not an allotrope of carbon?
(a) Soot
(b) Graphite
(c) Diamond
(d) Carborundum

13. The soap molecule has a
(a) hydrophilic head and a hydrophobic tail
(b) hydrophobic head and a hydrophilic tail
(c) hydrophobic head and a hydrophobic tail
(d) hydrophilic head and a hydrophilic tail

14. In the soap micelles

(a) the ionic end of soap is on the surface of the cluster while the carbon chain is in the interior of the cluster.
(b) ionic end of soap is in the interior of the cluster and the carbon chain is out of the cluster.
(c) both ionic end and carbon chain are in the interior of the cluster
(d) both ionic end and carbon chain are on the exterior of the cluster

15. Carbon forms four covalent bonds by sharing its four valence electrons with four univalent atoms, e.g. hydrogen. After the formation of four bonds, carbon attains the electronic configuration of
(a) helium
(b) neon
(c) argon
(d) krypton

16. Gas welding used for welding broken pieces of iron, we normally use a mixture of :
(a) ethane and oxygen
(b) ethene and oxygen
(c) ethyne and oxygen
(d) ethene and air

17. Ethene and ethane can be distinguished from each other by :
(a) Blue litmus paper
(b) Red litmus paper
(c) Bromine water
(d) Sodium hydrogen carbonate

18. Four students observed the colour and odour of acetic acid in its reaction with sodium hydrogen carbonate. They tabulated their observations as below :

Student	Colour of acetic acid	Odour of acetic acid	Action with sodium hydrogen carbonate
I	Blue	fruity	gas evolves without bubbles
II	Colourless	smell of vinegar	effervescence
III	Light green	odourless	gas evolves without bubbles
IV	Light brown	rotten egg	effervescence

The correct set of observations is that of student

(a) I
(b) II
(c) III
(d) IV

19. Covalent compounds :
(a) have high melting and boiling points.
(b) are mostly soluble in water.
(c) are formed between atoms of metals and non metals
(d) are formed by the sharing of electrons in the bonding atoms.

20. The by-product of soap is :
(a) Isoprene
(b) Glycerol
(c) Butene
(d) Ethylene glycol

21. When the stopper of a bottle containing a colourless liquid was removed, the bottle gave out a smell like that of vinegar. The liquid in the bottle could be :
(a) hydrochloric acid solution
(b) sodium hydroxide solution
(c) acetic acid solution
(d) saturated sodium hydrogen carbonate solution.

22. Which of the following cannot distinguish ethanol from ethanoic acid ?
(a) Blue litmus
(b) Sodium hydroxide
(c) Sodium hydrogen carbonate
(d) Sodium metal

23. Buckministerfullerene is an allotropic form of

(a) phosphorus
(b) sulphur
(c) carbon
(d) tin

24. We can not use graphite as a lubricant in space because
(a) there is no atmosphere in space and so graphite sublimes in space.
(b) there is no atmosphere in space and so there is no adsorbed air and water between layers of graphite.
(c) absence of external pressure transforms crystalline graphite to amorphous graphite.
(d) None of the above is correct.

25. It is advised that we should not light a candle in a closed room with people, because
(a) the carbon dioxide formed by burning candle causes breathlessness.
(b) carbon particles that are formed due to burning of candle are dangerous for respiratory tract.
(c) methane gas, which is poisonous in nature, is formed when a candle burns.
(d) carbon monoxide gas, which reduces the ability of blood to carry oxygen, is formed when a candle burns.

26. Which of the following attractive forces exists between different layers of graphite ?
(a) Gravitational forces
(b) van der Waals forces
(c) Coulombic forces
(d) None of these

27. Water gas is
(a) $CO + CO_2$
(b) $CO + N_2$
(c) $CO + H_2$
(d) $CO + N_2 + H_2$

28. Nature of products obtained on complete combustion of methane are

(a) acidic, basic
(b) acidic, neutral
(c) basic, neutral
(d) neutral, neutral

29. Main Composition of Liquified Petroleum Gas (LPG) is
(a) n-butane, iso-butane and propane
(b) n-ethane, propane and hexane
(c) Octane, methane and butane
(d) only methane and octane

30. Water gas is a mixture of carbon monoxide with
(a) Nitrogen
(b) Hydrogen
(c) Methane
(d) Ethane

31. Which of the following is obtained from organic wastes?
(a) Natural gas
(b) Oil gas
(c) Gobar gas
(d) Water gas

32. Best variety of coal is
(a) Anthracite
(b) Bituminous
(c) Lignite
(d) Peat

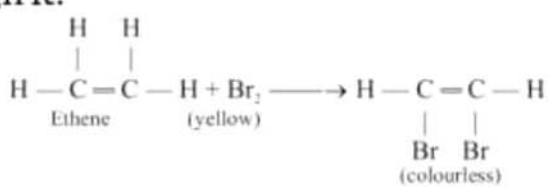
33. Petroleum is also known as
(a) Rock oil
(b) Mineral oil
(c) Crude oil
(d) All of these

Hints & SOLUTIONS

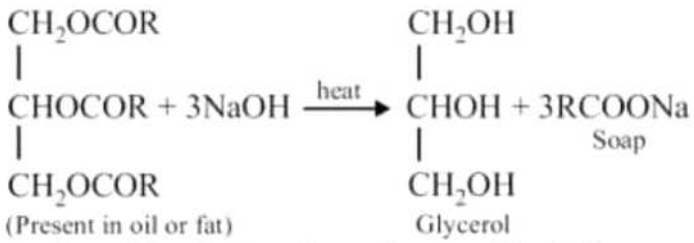
1. (c)
2. (a)
3. (a)
4. (b)
5. (d)
6. (d)
7. (c)
8. (b)
9. (d) $\underset{\underset{CH_2}{||}}{CH_2} + 3O_2 \longrightarrow 2CO_2 + 2H_2O$
10. (a)
11. (c)
12. (d) Carborundum is SiC (silicon carbide).
13. (a)
14. (a)
15. (b)
16. (c) A mixture of ethyne and oxygen is used for gas welding. The reaction is highly exothermic in nature.

    $C_2H_2(g) + 5/2\ O_2(g) \rightarrow 2CO_2(g) + H_2O(l)$ + heat and light

    Ethyne
17. (c) Bromine water will discharge the colour of ethene when the vapours of the gas are passed through it.



    Ethane will not react with bromine water and the colour will not be discharged.
18. (b) This student (II) has made the correct observation. Acetic acid is colourless with vinegar smell. It gives brisk effervescence of carbon dioxide on reacting with sodium hydrogen carbonate.
19. (d) Covalent compounds are formed by the sharing of one or more electrons in the combining atoms. They mostly belong to non-metals.
20. (b) Soaps are formed by the saponification of triesters of glycerol (oils or fats) with alkalies like NaOH or KOH upon heating. Glycerol is formed as by product.



21. **(c)** Acetic acid solution has the smell of vinegar.

22. **(d)** Sodium metal will react with both the acid and alcohol evolving hydrogen gas

$$2CH_3COOH + 2Na \longrightarrow 2CH_3COONa + H_2$$

$$2C_2H_5OH + 2Na \longrightarrow 2C_2H_5ONa + H_2$$

It cannot be used for distinction between acid and alcohol.

23. **(c)**

24. **(a)**

25. **(d)**

26. **(b)**

27. **(c)** Water gas is a mixture of CO and H_2.

28. **(b)** On complete combustion of methane, we get CO_2 (acidic) and H_2O (neutral).

29. **(a)**

30. **(b)**

31. **(c)**

32. **(a)**

33. **(d)**

Chapter 7 Classification of Elements and Periodicity in Properties

MENDELEEV'S PERIODIC TABLE

According to Mendeleev *"the properties of the elements are a periodic function of their atomic masses."*

Merits of Mendeleev's Periodic Table

Mendeleev left some gap for new elements which were not discovered at that time e.g., gallium and germanium were not known at that time.One of the strengths of Mendeleev's periodic table was that, when inert gases were discovered they could be placed in a new group without disturbing the existing order.

Characteristics of the Periodic Table

(i) In the periodic table, the elements are arranged in vertical rows called **groups** and horizontal rows called **periods**.

(ii) There are **eight groups** indicated by Roman Numerals I, II, III, IV, V, VI, VII, VIII. The elements belonging to first seven groups have been divided into **sub-groups** designated as **A** and **B** on the *basis of similarities*. Group VIII consists of nine elements arranged in **three triads**.

(iii) There are **six periods** (numbered 1, 2, 3, 4, 5 and 6). In order to accomodate more elements, the periods 4, 5, 6 are divided into two halves.

Achievements of Mendeleev's Periodic Table

(i) The arrangement of elements in groups and periods *made the study of elements quite systematic.*

(ii) Many gaps were left in this table for undiscovered elements. However, properties of these elements could be predicted in advance from their expected position.

(iii) Mendeleev corrected the atomic masses of certain elements with the help of their expected positions and properties.

Limitations of Mendeleev's Classification

(i) He could not assign a correct position of hydrogen in his periodic table, as the properties of hydrogen resembles both with alkali metals as well as with halogens.

(ii) The isotopes of the same element will be given different position if atomic number is taken as basis, which will disturb the symmetry of the periodic table.

(iii) The atomic masses do not increases in a regular manner in going from one elements to the next.

MODERN PERIODIC LAW

- This law was given by **Henry Moseley** in 1913. It states, "*Properties of the elements are the periodic function of their atomic numbers*".
- The *cause of periodicity* is the resemblance in properties of the elements is the *repetition of the same valence shell electronic configuration.*

Modern Periodic Table

(i) The modern periodic table has 18 vertical columns called "*groups*" and seven horizontal rows called "*periods*".

(ii) The elements belonging to a particular group make a family and usually named after the first member. In a group all the elements contain the same number of valence electrons. e.g., in halogen family all the elements i.e., F, Cl, Br, I have 7 electrons in their valence shell.

(iii) In a period all the elements contain the same number of shells, but as we move from left to right the number of valence shell electrons increases by one unit. The maximum number of electrons that can be accommodated in a shell can be calculated by the formula $2n^2$ where n is

the number of the given shell from the nucleus e.g.

K shell = $2 \times (1)^2 = 2$
L shell = $2 \times (2)^2 = 8$
M shell = $2 \times (3)^2 = 18$
N shell = $2 \times (4)^2 = 32$

Important Characteristics of Groups in a Modern Periodic Table

(i) The elements present in a group are separated by definite gaps of atomic numbers (8, 8, 18, 18, 32)
(ii) There are 18 groups in *long form of periodic table.*
(iii) The elements in a group have the *same valency.*
(iv) The elements present in a group have *identical chemical properties.*

- **Characteristics of periods :** We know that there are **seven periods** in the modern periodic table.
  (i) In all the elements present in a period, the electrons are filled in the valence shell.
  (ii) As the number of electrons in the valence shell change, there also occurs a change in the chemical properties of the elements present in a period.

Merits of Modern Periodic Table Over Mendeleev's Periodic Table

(i) **Position of isotopes :** All isotopes of the same elements have different atomic masses but same atomic number. Therefore, they occupy the same position in the modern periodic table which they should have because all of them are chemically similar.
(ii) **Anomalous pairs of elements :** When elements are arranged in the periodic table according to their atomic numbers the anomaly regarding certain pairs of elements in Mendeleev's periodic table disappears.

(iii) It explains the periodicity of the properties of the elements and relates them to their electronic configurations.

(iv)The table is simple, systematic and easy way for remembering the properties of various elements and moreover lanthanides and actinides are placed separately.

CLASSIFICATION BASED ON DIFFERENTIATING ELECTRON

s-block elements : Those elements of the periodic table in which the last electron enters in s–orbital, are called s-block elements. s-orbital can accommodate a maximum of two electrons. Their general formulae are ns^1 and ns^2 respectively, where n = (1 to 7).

p-block elements : Those elements of the periodic table in which the last electron gets filled up in the p-orbital, called p-block elements. A p-orbital can accommodate a maximum of six electrons.

d-block elements : Those elements of the periodic table in which the last electron gets filled up in the d-orbital, called d block elements.

f-block elements : Those elements of the periodic table in which the last electron gets filled up in the f orbital, called f-block elements. There are 28 f-block elements in the periodic table. The elements from atomic number 58 to 71 are called lanthanides because they come after lanthanum (57). The elements from 90 to 103 are called actinides because they come after actinium (89).

TRENDS IN THE MODERN PERIODIC TABLE

Valency

The combining capacity of an atom or radical is known as its valency. Valency of an element is defined as the number of hydrogen, chlorine and

double the number of oxygen atom with which atom of an element can combine.

Valency in a Period

The number of valence electrons increases in a period from 1 to 8 from left to right. It reaches 8 in group 18 elements (noble gases) which show practically no chemical activity under ordinary conditions and their valency is taken as zero.

Valency in a group : All the elements of a group have the same number of valence electrons. Therefore, they all have the same valency.

Atomic Radii

For an isolated atom atomic radius may be taken as the distance between the centre of nucleus of atom and the outermost shell of electrons.

Variation of atomic radii in a period : In a period there is a gradual increase in the nuclear charge with increase in atomic number. Since valence electrons are added in the same shell since, the electrons in the same shell do not screen each other from the nucleus, the increase in nuclear charge is not neutralised by the extra valence electron. As a result effective nuclear charge increases therefore valence electrons are more and more strongly attracted towards nucleus. This gradually decreases atomic radii across a period.

Variation of atomic radii in a group : In moving down the group the nuclear charge increases with increase in atomic number. However, while going down in a group from one atom to another the number of inner shells also increases, although the number of electrons in the outermost shell remains the same. The effect of increase in the size of the electron cloud (due to increase in number of shells) is more pronounced than the effect of increased nuclear charge. Thus the distance of outermost electron from the nucleus increases as we move down a group. This gradually increases atomic radii along a group.

Ionization Energy

The minimum amount of energy required to remove an electron from a gaseous atom in its ground state to form a gaseous ion is called ionization energy. It is measured in unit of kJ mol^{-1}.

Variation of ionization energy in a group : Force of attraction between valence electrons and nucleus decreases in a group from top to bottom because of increase in atomic size due to addition of inner shells. As a result, the electron becomes less and less firmly held to nucleus as we move down the group. Ionization energy decreases in a group from top to bottom.

Variation of ionization energy in a period : We know that the force of attraction between valence electron and nucleus increases in a period from left to right due to increase in nuclear charge. As a consequence of this, the ionization energy generally increases in a period from left to right.

Electron Affinity

It is the energy change when an electron is accepted by an atom in the gaseous state. It corresponds to the process : $X(g) + e \longrightarrow X^-(g) + E$

Variation of electron affinity in a group : In a group, the electron affinity decreases on moving from top to bottom.

Variation of electron affinity along a period : On moving across a period, the size of atom decreases and nuclear charge increases. Both of these factors result into greater attraction for incoming electron. Thus electron affinity increases in a period from left to right.

Electronegativity

Electronegativity is relative tendency of a bonded atom to attract the bond-electrons towards itself.

Electronegativity generally decreases in a group from top to bottom.

Electronegativity generally increases in a period from left to right.

Metallic and Non-Metallic Character

Characteristic properties of a metal. They are electropositive in nature (the tendency to lose electrons), have luster, ductility, malleability and electrical conductance.

Variation of Metallic Character in a Group

Metallic character of elements increases from top to bottom. As we move down in a group atomic size increases therefore distance between valence electrons and nucleus also increase. Thus electrostatic force of attraction on valence electrons decreases and they can be easily removed.

Variation of Metallic Character in a Period

Metallic character of elements decreases in a period from left to right. As we move from left to right in a period atomic size decreases. Thus electrostatic force of attraction increases for valence electrons thereby decreasing electropositive character.

Exercise

DIRECTIONS : This section contains multiple choice questions. Each question has 4 choices (a), (b), (c) and (d) out of which only one is correct.

1. The early attempt to classify elements as metals and non-metals was made by
   (a) Mendeleev
   (b) Lother Meyer
   (c) Lavoisier
   (d) Henry Moseley
3. Mendeleev classified elements in
   (a) increasing order of atomic groups
   (b) eight periods and eight groups
   (c) seven periods and eight groups
   (d) eight periods and seven groups
4. The long form of periodic table consists of
   (a) seven periods and eight groups
   (b) seven periods and eighteen groups
   (c) eight periods and eighteen groups
   (d) eighteen periods and eight groups
5. All the members in a group in long form of periodic table have the same
   (a) valence
   (b) number of valence electrons
   (c) chemical properties
   (d) All of these
6. An element 'M' has an atomic number 9 and its atomic mass 19. The ion of M will be represented by
   (a) M
   (b) M^{2+}
   (c) M^{-}
   (d) M^{2-}
7. The element with smallest size in group 13 is
   (a) beryllium
   (b) carbon
   (c) aluminium
   (d) boron
8. Which of the following properties generally decrease along a period?
   (a) Atomic size
   (b) Non-metallic character
   (c) Metallic character
   (d) Both (a) and (c)

9. The elements with atomic numbers 2, 10, 18, 36, 54 and 86 are all
   (a) halogen
   (b) noble gases
   (c) noble metals
   (d) light metals
10. The number of elements in the third period of periodic table is
   (a) 2
   (b) 8
   (c) 18
   (d) 32
11. Which of these choices is not a family of elements?
   (a) Halogens
   (b) Metals
   (c) Inert gases
   (d) All of these
12. The element which has least tendency to lose electron is
   (a) H
   (b) Li
   (c) He
   (d) Ne
13. The most metallic element in the fourth period is
   (a) Ca
   (b) K
   (c) S
   (d) P
14. The elements of group sixteen are called
   (a) halogens
   (b) chalcogens
   (c) pnicogens
   (d) noble gases
16. The metal which is hard and has high m.p. and used in electric bulbs is
   (a) Ni
   (b) Pt
   (c) Fe
   (d) W
17. The lightest liquid metal is

(a) Hg
(b) Ga
(c) Cs
(d) Fr

18. Which is not true about noble gases?
(a) They are non-metallic in nature
(b) They exist in atomic form
(c) They are radioactive in nature
(d) Xenon is the most reactive among them

19. Elements of which group form anions most readily?
(a) Oxygen family
(b) Nitrogen family
(c) Halogens
(d) Alkali metals

20. Which of the following is not a representative element?
(a) Fe
(b) K
(c) Ba
(d) N

21. On moving horizontally across a period, the number of electrons in the outermost shell increases from ..... to ..... .
(a) 2, 8
(b) 2, 18
(c) 1, 8
(d) 1, 18

22. Which one of the following is most electropositive element?
(a) Sodium
(b) Calcium
(c) Aluminium
(d) Silicon

23. As you move down the group, the alkali metals become
(a) brighter
(b) hotter
(c) more reactive
(d) less reactive

24. Which is a metalloid?

(a) Pb
(b) Sb
(c) Bi
(d) Zn

25. The scientist who made maximum contribution towards periodic table was
(a) Chadwick
(b) Rutherford
(c) Dalton
(d) Mendeleev

26. In the modern periodic table, the period indicates the value of
(a) atomic number
(b) atomic mass
(c) main energy level
(d) atomic size

28. Which one of the following elements have maximum number of valence electrons?
(a) Na
(b) Al
(c) Si
(d) P

29. Which of the following elements does not lose an electron easily?
(a) Na
(b) F
(c) Mg
(d) Al

34. Which of the given elements A, B, C, D and E with atomic number 2, 3, 7, 10 and 30 respectively belong to the same period?
(a) A, B, C
(b) B, C, D
(c) A, D, E
(d) B, D, E

35. An element which is an essential constituent of all organic compounds belongs to
(a) group 1
(b) group 14
(c) group 15
(d) group 16

36. Which of the following gives the correct increasing order of the atomic radii of O, F and N ?
(a) O, F, N
(b) N, F, O
(c) O, N, F
(d) F, O, N

37. Which of the following are the characteristics of isotopes of an element?
(i) Isotopes of an element have same atomic masses
(ii) Isotopes of an element have same atomic number
(iii) Isotopes of an element show same physical properties
(iv) Isotopes of an element show same chemical properties
(a) (i), (iii) and (iv)
(b) (ii), (iii) and (iv)
(c) (ii) and (iii)
(d) (ii) and (iv)

39. The element with atomic number 14 is hard and forms acidic oxide and a covalent halide. To which of the following categories does the element belong?
(a) Metal
(b) Metalloid
(c) Non-metal
(d) Left-hand side element

40. Which of the following properties donot match elements of halogen family ?
(a) They have seven electrons in their valence shell
(b) They are diatomic in their molecular form
(c) They are highly reactive chemically
(d) They are metallic in nature

41. Which of the following sets of elements belongs to halogen family ?
(a) 1, 12, 30, 4, 62
(b) 37, 19, 3, 55
(c) 9, 17, 35, 53
(d) 12, 20, 56, 88

42. Which of the following is not isoelectronic with O^{2-}?
(a) N^{3-}
(b) Na^{+}
(c) F^{-}
(d) Ti^{+}

43. The correct order of the increasing radii of the elements Na, Si, Al and P is :
(a) Si, Al, P, Na
(b) Al, Si, P, Na
(c) P, Si, Al, Na
(d) Al, P, Si, Na

45. Hydrogen has three isotopes ^{1}H, ^{2}H and ^{3}H respectively.
On what is the basis of these elements were placed in modern periodic table ?
(a) Atomic mass
(b) Atomic number
(c) Both (a) and (b)
(d) We can't say

Hints & SOLUTIONS

1. **(c)**

3. **(c)** Mendeleev's periodic table consists of eight groups only while modern periodic table consist of eighteen groups.

4. **(b)**

5. **(d)** Because of the presence of same number of valence electrons the elements of same group have similar chemical properties.

6. **(c)** The electronic configuration of M is 2, 7. It needs one electron to complete its octet. It has a strong tendency to gain 1 electron and so its ion will be M^-.

7. **(d)** In group 13, boron is above aluminium. Rest of elements not belong to group 13.

8. **(d)** As atomic size decreases along a period valence electrons becomes more firmly held with nucleus. Thus more amount of energy is required to remove valance electrons which reduces metallic character

9. **(b)** All these are noble gases with completely filled outermost shell.

10. **(b)**

11. **(b)** A family of elements consists of elements present in a group of the periodic table.

12. **(c)**

13. **(b)** The fourth period contains elements with atomic number 19 to 36. K (Z = 19) is the first member and so it is most metallic.

14. **(b)** Elements of oxygen family are known as chalcogens.

16. **(d)** Tungsten (W) is used in electric bulbs.

17. **(c)** Cs is a metal. It is liquid at room temperature. It is lighter than Hg (also a liquid metal).

18. **(c)** Only Radon (Rn) is radioactive whereas other noble gases (i.e., He, Ne, Ar, Kr, Xe) are non-radioactive.

19. **(c)** Halogens are most electronegative elements i.e., they are likely to form anions most readily.

20. **(a)** Fe is a transition element.

21. **(c)**

22. **(a)** Alkali metals are most electropositive in their respective period. i.e. they have maximum tendency to lose electron and form a cation.

23. **(c)**

24. **(b)**

25. **(d)**

26. **(c)**

28. **(d)** P is in group 5 and has 5 valence electron. Number of valence electrons in Na, Al and Si are 1, 3 and 4.

29. **(b)** F has a tendency to gain an electron.

34. **(b)**

35. **(b)**

36. **(d)**

37. **(d)**

39. **(b)**

40. **(d)** The members of the halogen family are non-metallic in nature. However, iodine and astatine are crystalline solids and have lustre just like metals.

41. **(c)** The element with atomic number (Z = 9) is Fluorine (F). It is a halogen. The rest of the elements also belong to the same group since they have definite gaps of atomic numbers as is expected in a group.

Elements:	9,	17	35	53		
Gap	:	8	18	18		

42. **(d)** Isoelectronic species have same number of electrons. N^{3-}, Na^{+} and F^{-} all have ten electrons just like O^{2-}. However, Ti^{+} (Z = 22) has twenty one (21) electrons.

43. **(c)** All the elements belong to third period. The atomic radii decrease along a period. The correct decreasing order is :

Na, Al, Si, P. The correct increasing order is the reverse.

45. **(b)**

Section : BIOLOGY

Chapter 1

Cell & Tissues

CELL BIOLOGY

Biology is the science of life. Biologist study the structure, function, growth, origin, evolution and distribution of living organism.

Father of biology & zoology: Aristotle

Father of Botany : Theophrastus.

Cell

Cell is a basic structural and functional unit of life.

- **Robert Hooke** in 1665 coined the word 'cell'.
- **Anton van Leeuwenhoek** first saw and described a live cell.
- **Robert Brown** later discovered the nucleus.
- Cell theory was proposed by **Schleiden and Schwann** in 1839 to explain the concept of the cellular nature of living organism.

Note : Every cell originates from pre-existing cell.

Cells are of 2 types: Prokaryotic cell and Eukaryotic cell

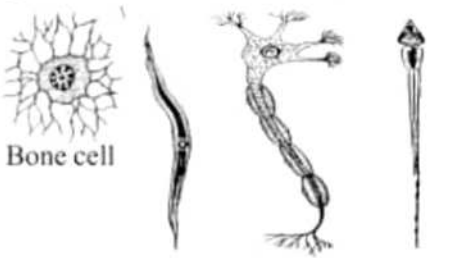
Difference between Prokaryotes and Eukaryotes.

	Prokaryotes		Eukaryotes
1	Size of cell is generally small.	1	Size of cell is generally large.
2	It contains single chromosome which is circular in shape.	2	It contains more than one chromosomes.
3	Nucleus absent.	3	Nucleus present
4	Cell division takes place by fission or budding.	4	Cell division takes place by mitosis and meiosis.
5	Membrane bound cell organelles are absent.	5	Membrane bound cell organelles present.

- A tissue is a group of cells of similar structure and function arranged in the body so as to give the highest possible efficiency to the function they perform.
- All living organisms are made up of cells. In unicellular or acellular organisms a single

cell may constitutes a whole organism. *E.g. Amoeba, Chlamydomonas.* In multicellular organisms many cells group together in a single body and assume different functions. *E.g.* fungi, plants.

- Various cells of human body vary in structure according to their function.



Various cells from the human body

- Each living cell perform certain basic functions that are characteristic of all living forms.

Structural Organisation of a Cell

(i) Plasma membrane or Cell membrane

It is the outermost covering of the cell which separates the contents of the cell from its external environment. It allows entry and exit of only certain materials so it is also called selectively permeable membrane. CO_2 and O_2 move across the membrane through *diffusion.*

It is made up of lipids and proteins. Fluid Mosaic Model of Plasma membrane was proposed by **Singer** and **Nicolson**.

Diffusion — It is the movement of a substance from a region of higher concentration to a region of lower concentration.

Osmosis — It is the movement of water through a selectively permeable membrane from a region of high water concentration to a region of low water concentration.

Fate of animal or plant cell in Hypertonic, Hypotonic and Isotonic solution

- **Hypertonic solution** — The concentration of solution is more than that of cell. Therefore, the cell will loose water by exosmosis and shrink.
- **Hypotonic solution** — The concentration of solution is less than that of cell. Therefore, the cell will gain water by endosmosis and swell up.
- **Isotonic solution** — The concentration of solution is same as that of cell. Therefore, there will be no movement of water, and cell size will remain same.

Functions : (i) It separates contents of the cell from external environment.

(ii) It helps in engulfing food by endocytosis as in *Amoeba*.

(ii) Cell wall

It is outermost covering which lies outside the plasma membrane. Plant cell wall is composed of a complex substance cellulose which provides structural strength to plants. Due to cell wall, plants, fungi and bacteria withstand much greater changes in the surrounding medium than animal cell. It is absent in animal cell.

Plasmolysis : Shrinking of protoplasm of a cell due to exosmosis when kept in hypertonic solution.

Functions : (i) It provides rigidity and strength to the cell.

(ii) It helps to sustain during unfavourable conditions.

(iii) Nucleus

It is the dark coloured, spherical or oval structure near the centre of a cell. It has a double layered covering called nuclear membrane Nu-

cleus contains hereditary material called chromosomes.

Functions : (i) It plays an important role in cellular reproduction.

(ii) It plays an important role in inheritance of characters from parents to the offsprings.

- **Cytoplasm :** A large region of each cell enclosed by the cell membrane. It contains many specialised cell organelles which perform specific functions for the cell.

(iv) Endoplasmic Reticulum (ER)

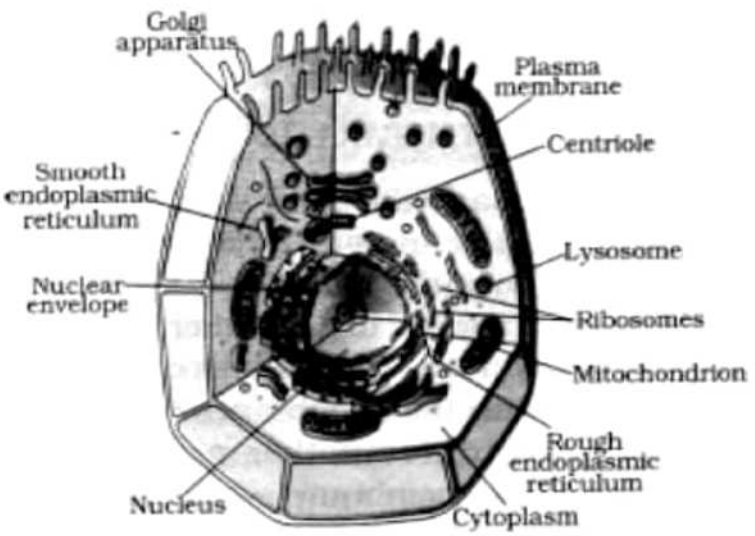
It is a large network of membrane - bound tubules. It is two types-

(a) **Rough endoplasmic reticulum (RER)**- contains ribosomes attached to its surface. Ribosomes are site of protein synthesis.

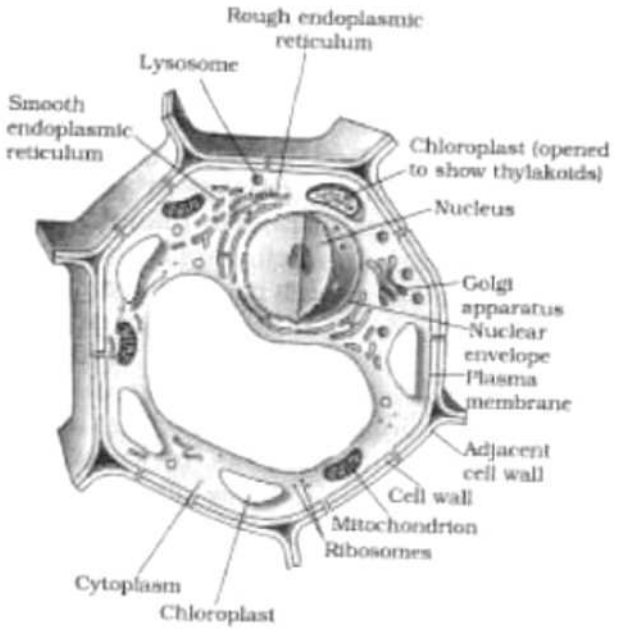
(b) **Smooth endoplasmic reticulum (SER) –** It helps in manufacture of fats and lipids.

Functions: (i)It act as a channel for transport of materials within cytoplasm or between cytoplasm and nucleus.

(ii) In liver cells of vertebrates, SER detoxifies poisons and drugs



Animal cell



Plant cell

(v) Golgi apparatus

Discovered by **Camillo Golgi**. It consists of membrane bound vesicles arranged parallel to each other in stacks called cisternae, connected with ER.

Functions : (i) It helps in transport of substances synthesised near ER inside and outside the cell.

(ii) It helps in storage, modification and packaging of products in vesicles.

(vi) Lysosomes

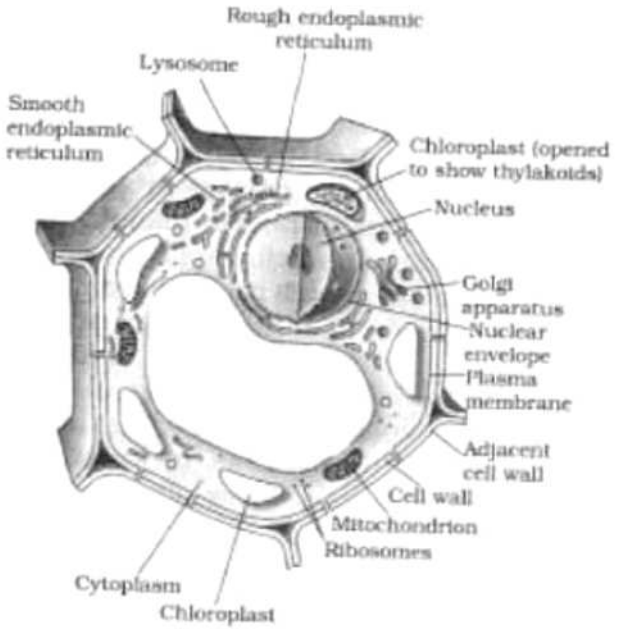
These are membrane bound sacs filled with digestive enzymes. When cell gets damaged, lysosomes burst and enzymes digest their own cell. So, they are also called **"suicide bags"** of a cell.

Functions: It keeps the cell clean by digesting foreign materials and old worn-out cell organelles.

(vii) Mitochondria

These are double membrane bound organelles. The outer membrane is porous while the inner membrane is deeply folded providing large surface for ATP– generating chemical reactions. So, they are also called **"Power houses"** of the cell. Mitochondria have its own DNA and ribosomes.

Functions : It helps in ATP and Protein synthesis.



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(viii) Plastids

They are present only in plant cells. They are two types – Chromoplasts (coloured plastids) and Leucoplasts (white plastids). Plastids that contain green colour pigment, chlorophyll are called chloroplasts. They also have their own DNA and ribosomes.

Functions: (i) Chloroplasts play an important role in photosynthesis in plants.

(ii) Leucoplasts store starch, oil and protein granules.

(ix) Vacuoles

These are storage sacs for solid or liquid contents. They are small sized in animal cell and large sized in plant cells.

Functions : (i) Vacuoles provide turgidity and rigidity to the cell.

(ii) Contractile vacuoles help in expelling excess water and wastes in some animals.

- Cells specialising in one function is carried out by a cluster of cells at a definite place in the body called a **tissue**. Blood, phloem and muscle are all example of tissues.

Difference between Plant and Animal Cells

	Plant Cell		Animal Cell
1	Plant cells are larger in size.	1	Animal cells are generally smaller in size.
2	Plastid present.	2	Plastid absent.
3	Cell wall present, made up of cellulose and chitin.	3	Cell wall absent.
4	Centrosome absent.	4	Centrosome present.
5	Vacuoles are larger in size.	5	Vacuoles are smaller in size.

TISSUE

- **Are plants and animals made of same types of tissues :**

(i) Plants are stationary, adopted for sedentary mode of life while animals live active locomotive life.