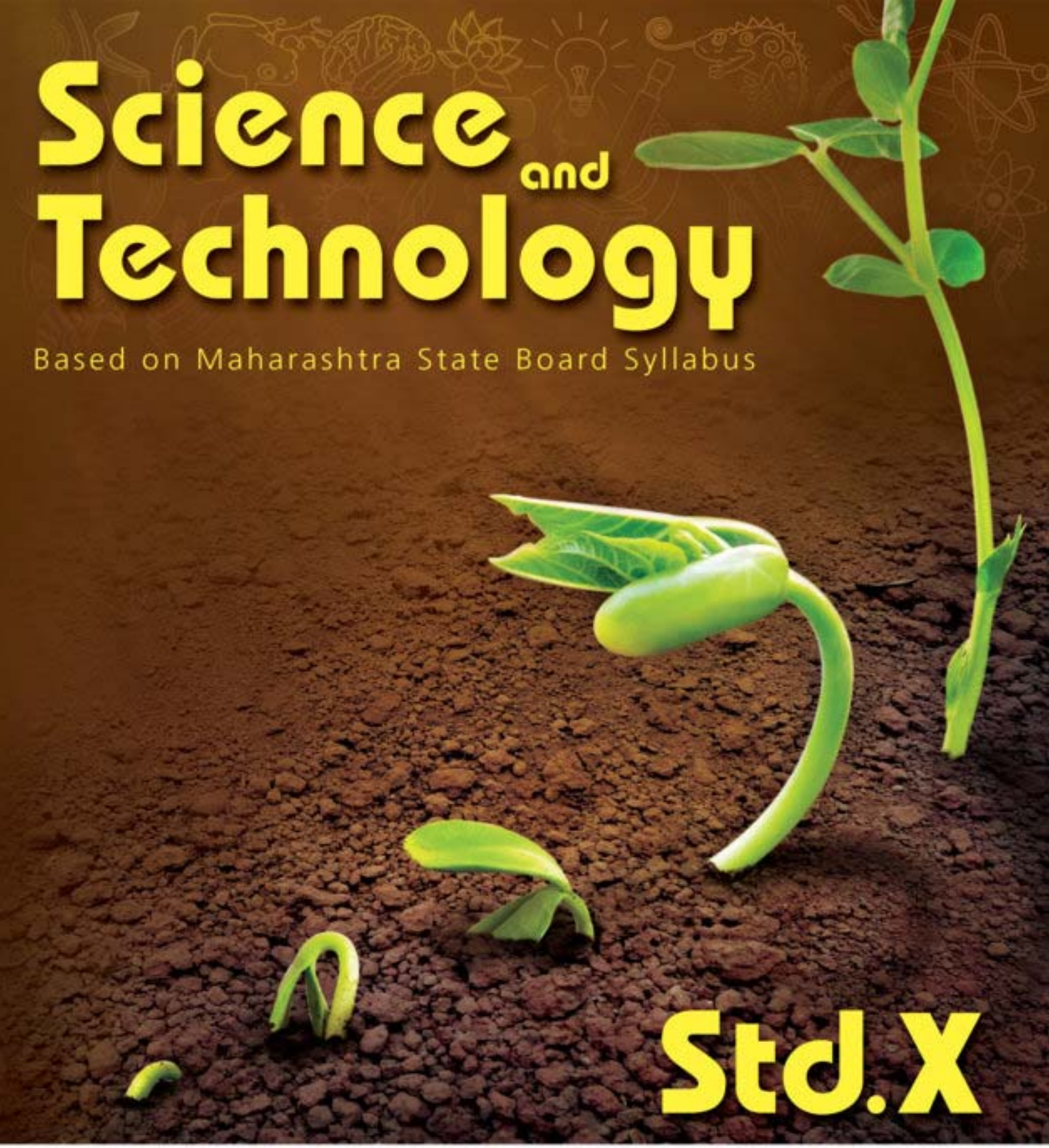
Science and Technology

Based on Maharashtra State Board Syllabus



Std.X

Std. 10th Science and Technology – English Medium

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As Per New Syllabus

Std. X

Science and Technology

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PREFACE

In the case of good books, the point is not how many of them you can get through, but rather how many can get through to you.

Science is the observation, identification, experimental investigation and theoretical explanation of phenomenon. It is the study of physical, chemical and biological aspects of natural phenomenon. It deals with inherent properties of space, matter, energy and their interactions.

Technology is the application of scientific knowledge for the benefit of mankind. It includes the use of materials, tools, techniques and knowledge to make life more pleasant and work more productive. Whereas science is concerned with how things happen, technology focuses on making things happen.

The study of Science and technology requires a deep and intrinsic understanding of concepts. Hence to ease this task we bring to you **"Std. X: Science and Technology"** a complete and thorough guide extensively drafted to boost the students confidence. The topicwise question and answer format of this book helps the student to understand each and every concept thoroughly. It includes all the important definitions, laws and formulae. Neat and labelled diagrams are provided wherever necessary. Numerical problems at the end of related topics help the student to understand the technique of solving numerous problems efficiently.

And lastly, I would like to thank all those who have helped me in preparing this book. There is always room for improvement and hence we welcome all suggestions and regret any errors that may have occurred in the making of this book.

A book affects eternity; one can never tell where its influence stops.

Best of luck to all the aspirants!

From

Publisher

Contents

Note: Textual Questions are represented by * marks.
Intext Questions are represented by # mark.

01 School of Elements

Rewrite the following statements by selecting the correct option

1.0 Introduction

1. Elements were classified as metals and non-metals based on their _____
   (A) properties (B) physical states
   (C) atomic numbers (D) atomic weights

1.1 Dobereiner's Triads

2. _____ found some groups of three elements which showed similar properties.
   (A) Moseley **(B) Dobereiner**
   (C) Newland (D) Mendeleev

3. In Dobereiner's triads, atomic mass of the middle element was approximately the mean of the _____ of the other two elements.
   (A) atomic masses (B) atomic weights
   (C) valencies (D) atomic sizes

4. Johann Wolfgang Dobereiner was a/an _____ scientist (1780 – 1849).
   (A) Italian (B) British
   (C) American **(D) German**

5. Dobereiner studied chemistry at _____
   (A) London (B) Japan
   (C) Strasbourg (D) India

1.2 Newlands' Octaves

6. _____ elements were discovered at the time of Newlands' classification of elements.
   (A) 46 (B) 50
   (C) 56 (D) 60

7. Newlands' arranged the elements in increasing order of their _____
   (A) atomic numbers **(B) atomic masses**
   (C) atomic size (D) atomic volumes

8. According to Newlands' octaves, the properties of the eighth element is similar to the _____ element.
   (A) first (B) second
   (C) fourth (D) sixth

9. Newlands' could arrange elements only upto _____ out of the total 56 elements known.
   (A) potassium (B) magnesium
   (C) calcium (D) sodium

10. Newlands' periodic table did not include _____ gases as they were not discovered.
    (A) inert (B) real
    (C) ideal (D) poisonous

1.3 Mendeleev's Periodic Table

11. _____ created the first periodic table containing all the known elements at that time.
    (A) Moseley (B) Newlands'
    (C) Dobereiner **(D) Mendeleev**

12. Mendeleev's periodic law is based on _____
    (A) atomic number **(B) atomic mass**
    (C) atomic valency (D) atomic size

13. Mendeleev arranged _____ elements in his periodic table.
    (A) 116 (B) 65
    (C) 63 (D) 108

14. The _____ rows in the periodic table are called periods.
    (A) elliptical (B) vertical
    (C) horizontal (D) diagonal

15. There was no fixed position for _____ in the Mendeleev's periodic table.
    (A) oxygen (B) calcium
    (C) hydrogen (D) scandium

16. The element Eka-boron in Mendeleev's periodic table is now known as _____
    (A) Scandium (B) Uranium
    (C) Gallium (D) Germanium

1.4 Modern Periodic Table

17. _____ discovered that atomic number is the most fundamental property of an element, and not its atomic mass.
    (A) Moseley (B) Newlands
    (C) Dobereiner (D) Mendeleev

18. Atomic number is the number of _____ present in the nucleus of an atom.
    (A) electrons **(B) protons**
    (C) neutrons (D) particles

19. The _____ period in modern periodic table is the shortest period containing only 2 elements.
    (A) seventh (B) second
    (C) first (D) sixth

20. Second and third period of modern periodic table contain _____ elements each.
(A) 7 **(B) 8**
(C) 9 (D) 10

21. Fourth and _____ period of modern periodic table contain 18 elements each.
(A) sixth (B) seventh
(C) fifth (D) third

22. _____ is the longest period in modern periodic table which contains 32 elements.
(A) Fourth period (B) Fifth period
(C) Sixth period (D) Seventh period

23. _____ is an incomplete period.
(A) Seventh period (B) Fourth period
(C) Sixth period (D) Fifth period

24. _____ is on the extreme right of the periodic table which contains inert gases.
(A) Group 9 (B) Group 17
(C) Group 18 (D) Group 16

25. The outermost shell of inert gases contain _____ electrons, except helium.
(A) 3 (B) 6
(C) 4 **(D) 8**

26. Elements present in group 3 to 12 are called _____
(A) normal elements
(B) transition elements
(C) inner-transition elements
(D) rare earth elements

27. Modern periodic table is divided into _____ blocks.
(A) six **(B) four**
(C) eight (D) two

28. Elements of group 1 and 2 are called _____ elements.
(A) s - block (B) p - block
(C) d - block (D) f - block

29. _____ contains all types of elements – metals, non-metals and metalloids.
(A) s - block **(B) p - block**
(C) d - block (D) f -block

30. _____ elements are all gases.
(A) 0 group (B) 1 group
(C) 2 group (D) 3 group

31. Inert elements are _____
(A) solids (B) liquids
(C) semi - solids **(D) gases**

32. Elements present at the bottom of the periodic table are called as _____ elements.
(A) f-block (B) p-block
(C) d-block (D) s-block

33. d-block elements and f-block elements are _____
(A) metalloids **(B) metals**
(C) non-metals (D) none of these

34. In a period, atomic radius generally _____
(A) decreases from right to left
(B) decreases from left to right
(C) increases from left to right
(D) remains same

35. In a group, atomic radius _____
(A) decreases from top to bottom
(B) increases from bottom to top
(C) increases from top to bottom
(D) remains same

36. _____ is a metalloid.
(A) Boron (B) Helium
(C) Calcium (D) Radon

37. _____ is the first element in group 14.
(A) Boron (B) Helium
(C) Carbon (D) Silicon

38. In a period, metallic character _____
(A) decreases from left to right
(B) decreases from right to left
(C) increases from left to right
(D) remains same

39. In a period, non - metallic character _____
(A) decreases from left to right
(B) increases from right to left
(C) increases from left to right
(D) remains constant

40. _____ elements contain 3 to 8 electrons in their outermost shell.
(A) s-block (B) d-block
(C) p-block (D) f-block

41. Lanthanides contain _____ elements.
(A) 12 (B) 10
(C) 8 **(D) 14**

42. 14 elements with atomic numbers 90 to 103 are called _____
(A) lanthanides **(B) actinides**
(C) halogens (D) inert gases

43. f-block elements have _____ outermost shells incomplete.
(A) one (B) two
(C) three (D) four

Fill in the Blanks

1.0 Introduction

1. _____ can exist in the form of elements, compounds and mixtures.

1.1 Dobereiner's Triads

*2. The arrangement of elements in a group of three is known as _____

3. The atomic mass of _____ is the mean of the atomic mass of lithium and potassium.

4. _____ could find only some triads from the elements known.

5. Dobereiner became the professor of chemistry and pharmacy at the University of _____

1.2 Newlands' Octaves

*6. The law used by Newlands to arrange elements is known as _____ **[Mar 2013]**

7. After _____ , every eighth element did not possess properties similar to that of the first.

8. Newlands' periodic table did not include _____ elements.

1.3 Mendeleev's Periodic Table

9. There are _____ periods in Mendeleev's periodic table.

*10. The element Eka-aluminium in Mendeleev's periodic table is known as _____ in the modern periodic table.

11. The Element Eka-silicon in Mendeleev's periodic table is known as _____ in the modern periodic table.

12. _____ periodic table had vacant places for elements that were to be discovered.

13. In Mendeleev's periodic table element _____ is placed with halogens which totally differ in the properties.

1.4 Modern Periodic Table

14. The tabular arrangement of elements based on Modern periodic law is called the _____ periodic table.

15. Elements in the modern periodic table are classified on the basis of their _____

*16. _____ group in the periodic table contains elements that are all gases at room temperature.

17. In 1913, Moseley discovered that _____ is the fundamental property of an element and not its atomic mass.

*18. The formula of chloride of metal M is MCl_2. The metal M belongs to _____ group.

19. The Modern periodic table is also called as _____ form of periodic table.

*20. Elements showing properties of both metals and non – metals are known as _____

21. All _____ of the same elements have different masses but same atomic number.

22. The vertical columns in the Modern periodic table are called as _____

23. Elements present in the same _____ show same chemical properties.

24. _____ in modern periodic table contains halogens.

25. _____ elements have their last two shells incompletely filled.

26. _____ elements contain two series of elements lanthanides and actinides.

27. Lanthanides and actinides are _____ block elements.

28. s-block and p-block elements have outermost shell incomplete except _____ elements.

29. _____ of an element is determined by the number of valence electrons present in the outermost shell of an atom.

30. _____ is the distance between the centre of atom and the outermost shell.

31. Metals show tendency to lose _____

32. _____ show tendency to accept or share electrons with other atoms.

33. Metals are said to be _____

34. Non-metals are said to be _____

Answers:

1. Matter
2. triads
3. sodium
4. Dobereiner
5. Jena
6. Newlands' Octaves
7. calcium
8. inert gas

9.	seven	10.	Gallium
11.	Germanium	12.	Mendeleev's
13.	manganese	14.	modern
15.	electronic configuration		
16.	0 or 18		
17.	atomic number	18.	2^{nd}
19.	long	20.	metalloids
21.	isotopes	22.	groups
23.	group	24.	Group 17
25.	Transition	26.	Inner transition
27.	f	28.	0 group
29.	Valency	30.	Atomic radius
31.	electrons	32.	Non-metals
33.	electropositive	34.	Electronegative

Answer the following questions in one sentence each

1.1 Dobereiner's Triads

1. Why was Dobereiner's classification of elements not useful?

Ans: Dobereiner's classification of elements was not useful because he could identify only some triads from the known elements, as other triads did not obey the rule.

1.2 Newlands' Octaves

2. Who gave the octave rule for classification of elements?

Ans: Newlands gave the octave rule for classification of elements.

1.3 Mendeleev's Periodic Table

3. Who examined the relationship between the atomic masses of the elements and their properties?

Ans: Mendeleev examined the relationship between the atomic masses of the elements and their properties.

4. What is Mendeleev's periodic table?

Ans: The tabular arrangement of the elements in the increasing order of their atomic masses, based on Mendeleev's periodic law, is called Mendeleev's periodic table.

1.4 Modern Periodic Table

5. Who was Moseley?

Ans: Moseley was an English physicist who gave the modern periodic table based on atomic number.

6. How many periods are present in the modern periodic table?

Ans: Seven periods are present in the modern periodic table.

7. How many groups are present in the modern periodic table?

Ans: 18 groups are present in the modern periodic table.

8. Elements of which group are called as alkali metals?

Ans: Elements of group 1 (or I A) are called alkali metals.

9. Elements of which group are called as alkaline earth metals?

Ans: Elements of group 2 (or II A) are called alkaline earth metals.

10. Which is the incomplete period in the modern periodic table?

Ans: Seventh period is the incomplete period in the modern periodic table.

11. Elements of which group are halogens?

Ans: Elements of group 17 (or VII A) are halogens.

12. Elements of which group are inert gases?

Ans: Elements of group 18 (or zero group) having valency zero are inert gases.

13. Which law was modified into modern periodic law?

Ans: Mendeleev's periodic law was modified into modern periodic law.

14. How many electrons are present in the outermost orbit of inert elements?

Ans: Eight electrons are present in the outermost orbit of inert elements, except helium which has two electrons in the outermost orbit.

15. How many elements are there in shortest and long period?

Ans: There are two elements in shortest (first) period and eighteen elements in long (fourth and fifth) period.

16. To which period do actinides and lanthanides belongs?

Ans: Actinides belong to 7^{th} period and lanthanides belong to 6^{th} period.

17. What are periodic properties?

Ans: The properties which show gradual variation in a group and in a period and they repeat themselves after a certain interval of atomic number are called periodic properties.

Answer the following questions

1.0 Introduction

1. How were elements classified in earlier days? Which problems made the classification difficult?

Ans:
i. In earlier days, very few elements were known. They were classified as metals and non-metals on the basis of their properties.
ii. Later, some more elements were discovered which showed the properties of both metals and non-metals. Thus, it became difficult to place them in the group of metals or non-metals.

1.1 Dobereiner's Triads

2. State the features of Dobereiner's triads.

Ans: Features of Dobereiner's triads:
i. It was the first attempt to classify elements based on their properties.
ii. Properties of elements in each triad remains same.
iii. Atomic masses are arranged in increasing order in each triad.
iv. Atomic mass of middle element in each triad was approximate the mean of atomic masses as compared to other two elements of triad.

3. State the demerits of Dobereiner's triads.

Ans: Demerits of Dobereiner's triads:
i. All the known elements were not classified into triads. Only some triads obeyed Dobereiner's rule.
ii. Sometimes there was a large difference between the atomic mass of the middle element and the mean of other two elements in a triad.

1.2 Newlands' Octaves

4. What were the demerits of Newlands' Octaves?

Ans: Demerits of Newlands' Octaves:
i. Out of the 56 elements known, Newlands arranged the elements only upto calcium.
ii. After calcium, every eighth element did not possess similar properties to those of the first.
iii. Newlands thought that only 56 elements existed, but later several elements were discovered.
iv. In order to fit the existing elements, Newlands placed two elements in the same position which differed in their properties.
v. Newlands' periodic table did not include inert gases because they were not discovered.

1.3 Mendeleev's Periodic Table

5. Why was atomic mass considered most fundamental in Mendeleev's periodic table?

Ans:
i. Mendeleev examined the relationship between atomic masses of elements and their physical and chemical properties.
ii. By analysing the compounds of oxygen and hydrogen, Mendeleev believed that atomic mass of element is the most fundamental property in classifying elements.
iii. Thus, he arranged the elements in the increasing order of their atomic masses and found repetition in their properties after certain intervals.

6. How did Mendeleev arrange all the known elements in a periodic table?

Ans:
i. Mendeleev arranged all the known elements in a tabular form in the increasing order of their atomic masses.
ii. He found that the chemical and physical properties of elements showed repetition after certain intervals.
iii. He arranged known elements in the increasing order of their atomic masses in horizontal rows till he encountered an element which had properties similar to the first element.
iv. He placed this element below the first element and thus started the second row of elements. Proceeding in this manner he could arrange all known elements according to their properties and thus created the first periodic table containing 63 elements known till then.

7. State the features of Mendeleev's periodic table?

Ans: Features of Mendeleev's periodic table:
i. The horizontal rows in the periodic table are called periods. There are seven periods numbered form 1 to 7.
ii. Properties of elements in a particular period show regular gradation from left to right.

iii. Vertical columns in the periodic table are called groups. There are eight groups numbered from I to VIII. Groups I to VII are further divided into A and B subgroups.

8. State the merits of Mendeleev's periodic table.

Ans: Merits of Mendeleev's periodic table:

i. Mendeleev was the first to successfully classify all known elements.

ii. Mendeleev's periodic table had some blank places in it. These vacant spaces were for elements that were yet to be discovered.

iii. Mendeleev's periodic table predicted properties of these elements even before they were discovered, which were found to be correct later.

iv. When noble gases were discovered later, they were placed in Mendeleev's periodic table without disturbing the position of other elements.

***9. What are the demerits of Mendeleev's periodic table.**

Ans: Demerits of Mendeleev's periodic table:

i. No fixed position was given to hydrogen because it resembled alkali metals as well as halogens.

ii. Isotopes of same elements have different atomic mass number. So each element should be given different position. But isotopes which were chemically similar had to be given same position.

iii. At certain places, an element of higher atomic mass has been placed before an element of lower mass.

Eg. Cobalt (Co = 58.93) is placed before nickel (Ni = 58. 71).

iv. Some elements placed in the same sub-group had different properties.

Eg. Manganese (Mn) is placed with halogens which totally differ in the properties.

1.4 Modern Periodic Table

***10. How could the Modern periodic table remove various anomalies of Mendeleev's periodic table?**

Ans: The Modern periodic table removed various anomalies of Mendeleev's periodic table as follows:

i. All isotopes of the same elements have different masses but same atomic number. Therefore, they occupy the same position in the modern periodic table.

ii. When elements are arranged according to their atomic numbers, the anomaly regarding certain pairs of elements in Mendeleev's periodic table disappears.

Eg. Atomic number of cobalt and nickel are 27 and 28 respectively. Therefore, cobalt will come first and then nickel, although cobalt's atomic mass is greater.

iii. Elements are classified according to their electronic configuration into different blocks.

11. How does valency vary in a period and in a group?

Ans: i. The valency of an element is the number of valence electrons present in the outermost shell of an atom.

ii. All the elements of a group have the same number of valence electrons. Hence, they have the same valency.

iii. In second and third period, valency increases from 1 to 4 and then decreases from 4 to 0 as we go from left to right in the periodic table.

12. What are series in modern periodic table?

Ans: Series:

i. Apart from the seven rows, there are two additional rows placed separately at the bottom of the modern periodic table. These two additional rows are called series.

ii. Elements of these series are called as inner transition elements (Lanthanides and Actinides). They together form the f-block elements.

13. What are Lanthanides?

Ans: Lanthanides:

i. The fourteen elements after Lanthanum (La) shown separately in the first series, placed at the bottom of the modern periodic table, are called Lanthanides.

ii. Elements of this series are from Ce (58) to Lu (71).

iii. They belong to the sixth period and group 3.

iv. There is very close resemblance in properties between them.

14. What are Actinides?

Ans: Actinides:

i. The fourteen elements after Actinium (Ac) shown separately in the second series, placed at the bottom of the modern periodic table, are called Actinides.

ii. Elements of this series are from Th (90) to Lr (103).

iii. They belong to the seventh period and group 3.

iv. There is very close resemblance in properties between them.

***15. Define atomic size. How does it vary in a period and in a group?**

Ans: i. Atomic size is determined by using atomic radius. Atomic radius is the distance between centre of an atom and outermost shell.

ii. In a period, atomic radius generally decreases from left to right. This happens when the electrons are added to the same shell and thus experience a greater pull from the nucleus.

iii. Atomic radius increases in a group from top to bottom. F < Cl < Br < I. This happens because new shells are added down a group.Thus, the outermost-electrons go farther and farther from the nucleus, extending the radius and ultimately increasing the size of the atom.

***16. In the modern periodic table, which are the metals, non-metals and metalloids among the first 20 elements.**

Ans: The metals, non metals and metalloids among the first 20 elements of the modern periodic table are as follows:

Metals: Lithium (Li), Berylium (Be), Sodium (Na), Magnesium (Mg), Aluminium (Al), Potassium (K), Calcium (Ca)

Non Metals: Hydrogen (H), Helium (He), Carbon (C), Nitrogen (N), Oxygen (O), Fluorine (F), Phosphorus (P), Sulphur (S), Chlorine (Cl)

Metalloids: Boron (B), Silicon (Si)

17. State the gradation in the states of elements of group VII A at room temperature. OR Name the physical state of halogens under ordinary conditions.

Ans: i. As the atomic number increases down the group VIIA (17), the physical state of halogens shows gradation from fluorine to iodine.

ii. At normal temperature, fluorine and chlorine are gases, bromine is a liquid while iodine and astatine are solids.

18. How does metallic and non-metallic character vary in periods and groups?

Ans: i. In a period, metallic character decreases and non-metallic character increases from left to right due to decrease in atomic size.

ii. In a group, metallic character increases and non-metallic character decreases from top to bottom due to increase in atomic size.

Answer in brief

1.1 Dobereiner's Triads

1. Explain Dobereiner's classification of elements.

Ans: Dobereiner's classification of elements:

i. In 1829, Dobereiner classified existing elements in a tabular form taking three elements at a time in a group called triad.

ii. In each triad elements with similar properties were placed according to increasing order of their atomic masses.

iii. The atomic mass of the middle element in each triad was found to be the approximate mean of those of the other two elements of triad.

Eg.

Triad	Elements	Atomic mass
1.	Lithium (Li)	6.9
	Sodium (Na)	23
	Potassium (K)	39
2.	Calcium (Ca)	40.1
	Strontium (Sr)	87.6
	Barium (Ba)	137.3
3.	Chlorine (Cl)	35.5
	Bromine (Br)	79.9
	Iodine (I)	126.9
4.	Sulphur (S)	32
	Selenium (Se)	79
	Tellurium (Te)	128

In the above table, 1^{st} triad contains Li, Na and K. Mean atomic mass of Li and K is $\frac{6.9+39}{2} = 22.95$

which is approximately equal to the atomic mass of sodium (23).

v. Thus, atomic mass of Na is the approximate mean value of those of Li and K.
vi. Similarly, in the other triads, the atomic mass of middle element is the approximate mean of those of other two elements.

1.4 Modern Periodic Table

2. Which column is known as zero group in the modern periodic table? Write the names of any four elements in this group. Why do zero group elements not take part in chemical reactions?

Ans:
i. The 18th column of modern periodic table is known as zero group or inert gases.
ii. Four elements of zero group are Helium (He), Neon (Ne), Argon (Ar) and Krypton (Kr).
iii. The inert gases have stable electronic configuration with complete duplet (in the case of He) or complete octet (in the case of Ne, Ar, etc).
iv. Due to this, the valency of inert gases becomes zero.
v. They can neither form ionic nor covalent bonds with other atoms.
vi. Hence, zero group elements do not take part in chemical reactions.

3. Describe the classification of elements in the modern periodic table on the basis of their electronic configuration.

OR

Describe the four blocks of the modern periodic table based on the electronic configuration of elements.

Ans: On the basis of electronic configuration, elements in the modern periodic table are classified into four blocks: s-block, p-block, d-block and f-block.

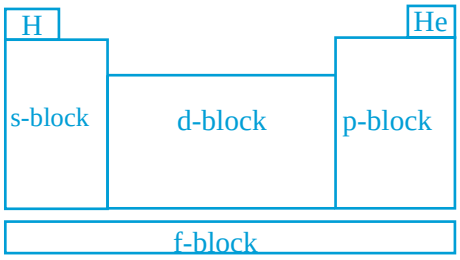
s-block:
i. Groups 1 (IA) and 2 (IIA) are included in s-block.
ii. These elements contain 1 or 2 electrons in their outermost shell. They are normal elements.
iii. All these elements are metals except hydrogen.

p-block:
i. Group 13 (IIIA) to 17(VIIA) and group 18 (0 group) elements are included in p-block.
ii. They contain 3 to 8 electrons in their outermost shell. These are normal elements and inert gases.
iii. Group-18 elements have completed outermost shell. They are called inert elements or noble elements. Elements of Group-18 are gases.
iv. p-block contains all types of elements, i.e. metals, non - metals and metalloids.

d-block:
i. Group 3 (III B) to Group 12 (II B) are known as d-block elements.
ii. These elements are known as transition elements.
iii. These elements have two outermost shells which are incomplete.
iv. All these elements are metals.

f-block:
i. Elements present at the bottom of the periodic table i.e. lanthanides and actinides are called f-block elements.
ii. They have three incomplete outermost shells.
iii. They are called inner transition elements.
iv. All these elements are metals.

The position of the four blocks in the periodic table is as follows:



4. Explain in brief the position of elements in the Modern Periodic Table.

Ans: Position of elements in the Modern Periodic Table:
i. The horizontal rows in the Modern Periodic Table are called periods and the vertical columns are called groups.
ii. The Modern Periodic Table consists of seven periods and eighteen groups.
iii. Periods are numbered from 1 to 7. Elements present in the same period have the same number of shells, which is equal to the period number.
iv. In each period a new shell starts filling up. The period number is also the number of the shell which starts filling up in it.

v. The first period is the shortest period containing only 2 elements. Second and third periods are short periods and contain 8 elements each. Fourth and fifth periods are long periods. Sixth period is the longest and contains 32 elements in it. Seventh period is an incomplete period.

vi. Groups are numbered from 1 to 18. Elements having same number of valence electrons or having same outer electronic configuration are present in the same group.

vii. Elements present in the same group show same chemical properties.

viii. Group 1 contains alkali metals. Group 2 contains alkaline earth metals. Group 17 contains halogens. Group 18 contains inert gases.

ix. Metals are present on the left-hand side of the periodic table, whereas non-metals are present on the right hand side of the periodic table.

x. Elements present in group 1 and 2 on the left side and 13 to 17 on the right side of the periodic table are called normal elements. Their outermost shell is incomplete.

xi. Elements present in groups 3 to 12 in the middle of the periodic table are called as transition elements. Their two outermost shells are incomplete.

xii. Group 18 on the extreme right of the periodic table contains inert gases. Their outermost shell contains 8 electrons.

xiii. Elements placed at the bottom of the periodic table are called inner transition elements. They contain two series of elements: lanthanides and actinides.

Write short notes on

1.2 Newlands' Octaves

1. Newlands' Octaves

Ans: i. Newlands was next after Dobereiner who attempted to classify elements according to their properties.

ii. Newlands arranged all the 56 existing elements at that time in an increasing order of their atomic masses.

iii. He found that every eighth element had properties similar to that of the first as observed in musical octaves.

iv. For example:

H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe

In the above example, properties of elements belonging to each group are identical. In the first group, properties of H, F and Cl are similar. In the second group, properties of Li, Na and K are similar and so on.

v. However, octave law was not successful in classifying all the discovered elements.

vi. After calcium, the higher elements did not possess properties similar to that of the first in the octaves.

1.4 Modern Periodic Table

2. Moseley's contribution and the modern periodic table

Ans: i. In 1913, Henry Moseley, an English physicist, found that it was the atomic number (Z) and not atomic mass, which was the fundamental property of elements and which must be used for arranging them in the periodic table.

ii. Atomic number (Z) of an element is the number of protons in the nucleus of the atom. It also represents the number of electrons present in outer shells.

iii. This discovery changed the whole perspective about elements and their properties.

iv. Accordingly, Mendeleev's periodic law was modified into Modern Periodic Law.

3. Halogen group elements

Ans: i. The second last column in the periodic table is group VII A (group 17) which is a group or family of halogens.

ii. The members of this group from top to bottom are as given in the following table:

Group VII A elements	Symbol	Atomic number (Z)	Electronic configuration	Valency	Physical state
Fluorine	F	9	2, 7	1	Gas
Chlorine	Cl	17	2, 8, 7	1	Gas
Bromine	Br	35	2,8,18,7	1	Liquid
Iodine	I	53	2,8,18,18,7	1	Solid
Astatine	At	85	2,8,18,32,18,7	1	Solid

iii. The valence shell of a halogen contains seven electrons.
iv. Thus, it is short of one electron to complete its octet.
v. The halogens complete their octet and attain the stable inert gas configuration by gaining one electron.
vi. This makes the valency of a halogen one (monovalent).

4. Normal elements

Ans: i. The atoms of the elements in which only the outermost shell is incompletely filled are called normal elements.
ii. The elements of the s-block and p-block together (except the zero group elements) constitute normal elements i.e. elements from group 1, 2 and 13 to 17.
iii. They are reactive elements.
iv. Alkali metals, alkaline earth metals and halogens are some of the normal elements.

5. Transition elements

Ans: i. Elements present in group 3 to 12 in the middle of the periodic table are called transition elements.
ii. Their two outermost shells are incomplete.
iii. These elements are also called d-block elements.
iv. All these elements are solid metals at room temperature.

6. Inner transition elements

Ans: i. Elements placed at the bottom of the periodic table are called inner transition elements.
ii. They contain two series of elements: lanthanides and actinides and called as 'f' block elements.
iii. 14 elements with atomic numbers 58 to 71 (Ce to Lu) are called Lanthanides. These elements are placed along with lanthanum (La = 57) in group 3 and period 6 because of very close resemblance in properties between them.
iv. 14 elements with atomic number 90 to 103 (Th to Lr) are called Actinides. These elements are placed along with actinium (Ac = 89) in group 3 and period 7 because of very close resemblance in their properties.
v. They have three incomplete outermost shell.
vi. All these elements are metals.

7. Inert elements

Ans: i. In modern periodic table groups 18 elements have completed outermost shell.
ii. They have stable electronic configuration with complete duplet (helium) and octet (neon, argon, krypton etc.)
iii. These elements do not gain or lose or share electrons with other atom and hence do not undergo any chemical reaction i.e. they are chemically inactive.
iv. Their valency is zero.
v. They are called zero group elements or noble gases or rare gases.
vi. These elements are included in 'p'-block of modern periodic table.
v. Inert elements include Helium (He), Neon (Ne), Argon (Ar), Krypton (Kr), Xenon (Xe) and Radon (Rn).

8. Zig-Zag line in modern periodic table

Ans: i. In the p-block, all the three types of elements, i.e. metals, non-metals and metalloids are present.
ii. A zig-zag line separates the metals on the left side from the non-metals on the right side of the modern periodic table.
iii. The border line elements i.e. Boron (B), Silicon (Si), Germanium (Ge), Arsenic (As), Antimony (Sb), Tellurium (Te) and Polonium (Po), show intermediate properties of metals and non-metals.
iv. These elements which lie along the zig–zag line and show properties of both metals and non metals are called as metalloids or semi-metals.

Give scientific reasons

1.4 Modern periodic table

1. Atomic number is a more fundamental property of an element than its atomic mass.

Ans: i. The atomic number of an element indicates the number of protons in the nucleus and the number of extra-nuclear electrons in the atom.
ii. All the atoms of an element have the same atomic number.

iii. The number of electrons present in the outermost shell of an atom is responsible for the formation of compounds either by sharing, accepting or donating it.
iv. The chemical properties of an element are decided by its atomic number.

Hence, atomic number is a more fundamental property of an element than its atomic mass.

2. Zero group elements are chemically inert.

Ans: i. Zero group elements have complete outermost shell.
ii. Their valency is 0.
iii. All the elements have stable electronic configuration with complete octet or duplet (Eg. Helium)
iv. As their valencies are satisfied, these elements do not lose, gain or share electrons and hence, they do not take part in the chemical reactions.

So, zero group elements, i.e. inert gases are chemically inert.

3. Valency varies gradually along a period.

Ans: i. Valency of an element is the number of valence electrons present in the outer most orbit of an atom.
ii. As we move from left to right along a period, the atomic number goes on increasing and therefore the number of electrons in the valence shell (valency) goes on increasing from 1 to 4 for second and third period and then decreases from 4 to 0.

Hence, valency varies gradually along a period.

***4. Atomic size increases down the group.**

Ans: i. Atomic size is determined by atomic radius.
ii. Atomic radius is the distance between the centre of atom and the outermost shell.
iii. As we move from top to bottom in a group, number of shells increases.
iv. Thus, atomic radius also increases.

Hence, atomic size increases down the group.

***5. Metallic character decreases from left to right in a period.**

Ans: i. Metals have a tendency to lose electrons.
ii. In a period, Metallic character depends on tendency to loose electrons. In a period electrons are added to the same shell. Hence experiences greater pull from nucleus. Thus atomic size decreases.
iii. It becomes difficult to remove electron from atom due to nuclear pull.

Hence, metallic character decreases from left to right in a period.

***6. Elements in the same group show same valency.**

Ans: i. Number of electrons in the outermost orbit of an atom is its valence electron i.e. valency.
ii. Number of valence electrons is equal to group number in the periodic table.
iii. As we go from top to bottom in a particular group of periodic table, size of atom increases due to increase in new orbits but valence electrons remain same.

Hence, elements in the same group show same valency.

7. Inert gases exist in the form of free atoms.

Ans: i. Formation of molecules is based on its electronic configuration.
ii. In the case of inert gases, all the electronic shells, including the outermost shell, are completely filled.
iii. They have stable electronic configuration with complete duplet (in case of He) or complete octet (in case of Ne, Ar, etc).
iv. Due to this stable electronic configuration atoms of these elements do not lose, gain or share electrons.

Hence, inert gases exist in the form of free atoms.

8. The family of noble gases is named as Zero group.

Ans: i. In the atoms of noble gases, all the electronic shells including the outermost shell are completely filled.
ii. They have stable electronic configuration with complete duplet (in the case of He) or complete octet (in the case of Ne, Ar, etc).
iii. Therefore, these elements do not lose, gain or share electrons. Hence, these elements do not take part in chemical reaction and their valency is zero.

Hence, the family of noble gases is named as Zero group.

Name the following

1. An element having atomic mass 23 and valency 1
2. Middle element of Dobereiner's second triad
3. A Zero group element having atomic number 18
4. First element of lanthanide series
5. First element of actinide series
6. A group of elements having three incomplete outer most shells
7. Element having one shell and one valence electron.

Answers:

1. Sodium (Na)
2. Strontium (Sr)
3. Argon (Ar)
4. Cerium (Ce)
5. Thorium (Th)
6. Inner transition elements
7. Hydrogen

State whether the following statements are true or false

1. The atomic mass of sodium (23) is double the atomic masses of lithium and potassium.
2. Newlands arranged all the elements in an increasing order of their atomic sizes.
3. Newlands thought only 56 elements existed.
4. Newlands' periodic table included inert (noble) gases.
5. The horizontal rows in the periodic table are called periods.
6. Properties of elements in a particular period show regular gradation from left to right.
7. The horizontal columns in the periodic table are called groups.
8. Mendeleev was the first who classified all elements successfully.
9. Hydrogen resembles alkali metals as well as halogens in Mendeleev's periodic table.
10. The modern periodic law is based on the atomic mass of an element.
11. Metals are present on the left hand side of the periodic table.
12. Non-metals are present on the right hand side of the periodic table.
13. Group 18 contains noble gases.
14. Group 2 contains alkali metals.
15. f-block elements are placed at the top of the periodic table.
16. Lanthanides and actinides are known as normal elements.
17. Valency increases from 1 to 4 for second and third period.
18. Metals show electronegative character.
19. Halogens are placed in group 17 of periodic table.

Answers:

1. **False:** The atomic mass of sodium is the mean of the atomic masses of lithium and potassium.
2. **False:** Newlands arranged all the elements in an increasing order of their atomic masses.
3. True
4. **False:** Newlands' periodic table did not include inert (noble) gases.
5. True
6. True
7. **False:** The vertical columns in the periodic table are called groups.
8. True
9. True
10. **False:** The modern periodic law is based on the atomic number of an element.
11. True
12. True
13. True
14. **False:** Group 2 contains alkaline earth metals.
15. **False:** f-block elements are placed at the bottom of the periodic table.
16. **False:** Lanthanides and actinides are known as inner transition elements.
17. True
18. **False:** Metals show electropositive character.
19. True

Find the odd man out

1. Lithium, Beryllium, Boron, Chlorine
2. Hydrogen, Helium, Neon, Xenon
3. Lithium, Sodium, Magnesium, Potassium
4. Boron, Silicon, Potassium, Antimony
5. Chlorine, Bromine, Iodine, Oxygen
6. Boron, Carbon, Nitrogen, Helium
7. Cerium, Thorium, Gadolinium, Radium
8. Helium, Radon, Argon, Boron

9. Newlands' octaves, Moseley's table, Dobereiner's triads, Mendeleev's table
10. Sodium, Lithium, Beryllium, Copper

Answers:

1. **Chlorine:** Others are second period elements.
2. **Hydrogen:** Others are Zero group elements.
3. **Magnesium:** Others are I A elements.
4. **Potassium:** Others are metalloids.
5. **Oxygen:** Others are halogens.
6. **Helium:** Others are normal elements.
7. **Radium:** Others are f-block elements.
8. **Boron:** Others are inert gas elements.
9. **Moseley's table:** Others failed to classify elements.
10. **Copper:** Others are metals, while copper is a transition metal.

Give three examples of

*1. Elements having a single electron in their outermost shell
*2. Elements with filled outermost shell
*3. Elements having 7 electrons in their outermost shell
4. Metalloids
5. Member of the 2nd period
6. Alkali metals
7. Alkaline earth metals
8. Members of the 3rd period
9. Lanthanide elements
10. Actinide elements
11. d-block elements

Answers:

1. Hydrogen, Sodium, Potassium
2. Helium, Neon, Argon
3. Chlorine, Bromine, Iodine
4. Silicon, Antimony, Germanium
5. Carbon, Nitrogen, Oxygen
6. Lithium, Sodium, Potassium
7. Magnesium, Calcium, Strontium
8. Phosphorus, Sulphur, Chlorine
9. Lanthanum, Cerium, Lutetium
10. Thorium, Radium, Actinium
11. Copper, Zinc, Iron

Complete the analogy

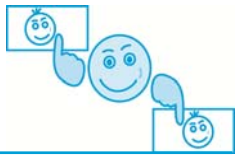
1. Dobereiner: Triads :: Newlands: ……..
2. Newlands' table: 56 elements :: Mendeleev's table: ……
3. Mendeleev's periodic table: Atomic mass :: Modern periodic table: ……..
4. Hydrogen: First period :: Lithium: ……..
5. Short period: Second and third period :: Longest period: ……..
6. Fluorine: 2,7 :: Chlorine: ……..
7. Group I A: Alkali metal :: …….. : Alkaline earth metal
8. Transition elements: d-block :: Inner transition elements: ……..
9. Tellurium: …….. :: Radium: Metal
10. Iodine: Solid :: Bromine: ……..
11. Transition elements: …….. :: Inner transition elements: Last three shells incompletely filled

Answers:

1.	Octaves	2.	63 elements
3.	Atomic number	4.	Second period
5.	Sixth period	6.	2,8,7
7.	Group II A	8.	f-block
9.	Metalloid	10.	Liquid

11. Last two shells incompletely filled

Rewrite the second column so as to match the first column



***1**

	Column I		Column II
i.	Sodium	a.	Non-metal
ii.	Sulphur	b.	Lanthanide
iii.	Manganese	c.	Metal
iv.	Cerium	d.	Transition metal

Ans: (i - c), (ii - a), (iii - d), (iv - b)

2.

	Column I		Column II
i.	First period	a.	Longest period
ii.	Fourth and fifth periods	b.	Short period
iii.	Second period	c.	Hydrogen and Helium
iv.	Sixth period	d.	Long periods

Ans: (i - c), (ii - d), (iii - b), (iv - a)

3.

	Column I		Column II
i.	s-block	a.	Group 13 to 17 and 0
ii.	p-block	b.	Lanthanides and actinides
iii.	d-block	c.	Group 1 and 2
iv.	f- block	d.	Group 3 to 12

Ans: (i - c), (ii - a), (iii - d), (iv - b)

4.

	Column I		Column II
i.	Newlands	a.	Triads
ii.	Mendeleev	b.	Atomic number
iii.	Dobereiner	c.	Atomic mass
iv.	Moseley	d.	Octaves

Ans: (i - d), (ii - c), (iii - a), (iv - b)

5.

	Column I		Column II
i.	Horizontal rows	a.	Groups
ii.	Vertical columns	b.	Periods
iii.	Two additional rows	c.	Series
iv.	Modern periodic table	d.	Long form of periodic table

Ans: (i - b), (ii - a), (iii - c), (iv - d)

6.

	Column I		Column II
i.	Eka-boron	a.	Germanium
ii.	Eka-aluminium	b.	Helium
iii.	Eka-silicon	c.	Scandium
iv.	Inert element	d.	Gallium

Ans: (i - c), (ii - d), (iii - a), (iv - b)

7.

	Column I		Column II
i.	Chlorine	a.	I A group
ii.	Sodium	b.	II A group
iii.	Argon	c.	VII A group
iv.	Magnesium	d.	Zero group

Ans: (i - c), (ii - a), (iii - d), (iv - b)

8.

	Column I		Column II
i.	Alkali metals	a.	Valency 4
ii.	Alkaline earth metals	b.	Valency 0
iii.	Argon	c.	Divalent
iv.	Carbon	d.	I A group
v.	Lithium	e.	Monovalent

Ans: (i - e), (ii - c), (iii - b), (iv - a), (v - d)

9.

	Column I		Column II
i.	Noble gas	a.	B, Si, Ge
ii.	Metalloid	b.	Mg, Ca, Ba
iii.	Alkaline earth metals	c.	He, Ne, Ar
iv.	Halogens	d.	Cl, Br, I

Ans: (i - c), (ii - a), (iii - b), (iv - d)

Distinguish between the following pairs

1. Mendeleev's periodic table and Modern periodic table

Ans:

	Mendeleev's periodic table	Modern periodic table
i.	This table is based on the atomic mass of the elements.	This table is based on the atomic number of the elements.
ii.	Elements are arranged in increasing order of their atomic mass.	Elements are arranged in increasing order of their atomic number.
iii.	It is not divided into any blocks.	It is divided into four blocks, namely s-block, p-block, d-block and f-block.
iv.	Inert elements are not mentioned.	Inert elements are mentioned.
v.	There are 8 groups	There are 18 groups.
vi.	There are 7 periods	Apart from 7 periods there are two extra additional rows called series placed separately at the bottom of modern periodic table

2. Groups and Periods

Ans:

	Groups	Periods
i.	The vertical columns of elements in the modern periodic table are called groups.	The horizontal rows of elements in the modern periodic table are called periods.
ii.	18 groups are present in the modern periodic table.	7 periods are present in the modern periodic table.
iii.	Group number indicates the number of electrons in the outermost shell of an atom of every element belonging to that group.	Period number indicates the number of electronic shells present in an atom of every element belonging to that period.

3. Inert gas elements and Normal elements

Ans:

	Inert gas elements	Normal elements
i.	Their valencies are zero.	They show one type of valency.
ii.	In the atoms of these elements, all the shells are completely filled including outermost shell.	In the atoms of these elements, only the outermost shell is incompletely filled.
iii.	They are stable and are chemically inactive. (i.e. inert)	They are unstable and are chemically active.
iv.	They are included in the p-block in the modern periodic table.	They are included in the s-block as well as p-block in the modern periodic table.
v.	These elements are placed in zero groups (Gr. 18) of modern periodic table.	These elements are placed in groups 1, 2 and 13 to 17 of modern periodic table.

4. Transition elements and Inner transition elements

Ans:

	Transition elements	Inner transition elements
i.	Elements present in groups 3 to 12 in the middle of the periodic table are called transition elements.	Elements present at the bottom of the periodic table are called inner transition elements.
ii.	These elements have two outermost shells incomplete.	These elements have three outermost shells incomplete.
iii.	They belong to the d-block in the modern periodic table.	They belong to the f-block in the modern periodic table.
iv.	They show variable valency.	They show zero valency.

5. s-block elements and p-block elements

Ans:

	s-block elements	p-block elements
i.	Group 1 and 2 are included in s-block.	Group 13 to 17 and 0 group elements are included in p-block.
ii.	These elements contain 1 or 2 electrons in their outermost shell.	They contain 3 to 8 electrons in their outermost shell.
iii.	All these elements are metals (except hydrogen).	It contains all types of elements i.e. metals, non-metals and metalloids.

6. Metallic character and Non-metallic character

Ans:

	Metallic character	Non-metallic character
i.	Metals show tendency to lose electrons. So, they are said to be electropositive.	Non-metals show tendency to accept electrons or share electrons with other atoms. So they are said to be electronegative.
ii.	Metallic character decreases from left to right in a period.	Non-metallic character increases from left to right in a period.
iii.	In a group, metallic character increases from top to bottom.	In a group, non-metallic character decreases from top to bottom.

7. Alkali metals and Alkaline earth metals

Ans:

	Alkali metals	Alkaline earth metals
i.	In the modern periodic table, the elements in group I A (Group 1), excluding hydrogen, are called alkali metals.	In the modern periodic table, the elements in group II A (Group 2) are called alkaline earth metals.
ii.	Atoms of these elements have one electron in the valence shell.	Atoms of these elements have two electrons in the valence shell.
iii.	They are monovalent.	They are divalent.
iv.	Their oxides and hydroxides readily dissolve in water.	Their oxides and hydroxides dissolve slightly in water.

8. d-block elements and f-block elements

Ans:

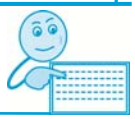
	d-block elements	f-block elements
i.	In the modern periodic table, group III B (3) to group II B (12) along with group VIII form the d-block elements.	In the modern periodic table, the two additional rows placed separately at the bottom of the table are called series and together the elements of these series form the f-block elements.
ii.	These include transition elements.	These include inner transition element (lanthanides and actinides).
iii.	They have their last two outermost shells incompletely filled.	They have their last three outermost shells incompletely filled.

9. Normal elements and Transition elements

Ans:

	Normal elements	Transition elements
i.	In the atoms of these elements, only the outermost shell is incompletely filled.	In the atoms of these elements, the last two outermost shells are incompletely filled.
ii.	These elements are placed in A group i.e. group I A (1), group II A (2), group III A to group VII A (13 to 17) of modern periodic table.	These elements are placed in B group i.e. group III B (3) to group II B (12) along with group VIII of modern periodic table.
iii.	They normally show a single valency.	They show variable valency.
iv.	They are included in s-block and p-block of modern periodic table.	They are included in d-block of modern periodic table.
v.	The compounds of these elements are generally colourless.	The compounds of these elements are generally coloured.

Define the following terms



1. Periods

Ans: Horizontal rows of elements in the modern periodic table are called periods.

2. Group

Ans: A vertical column of elements in the modern periodic table is called a group.

3. Inert gas elements

Ans: The elements having the outermost shell completely filled i.e. with eight electrons are called inert gas elements.

4. Normal elements

Ans: Elements present in group 1 and 2 on the left side and 13 to 17 on the right side of the modern periodic table with one outermost shell incomplete are called normal elements.

5. Transition elements

Ans: Elements present in group 3 to 12 in the middle of the periodic table with two outermost shells incomplete are called transition elements.

6. Inner transition elements

Ans: Elements placed at the bottom of the periodic table with three outermost shells incomplete are called inner transition elements.

7. Lanthanides

Ans: A set of 14 elements with atomic numbers 58 to 71 (Ce to Lu) having similar chemical properties are called lanthanides.

8. Actinides

Ans: A set of 14 elements with atomic numbers 90 to 103 (Th to Lr) having similar chemical properties are called actinides.

9. Isotopes

Ans: Atoms of the same elements having different atomic masses but same atomic number are called isotopes.

10. Valency

Ans: The valency of an element is defined as the number of valence electrons present in the outermost shell of an atom.

***11. Atomic radius (Atomic size)**

Ans: The distance between the centre and the outermost shell of an atom is called its atomic radius.

12. Zig-Zag line

Ans: A line that separates metals from non-metals in the modern periodic table is called zig-zag line.

13. Metalloids

Ans: Elements which shows property of both metals and non-metals are called as metalloids.

State the following laws

1. Newlands' Octaves law

Ans: Newlands' Octaves law states that **"**When the elements are arranged in an increasing order of their atomic masses, the properties of the eighth element are similar to the first."

2. Mendeleev's Periodic law

Ans: Mendeleev's Periodic law states that "The physical and chemical properties of elements are periodic function of their atomic masses."

3. Modern Periodic law

Ans: Modern Periodic law states that "The chemical and physical properties of elements are a periodic function of their atomic numbers."

Activities

Activity 1.1 (Text Book Page 1)

Ans:

i. All the items are stored in the shelves or counters in a particular order.

ii. Yes, there is a particular pattern which allows the customers to come across all the needful things and items.

iii. We arrange our books, clothes and other usable things in order. We keep our books in a study shelf, clothes in cupboard and other things like shoes, socks, toys etc. should be kept at proper place to retrieve them easily, when required.

iv. In the library, books of various subjects are placed in separate counters so that librarian as well as students can see them properly.

v. For keeping books in library, librarian uses specified method for classification so that all the available books can be viewed at a glance.

Activity 1.2 (Text Book Page 2)

Ans:

Triad	Elements	Atomic mass
I	H	1.01
	F	19.0
	Cl	35.5
II	Li	6.9
	Na	23.0
	K	39.1
III	Be	9.01
	Mg	24.3
	Ca	40.1

In each triad atomic mass of the middle element is the approximate value of the mean of the other two elements.

Activity 1.3 (Text Book Page 4)

Ans:

i. No, in Mendeleev's table, there was no space for isotopes.

ii. Compounds of hydrogen with chlorine, sulphur and oxygen are HCl, H_2S and H_2O respectively.
Compounds of alkali metals like potassium (K) with chlorine, sulphur and oxygen are KCl, K_2S and K_2O.
Both hydrogen and alkali metals form their respective chlorides, sulphides and oxides with chlorine, sulphur and oxygen which show the resemblance between hydrogen and alkali metals.

iii. Pairs of elements from the periodic table where higher mass element is placed before lower mass element:
   a. Cobalt (Co = 58.9) placed before Nickel (Ni = 58.7)
   b. Tellurium (Te = 128) placed before Iodine (I = 127)

Activity 1.4 (Text Book Page 6)

Ans:

i. Isotopes of same elements having same atomic number and different atomic mass occupy the same position in the modern periodic table.

ii. a. Hydrogen has 1 electron in the outer most shell. It can lose that electron or gain one electron and be a stable atom.
   b. Hydrogen can lose one electron like metals. Hence, it is placed at the top of the first group with alkali metals in modern periodic table on the basis of electronic configuration.

c. However, its position should be in the 17th group as it can gain one electron and complete its duplet and thus, shows its resemblance with halogens.

iii.

Name	Symbol	Atomic No.	Electronic configuration
Hydrogen	H	1	1
Helium	He	2	2
Lithium	Li	3	2,1
Beryllium	Be	4	2,2
Boron	B	5	2,3
Carbon	C	6	2,4
Nitrogen	N	7	2,5
Oxygen	O	8	2,6
Fluorine	F	9	2,7
Neon	Ne	10	2,8

Activity 1.5 (Text Book Page 6)

Ans: i. Electronic configuration of elements from atomic number 11 to 18.

Elements	Symbol	Atomic no.	Electronic configuration (K,L,M,N)
Sodium	Na	11	2,8,1
Magnesium	Mg	12	2,8,2
Aluminium	Al	13	2,8,3
Silicon	Si	14	2,8,4
Phosphorous	P	15	2,8,5
Sulphur	S	16	2,8,6
Chlorine	Cl	17	2,8,7
Argon	Ar	18	2,8,8

ii. The similarities found in the electronic configuration is that all the elements from Sodium (Z = 11) to Argon (Z = 18) contain same number of electrons in 1st 2 shells.

iii. Valence electrons present in sodium = 1, aluminium = 3 and chlorine = 7.

iv.

Element	Symbol	Atomic No.	Electronic configuration (K,L,M,N)
Magnesium	Mg	12	2,8,2
Calcium	Ca	20	2,8,8,2

Element	Symbol	Atomic No.	Electronic configuration (K,L,M,N)
Fluorine	F	9	2,7
Chlorine	Cl	17	2,8,7

v. Yes, These elements Mg and Ca contain same number of valence electron as well as F and Cl contains same number of valence electrons.

vi.

Elements	Symbol	Atomic no.	Electronic configuration (K,L,M,N)
Boron	B	5	2,3
Oxygen	O	8	2,6
Sodium	Na	11	2,8,1
Aluminium	Al	13	2,8,3
Sulphur	S	16	2,8,6
Potassium	K	19	2,8,8,1

Activity 1.6 (Text Book Page 6)

Ans: i.

Elements	Atomic No.	Electronic configuration (K,L,M,N)	Type of element
Sodium	11	2,8,1	Metal
Magnesium	12	2,8,2	Metal
Aluminium	13	2,8,3	Metal
Silicon	14	2,8,4	Metalloid
Phosphorus	15	2,8,5	Non-metal
Sulphur	16	2,8,6	Non-metal
Chlorine	17	2,8,7	Non-metal
Argon	18	2,8,8	Non-metal

Elements which have 1, 2 or 3 electrons in their outer most shells are metals. Elements which have 5, 6, 7 or 8 electrons are non-metals.

ii.

Elements	Electronic configuration (K,L,M,N)
Magnesium(Z = 12)	2,8,2
Potassium (Z = 19)	2,8,8,1
Argon (Z = 18)	2,8,8
Fluorine (Z = 9)	2,7

Activity 1.7 (Text Book Page 7)

Ans: i. 20 elements from all the groups are as follows:

a. Hydrogen(H_1) b. Beryllium (Be_4)
c. Scandium (Sc_{21}) d. Titanium (Ti_{22})
e. Vanadium (V_{23}) f. Chromium (Cr_{24})
g. Manganese (Mn_{25}) h. Iron (Fe_{26})
i. Cobalt (Co_{27}) j. Nickel (Ni_{28})
k. Copper (Cu_{29}) l. Zinc (Zn_{30})
m. Boron (B_5) n. Carbon (C_6)
o. Nitrogen (N_7) p. Oxygen (O_8)

q. Fluorine (F_9) r. Neon (Ne_{10})
s. Cerium (Ce_{58}) t. Thorium (Th_{90})

ii. **s-block elements:** Hydrogen(H_1), Beryllium (Be_4)
p-block elements: Boron (B_5), Carbon(C_6), Nitrogen (N_7), Oxygen (O_8), Fluorine (F_9), Neon (Ne_{10})
d-block elements: Scandium (Sc_{21}), Titanium (Ti_{22}), Vanadium (V_{23}), Chromium (Cr_{24}), Manganese (Mn_{25}), Iron (Fe_{26}), Cobalt (Co_{27}), Nickel (Ni_{28}), Copper (Cu_{29}), Zinc (Zn_{30})
f-block elements : Cerium (Ce_{58}), Thorium (Th_{90}).

iii. Elements with their corresponding groups are given below:

Elements	Group	Elements	Group
H_1	1 or I A	Cu_{29}	11 or I B
Be_4	2 or II A	Zn_{30}	12 or II B
Sc_{21}	3 or III B	B_5	13 or III A
Ti_{22}	4 or IV B	C_6	14 or IV A
V_{23}	5 or V B	N_7	15 or V A
Cr_{24}	6 or VI B	O_8	16 or VI A
Mn_{25}	7 or VII B	F_9	17 or VII A
Fe_{26}	8 or VIII	Ne_{10}	18 or Zero
Co_{27}	9 or VIII	Ce_{58}	3 or III B
Ni_{28}	10 or VIII	Th_{90}	3 or III B

Activity 1.8 (Text Book Page 7)

Ans: i. a. Valency is determined by the number of valence electron present in outermost shell.
b. Mg has electronic configuration (2, 8, 2). Hence valency of Mg is 2.
c. If valence shell contains more than 3 electrons, then valency of element is the number of electrons required to complete the outermost octet.

ii.

Atomic No.	Electronic configuration	Valency
8	2, 6	2
14	2, 8, 4	4
17	2, 8, 7	1
20	2, 8, 8, 2	2

iii. **Variation of valency in a period:** As we move from left to right in a period, valency of elements (metals) increases from 1 to 4 then decreases from 4 to 0 for non-metals.

Variation of valency in a group: As we move from top to bottom in a group, valency of elements remains same because number of valency electrons in a particular group is same.

Activity 1.9 (Text Book Page 8)

Ans: i. a. **Decreasing order of atomic radii of period 3 elements.**

Period elements:	Na	Mg	Al	Si	P	S	Cl
Atomic radius (pm):	190	160	143	132	128	127	99

b. Yes, they are arranged in same manner as that in the periodic table.
c. Atom of highest atomic radius is sodium (Na), i.e. 190 pm. Atom of lowest atomic radius is chlorine (Cl), i.e 99 pm.
d. Atomic number increases as electrons are added in the outermost shell and experience greater pull from nucleus. Hence in a period, the atomic radii decreases from left to right

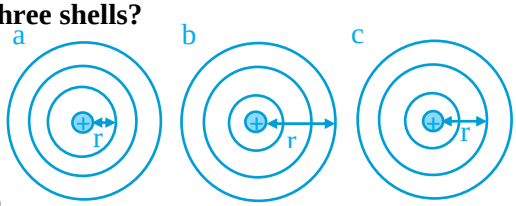
ii. a. **Increasing order of atomic radii in group 17 elements:**

Group 17 elements:	F	Cl	Br	I
Atomic radius (pm):	72	99	114	133

b. Yes, they are arranged in same manner as that in the periodic table.
c. Atom of highest atomic radius is iodine (I) i.e. 133 pm and atom of lowest atomic radius is fluorine (F) i.e. 72 pm.
d. Atomic radius increases in a group from top to bottom as new shells are added bringing outer most electrons farther from nucleus.

HOTS

1. Which of the following correctly depicts the atomic radius of a certain atom having three shells?



Ans: b

2. Which one of the following does not increase while moving down the group of periodic table?

a. Atomic radius
b. Metallic character
c. Valency electrons
d. Number of shells

Ans: c

3. In the following table, six elements A, B, C, D, E and F (here letters are not the usual symbols of the elements) of the modern periodic table with atomic numbers 3 to 18 are given.

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

a. Which of these is a noble gas?
b. Which of these is a halogen?
c. If B combines with F, what would be the formula of the compound formed?
d. Write the electronic configuration of C and E.

Ans: a. G is a noble gas (Neon) because its electronic configuration is (2,8).

b. F is a halogen (chlorine) because its atomic number is 17 and electronic configuration is (2,8,7).

c. B with atomic number 11 will have electronic configuration (2,8,1) i.e. Na.
F with atomic number 17 will have electronic configuration (2,8,7) i.e. Cl.
∴ Compound formed will have formula BF i.e. NaCl.

d. Electronic configuration of C = (2,8,2) and that of E = (2,6).

4. An element 'X' (atomic number 17) reacts with an element Y (at. no. 20) to form a divalent halide.

a. Give the formula of the compound.
b. Classify X and Y as metal, non metal or metalloid.
c. What will be the formula of oxide of element Y.

Ans: a. X has at. no. 17 i.e. Cl, so its electronic configuration is (2,8,7). So its valency is 1.
Y has atomic no. 20 i.e. Ca, so its electronic configuration is (2,8,8,2). Thus, its valency is 2.
∴ The compound will be YX_2 i.e. $CaCl_2$

b. X accepts electron, therefore, it is a non-metal; Y donates electrons, so it is a metal.

c. Y has valency 2 and oxygen also has valency 2.
∴ Formula of oxide of Y is YO i.e. CaO.

5. Chlorine, Bromine and Iodine form a Dobereiner's triad. Chlorine has at. mass 35.5 and Iodine has at. mass 126.9. Predict the atomic mass of Bromine.

Ans: As Cl, Br, I form the triad. Therefore, at. mass of Br should be the average of at mass of Cl and I.

∴ At mass of Br = $\frac{126.9 + 35.5}{2}$ = 81.2

∴ At mass of Br would be approximately 81 (actual mass is 79.9).

6. Classify the following elements into metal and non-metal. Justify your answer.

i. Atomic number of element 'X' is 11.
ii. Atomic number of element 'Y' is 16.

Ans: i. Element 'X' is a metal. Its electronic configuration being (2, 8, 1), it can easily lose 1 electron from its outermost orbit during a chemical reaction to attain the stable configuration of the nearest noble gas. This is a characteristic property of a metal.

ii. Element 'Y' is a non-metal. Its electronic configuration being (2, 8, 6), it can easily gain 2 electrons in its outermost orbit during a chemical reaction to attain the stable configuration of the nearest noble gas. This is a characteristic property of a non-metal.

7. The atomic masses of three elements A, B and C having similar chemical properties are 7, 23 and 39 respectively.

a. Calculate the average atomic mass of elements A and C.
b. Compare the average atomic mass with atomic mass of B.
c. What could the elements A, B and C be ? **[Mar 2013]**

Ans: a. $\frac{7 + 39}{2} = \frac{46}{2} = 23$

b. Average atomic mass is equal to atomic mass of B.

c. A-Lithium, B-Sodium, C-Potassium

8. What will happen? If –

i. inert elements lose one of the outermost electrons.

ii. atomic size of metals decreases.

iii. maximum capacity of outermost orbit of an atom becomes seven.

Ans: i. If inert elements lose one of the outermost electrons, they will no longer be inert. They will acquire an electron to become stable again.

ii. If the atomic size of metals decrease, the electrostatic force of attraction between the nucleus and the outermost electrons will increase as the distance between them decrease. Thus, it will be difficult for the metal atom to lose its outermost electron. Hence, their conductivity will decrease.

iii. If the maximum capacity of outermost orbit of an atom becomes seven, the eighth electron in the atomic orbit will shift to the next orbit. Thus, the inert gases will no longer be inert as a new set of elements will have stable electronic configuration.

9. With the help of information given below state the main characteristics of the elements

i. Element P is 0 group element.

ii. Element Q is group 1 element having atomic number 19.

iii. Element R is d-block element with two outermost incomplete shells.

iv. Element S is f-block element.

v. Element T has two different atomic mass number.

Ans: i. Element 'P' is an inert gas having stable electronic configuration.

ii. Element 'Q' is Potassium. It is an alkali metal having 1 electron in its outermost orbit.

iii. Element 'R' is a transition metal. It shows variable valency and has good lustre.

iv. Element 'S' is an inner transition metal. It has three outermost incomplete shells. It shows variable valency and is placed separately at the bottom of the periodic table as a member of either Lanthanide or Actinide Series.

v. If element 'T' has two different atomic mass number, it forms isotopes. Chemical properties of element 'T' remain same.

10. Atomic number of an element is 13. Write its place in the periodic table. Justify your answer.

Ans: The element is Aluminium. It's atomic number is 13. It is placed in Group 3A as it has 3 valence electrons in its outermost orbit (2, 8, 3).

11. Solve the puzzle.

Across

1. Element present in Vitamin B_{12} (6)

4. Element whose oxide is called sand (7)

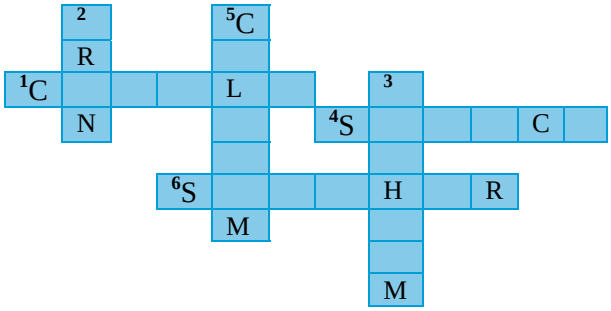
6. Non-metal used in skin ointment (7)

Down

2. Metal present in Haemoglobin (4)

3. Metal whose battery is used in mobile phones (7)

5. Metal whose phosphate is present in bones (7)



Ans: Across :

1. Cobalt
4. Silica
6. Sulphur

Down :

2. Iron
3. Lithium
5. Calcium