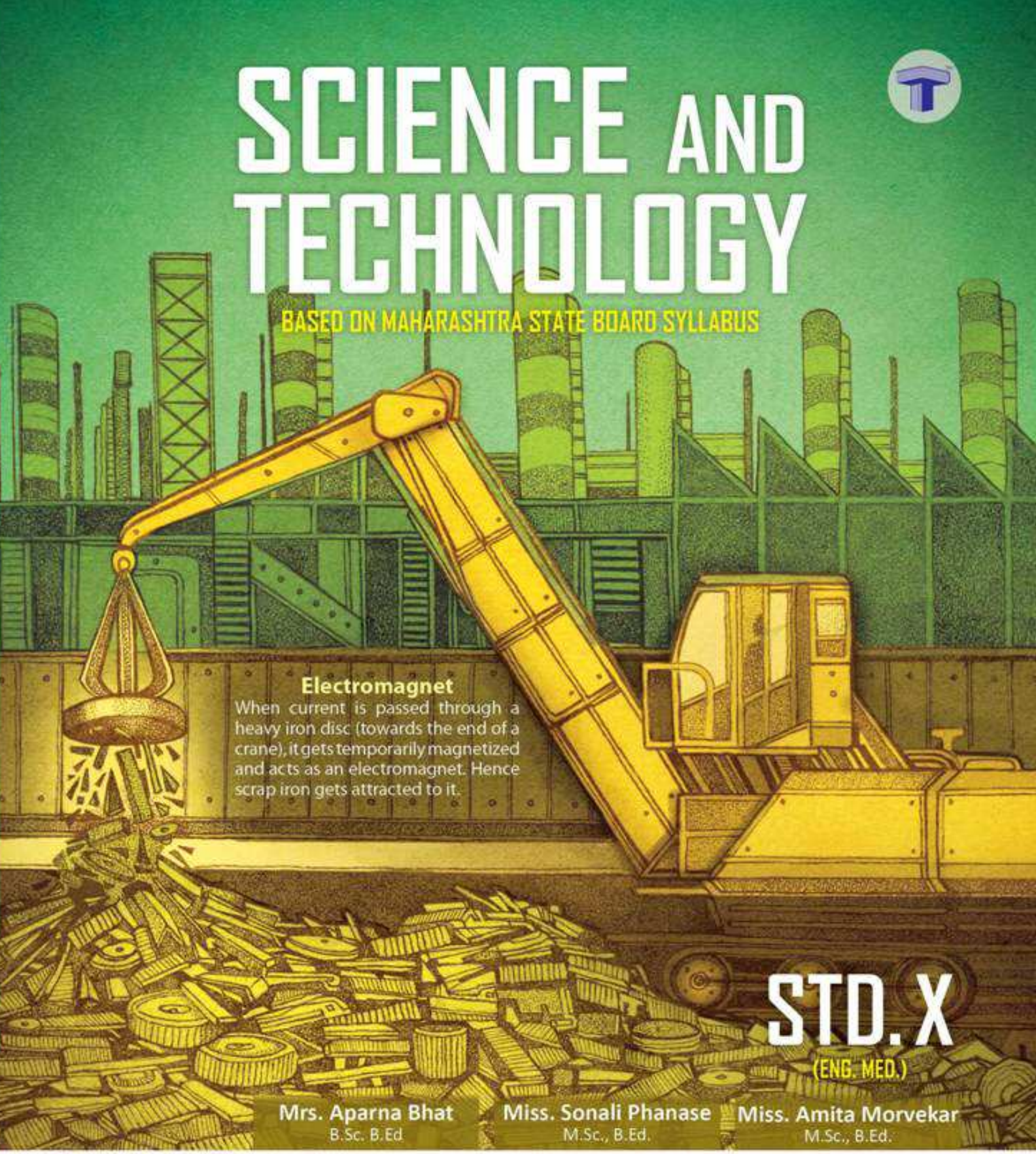
SCIENCE AND TECHNOLOGY

BASED ON MAHARASHTRA STATE BOARD SYLLABUS



STD. X

(ENG. MED.)

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STD. X

Science and Technology

Fifth Edition: March 2016

Salient Features

- Exhaustive coverage of entire syllabus in "Question-answer format".
- Covers answers to all Textual Questions, In-text Questions and Activities.
- Includes Questions based on diagrams / flow-charts.
- Includes MCQs based on practical and Paragraph based questions *(as per the latest paper pattern)*.
- Includes Higher Order Thinking Skills *(HOTS)*.
- Includes Solved and Practice Problems for better preparation.
- Neat and labelled diagrams.
- Includes Memory Maps at the end of each chapter to facilitate quick revision.
- Includes Two Model Question Papers *(as per the latest paper pattern)*.
- Includes Board Question Papers of 2014, 2015 and March 2016.

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Preface

We bring to you **"Std. X: Science and Technology"** a complete and thorough guide extensively drafted to boost the students' confidence.

This book has been written as per the latest syllabus and covers answers not only to the textual questions but also for the In-text questions and activities. All the important definitions, laws and formulae are also duly incorporated.

In addition to this, solved and practice problems are included which not only aim at covering the topic but also make students ready to face the competition.

The topic-wise classified "question and answer" format of this book helps students in easy comprehension.

Numerical problems included at the end of respective topics help the student to understand the technique of solving them efficiently. Moreover, neat and labelled diagrams, wherever necessary, are given so as to provide sound understanding of the concept.

Every chapter ends with a Memory Map to facilitate quick revision of the lesson learnt. Two model question papers *(as per the latest paper pattern)* and board question papers of 2014, 2015 and March 2016 are provided.

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

Marking Scheme

Marking Scheme (for March 2014 exam and onwards)

Total Marks: 100
Written examination: 80 Marks
Two separate question papers has to be solved on separate answer sheets.

Paper I: 40 Marks**: 2 hours**
Paper II: 40 Marks**: 2 hours**

Practical examination: 20 Marks: 1 hour 30 minutes
Question Paper pattern:

Questions	Marks	Marks with option
Paper – I (Section A)		
Q. 1 A. Answer 5 questions. (1 mark question)	5	5
Q. 1 B. Answer 5 MCQs. (1 mark question)	5	5
Q. 2. Answer any 5 out of 6. (2 marks question)	10	12
Q. 3. Answer any 5 out of 6. (3 marks question)	15	18
Q. 4. Answer any 1 out of 2. (5 marks question)	5	10
Paper – II (Section B)		
Q. 5 A. Answer 5 questions. (1 mark question)	5	5
Q. 5 B. Answer 5 MCQs. (1 mark question)	5	5
Q. 6. Answer any 5 out of 6. (2 marks question)	10	12
Q. 7. Answer any 5 out of 6. (3 marks question)	15	18
Q. 8. Answer any 1 out of 2. (5 marks question)	5	10
Total	**80**	**100**

Types of Questions

Q. 1 A and Q. 5 A

Fill in the blanks, Find odd man out, Find co-relation, Match the pairs, State true or false, Name, Write unit or molecular formula

Q. 1 B and Q. 5 B

Multiple choice questions based on practicals.

Q. 2 and Q. 6

Give reasons, Draw / correct diagrams, Write note, Write balanced chemical equation, Laws, Definitions, Solve examples, Distinguish, Complete the table, Write characteristics, Write uses.

Q. 3 and Q. 7

Give two examples and explain any one, Write law / definition and explain with example, Write merits-demerits, Explain.

Q. 4 and Q. 8

Prove, Explain working with appropriate diagram, Long question, Explain with given points – principle, diagram, construction, working, use, Questions based on given paragraph

About HOTS questions

HOTS questions means Higher Order Thinking Skill questions. Approx. 20% questions are HOTS questions and are based on the syllabus. HOTS questions can be of 1 mark to 5 marks. In depth study of textbook helps in answering HOTS questions.

Chapter wise weightage:

No.	Chapter Name	Marks	Marks with option
1	School of elements	4	5
2	The magic of chemical reactions	4	6
3	The acid base chemistry	4	5
4	The electric spark	5	7
5	All about electromagnetism	6	7
6	Wonders of light - Part I	7	8
7	Wonders of light - Part II	6	7
8	Understanding metals and non-metals	7	9
9	Amazing world of carbon compounds	5	7
10	Life’s internal secrets	6	7
11	The regulators of life	6	7
12	The life cycle	6	7
13	Mapping our genes	6	8
14	Striving for better environment - Part I	4	5
15	Striving for better environment - Part II	4	5

Contents

Note: Textual Questions are represented by * mark.
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. 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 numbers
   (C) valencies
   (D) atomic sizes

1.2 Newlands' Octaves

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

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

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

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

7. 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

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

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

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

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

12. 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

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

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

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

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

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

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

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

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

21. Elements present in groups 3 to 12 are called _____.
(A) normal elements
(B) transition elements
(C) inner transition elements
(D) zero group elements

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

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

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

25. _____ elements are all gases.
(A) Group 18 (B) Group 1
(C) Group 2 (D) Group 3

26. 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

27. All the elements of d-block and f-block are _____.
(A) metalloids **(B) metals**
(C) non-metals (D) gases

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

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

30. 14 elements with atomic numbers 90 to 103 are called _____.
(A) lanthanides **(B) actinides**
(C) halogens (D) inert gases

31. f-block elements have _____ outermost shell(s) incomplete.
(A) one (B) two
(C) three (D) four

32. 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

33. 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

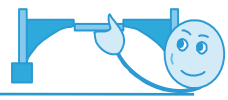
34. In a period, metallic character _____.
(A) decreases from left to right
(B) decreases from right to left
(C) increases from left to right
(D) remains same

35. 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

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

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. The atomic mass of strontium is the mean of the atomic masses of calcium and _____.

1.2 Newlands' Octaves

*5. The law used by Newlands to arrange elements is known as _____ . **[Mar 13]**

6. In Newlands' octaves, after _____ , every eighth element did not possess properties similar to that of the first.

7. Newlands' periodic table did not include _____.

1.3 Mendeleev's Periodic Table

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

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

10. The element Eka-silicon in Mendeleev's periodic table is known as _____ in the modern periodic table. [Mar 14]

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

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

1.4 Modern Periodic Table

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

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

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

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

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

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

*19. Elements showing properties of both metals and non–metals are known as _____ . [Sept 14]

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

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

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

23. _____ in modern periodic table contains halogens.

24. _____ elements have two outermost shells incompletely filled.

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

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

27. Metals show tendency to lose _____ .

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

29. Metals are said to be _____ .

30. Non-metals are said to be _____ .

Answers:

1.	Matter	2.	triads
3.	sodium	4.	barium
5.	Newlands' Octaves law	6.	calcium
7.	inert gases	8.	seven
9.	Gallium	10.	Germanium
11.	Mendeleev's	12.	manganese
13.	modern		
14.	atomic numbers	15.	18 or zero
16.	atomic number	17.	2nd
18.	long	19.	metalloids
20.	isotopes	21.	groups
22.	group	23.	Group 17
24.	Transition or d-block		
25.	Valency	26.	Atomic radius
27.	electrons	28.	Non-metals
29.	electropositive	30.	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 Dobereiner's rule.

1.2 Newlands' Octaves

2. What did Newlands find when he arranged the elements in an increasing order of their atomic masses?

Ans: When Newlands arranged the elements in an increasing order of their atomic masses, he found that every eighth element had properties similar to that of the first.

1.3 Mendeleev's Periodic Table

3. 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

4. How many periods are there in the modern periodic table?

Ans: There are seven periods in the modern periodic table.

5. How many groups are there in the modern periodic table?

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

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

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

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

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

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

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

9. Elements of which group are called halogens?

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

10. Elements of which group are called inert gases?

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

11. Which law was modified into modern periodic law?

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

12. 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.

13. How many elements are there in shortest and long periods?

Ans: Shortest period (first) contains two elements and long periods (fourth and fifth) contain eighteen elements each.

14. To which period do actinides and lanthanides belong?

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

15. 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? What made this 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 Dobereiner's triads giving one example. [Jul 15]

Ans: Dobereiner's triads:
i. In 1829, Dobereiner classified existing elements in a tabular form by placing three elements having similar properties in a group called triad.
ii. In each triad, the elements were placed according to increasing order of their atomic masses.
iii. The atomic mass of the middle element in each triad was approximately the mean of the atomic masses of other two elements.
Eg. In the triad of Lithium, Sodium and Potassium, the atomic mass of Sodium (23) is the mean of atomic masses of Lithium (6.9) and Potassium (39).

3. State the demerits of Dobereiner's triads.

Ans: Demerits of Dobereiner's triads:
i. All the known elements could not be classified into triads.
ii. Only some triads obeyed Dobereiner's rule. 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. In order to fit the existing elements, Newlands placed two elements in the same position which differed in their properties.

1.3 Mendeleev's Periodic Table

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

Ans:
i. Mendeleev examined the relationship between atomic masses of elements and their physical and chemical properties.
ii. By analyzing the compounds formed by the elements with 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 the properties of the elements after certain intervals.

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

Ans: i. Mendeleev found that the chemical and physical properties of elements showed repetition after certain intervals.

ii. He arranged all the known elements in a tabular form in the increasing order of their atomic masses in horizontal rows till he encountered an element which had properties similar to the first element.

iii. He placed this element below the first element and thus started the second row of elements.

iv. Proceeding in this manner he could arrange all the 63 elements known till then according to their properties and thus created the first periodic table.

7. Describe the main features of Mendeleev's periodic table. [Oct 13]

Ans: Features of Mendeleev's periodic table:

i. The horizontal rows in the periodic table are called periods. There are seven periods numbered from 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 vacant spaces in it. These were for elements that were yet to be discovered.

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

iv. When noble gases were discovered later, they were placed in Mendeleev's periodic table without disturbing the positions 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 element have different atomic masses. So each of these isotopes 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 element have different atomic masses but same atomic number. Therefore, they occupy the same position in the modern periodic table.

ii. When elements are arranged in increasing order of 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 atomic mass of cobalt is greater.

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

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

Ans: i. The valency of an element is determined by 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 Lanthanides?

Ans: Lanthanides:

i. Fourteen elements from Ce (58) to Lu (71) are called Lanthanides.

ii. They belong to the sixth period and group 3 of the periodic table, along with lanthanum (La = 57).
iii. These elements are shown separately in the first series, placed at the bottom of the modern periodic table.
iv. There is very close resemblance in properties between them.

13. What are Actinides?

Ans: Actinides:
i. Fourteen elements from Th (90) to Lr (103) are called Actinides.
ii. They belong to the seventh period and group 3 of the periodic table, along with actinium (Ac = 89).
iii. These elements are shown separately in the second series, placed at the bottom of the modern periodic table.
iv. There is very close resemblance in properties between them.

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

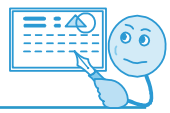
Ans: i. Atomic size is determined using atomic radius. For an isolated atom, atomic radius is the distance between the centre of the atom and the outermost shell.
ii. In a period, atomic radius generally decreases from left to right. This happens because the electrons are added to the same shell and hence experience a greater pull from the nucleus.
iii. Atomic radius increases in a group from top to bottom. This happens because a new shell is added to each successive elements, on moving 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.
Eg. In halogens the increase in atomic radius is F < Cl < Br < I.

***15. In the modern periodic table, which are the metals, non-metals and metalloids among the first twenty elements?**

Ans: The metals, non metals and metalloids among the first twenty 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), Carbon (C), Nitrogen (N), Oxygen (O), Fluorine (F), Phosphorus (P), Sulphur (S), Chlorine (Cl)
Metalloids: Boron (B), Silicon (Si)

16. 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:
Refer Answer the following Questions Q.2 (i), (ii), (iii).
iv. 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, 1st 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 Na (23).
Thus, atomic mass of Na is the approximately the mean of the atomic masses of Li and K.
v. Similarly, in the other triads, the atomic mass of the middle element is approximately the mean of the atomic masses of the 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 zero group elements are chemically inert?

Ans: i. The 18th column of modern periodic table is known as zero group or group 18.

ii. Four elements of zero group are Helium (He), Neon (Ne), Argon (Ar) and Krypton (Kr).
iii. Zero group elements (or inert gases or noble elements) 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 these elements is zero.
v. As their valencies are satisfied, these elements do not lose, gain or share electrons with other atoms and therefore, they do not take part in the chemical reactions under ordinary conditions. Hence, zero group elements or inert gases are chemically inert.

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 and 2 elements are included in s-block.
ii. These elements contain 1 or 2 electrons in their outermost shell.
iii. All these elements are metals (except hydrogen).

p-block:

i. Groups 13 to 17 and group 18 (zero group) elements are included in p-block.
ii. These elements contain 3 to 8 electrons in their outermost shell.
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.

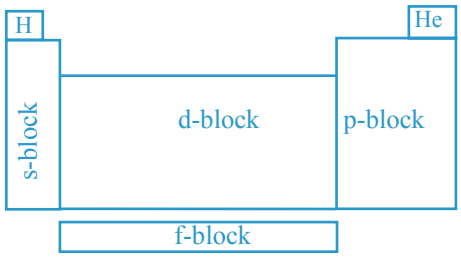
d-block:

i. Group 3 to Group 12 elements are included in d-block.
ii. These elements are known as transition elements.
iii. These elements have two incomplete outermost shells.
iv. All these elements are metals.

f-block:

i. Elements placed 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 with electrons. The period number is also the number of the shell which starts filling.
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 and contain 18 elements each. 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 or noble gases.
ix. Metals are present on the left-hand side of the periodic table while non-metals are present on the right-hand side of the periodic table.

x. Elements present in groups 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 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 except Helium which contains 2 electrons.

xiii. Elements placed at the bottom of the periodic table are called inner transition elements. They include two series of elements: lanthanides and actinides. They have three incomplete outermost shells.

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 vertical group are similar. 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, Newlands' octave law was not successful in classifying all the discovered elements.

vi. After calcium, every eighth element 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 the atomic number (Z) is the most fundamental property of an element and not its atomic mass. So, atomic number must be used for arranging elements 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 the 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, which states that 'the chemical and physical properties of elements are a periodic function of their atomic numbers'. The periodic table based on modern periodic law is called the modern periodic table.

3. Halogens or group 17 elements

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

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

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

iii. The valence shell of a halogen contains seven electrons.

iv. Thus, it needs one electron to complete its octet.

v. The halogens complete their octet and attain the stable inert gas configuration by gaining one electron.

vi. Hence, the valency of halogens is one (monovalent).

4. Normal elements

Ans: i. The elements of the s-block and p-block (except the group 18 or zero group elements) are called normal elements i.e. elements from groups 1, 2 and 13 to 17.

ii. In the atoms of these elements only the outermost shell is incomplete.

iii. Alkali metals, alkaline earth metals and halogens are some of the normal elements.

5. Transition elements

Ans: i. Elements present in groups 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 (except mercury).

6. Inner transition elements

Ans: i. Elements placed at the bottom of the periodic table are called inner transition elements.
ii. They include two series of elements: lanthanides and actinides and are also 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 numbers 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 shells.
vi. All these elements are metals.

7. Inert elements

Ans: i. Elements present in group 18 on the extreme right of the modern periodic table are called inert elements or noble gases. They have completed outermost shell.
ii. Their outermost shell contains 8 electrons except Helium which contains 2 electrons.
iii. These elements do not gain or lose or share electrons with other atoms and hence, do not undergo any chemical reactions under ordinary conditions.
iv. Their valency is zero.
v. Hence, they are also called zero group elements.
vi. These elements are included in 'p'-block of modern periodic table.
vii. Inert elements include Helium (He), Neon (Ne), Argon (Ar), Krypton (Kr), Xenon (Xe) and Radon (Rn).
viii. All these elements are gases.

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 or 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. Atomic size increases down the group.**

Ans: i. Atomic size is determined using atomic radius.
ii. For an isolated atom, atomic radius is the distance between the centre of the atom and the outermost shell.
iii. As we move from top to bottom in a group, number of shells increases.
iv. The outermost electrons go farther and farther from the nucleus, extending the radius and ultimately increasing the size of the atom.

Hence, atomic size increases down the group.

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

Ans: i. Metallic character is the tendency of an atom to lose electrons.
ii. In a period, electrons are added to the same shell and hence, these electrons experience greater pull from the nucleus. Thus, atomic size decreases.
iii. It becomes difficult to remove an electron from the atom.

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

***4. Elements in the same group show same valency.** **[Mar 14]**

Ans: i. The number of electrons in the outermost shell of an atom is its valence electrons. Valency is determined by the number of valence electrons present in the outermost shell of an atom.

ii. The number of valence electrons for all the elements in a group is the same.

So, elements in the same group show same valency.

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

Ans: i. Formation of molecules is based on the electronic configuration of the combining elements.

ii. In the case of inert gases, all the 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 with other atoms.

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

Name the following

1. Horizontal rows in the Modern Periodic Table. **[Oct 13]**
2. An element having atomic number 11 and valency 1
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 outermost shells
7. Element having one shell and one valence electron.

Answers:

1. Periods
2. Sodium (Na)
3. Argon (Ar)
4. Cerium (Ce)
5. Thorium (Th)
6. Inner transition elements or f-block elements
7. Hydrogen

State whether the following statements are true or false. If false, rewrite the correct statement.

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' periodic table included inert (noble) gases.
4. The horizontal rows in the periodic table are called periods.
5. Properties of elements in a particular period show regular gradation from left to right.
6. Mendeleev was the first who classified all elements successfully.
7. Hydrogen resembles alkali metals as well as halogens.
8. The modern periodic law is based on the atomic mass of an element.
9. Metals are present on the left-hand side of the periodic table.
10. Non-metals are present on the right-hand side of the periodic table.
11. Group 18 contains noble gases.
12. Group 2 contains alkali metals.
13. f-block elements are placed at the top of the periodic table.
14. Lanthanides and actinides are known as normal elements.
15. In second and third periods, valency increases from 1 to 4 and then decreases from 4 to 0 as we go from left to right.
16. Metals show electronegative character.

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. **False:** Newlands' periodic table did not include inert (noble) gases.
4. **True**
5. **True**
6. **True**
7. **True**
8. **False:** The modern periodic law is based on the atomic number of an element.
9. **True**
10. **True**
11. **True**
12. **False:** Group 2 contains alkaline earth metals.
13. **False:** f-block elements are placed at the bottom of the periodic table.
14. **False:** Lanthanides and actinides are known as inner transition elements.
15. **True**
16. **False:** Metals show electropositive character.

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. Helium, Radon, Argon, Boron
8. Sodium, Lithium, Beryllium, Copper

Answers:

1. **Chlorine:** Others are second period elements.
2. **Hydrogen:** Others are inert or noble gases.
3. **Magnesium:** Others are group 1 elements.
4. **Potassium:** Others are metalloids.
5. **Oxygen:** Others are halogens.
6. **Helium:** Others are normal elements.
7. **Boron:** Others are inert or noble gases.
8. **Copper:** Others are normal elements, while copper is a transition element.

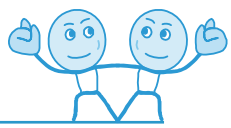
Give two examples of

1. Metalloids
2. Members of the 2nd period
3. Alkali metals
4. Alkaline earth metals
5. Members of the 3rd period
6. d-block elements

Answers:

1. Silicon, Germanium
2. Carbon, Nitrogen
3. Lithium, Sodium
4. Magnesium, Calcium
5. Phosphorus, Sulphur
6. Copper, Zinc

Complete the analogy

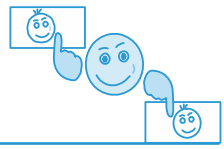


1. Dobereiner: Triads :: Newlands: ……..
2. Mendeleev's periodic table: Atomic mass :: Modern periodic table: ……..
3. Hydrogen: First period :: Lithium: ……..
4. Fluorine: 2,7 :: Chlorine: ……..
5. Group 1: Alkali metals :: …….. : Alkaline earth metals
6. Transition elements: d-block :: Inner transition elements: ……..
7. Tellurium: …….. :: Radium: Metal
8. Transition elements: …….. :: Inner transition elements: Three incomplete outermost shells
9. Lanthanides: Ce to Lu :: Actinides: ……..

Answers:

1. Octaves
2. Atomic number
3. Second period
4. 2,8,7
5. Group 2
6. f-block
7. Metalloid
8. Two incomplete outermost shells
9. Th to Lr

Match the columns



***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 periods
iii.	Second and third periods	c.	Shortest period
iv.	Sixth period	d.	Long periods

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

3.

	Column I		Column II
i.	Groups 1 and 2	a.	p-block
ii.	Groups 3 to 12	b.	d-block
iii.	Groups 13 to 18	c.	f-block
		d.	s-block

Ans: (i – d), (ii – b), (iii – a)

4.

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

Ans: (i – c), (ii – a), (iii – b)

5.

	Column I		Column II
i.	Horizontal rows	a.	Groups
ii.	Vertical columns	b.	Periods
iii.	Two additional rows	c.	Lanthanides and actinides
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.	Scandium
iii.	Eka-silicon	c.	Gallium

[Jul 15]

Ans: (i – b), (ii – c), (iii – a)

7.

	Column I		Column II
i.	Chlorine	a.	Group 1
ii.	Sodium	b.	Group 2
iii.	Argon	c.	Group 17
iv.	Magnesium	d.	Group 18

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.	Monovalent

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

9.

	Column I		Column II
i.	Noble gases	a.	B, Si, Ge
ii.	Metalloids	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 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.	There are 18 groups.	There are 7 periods.
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 gases and Normal elements

Ans:

	Inert gases	Normal elements
i.	In the atoms of inert gases all the shells are completely filled including outermost shell.	In the atoms of normal elements, only the outermost shell is incomplete.
ii.	They are stable and are chemically inert (i.e., chemically non-reactive)	They are unstable and are chemically reactive.
iii.	They are included in the p-block of the modern periodic table.	They are included in the s-block as well as p-block of the modern periodic table.
iv.	They are placed in zero group (Group 18) of the modern periodic table.	These elements are placed in groups 1, 2 and 13 to 17 of the modern periodic table.

4. Transition elements and Inner transition elements

Ans:

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

5. s-block elements and p-block elements

Ans:

	s-block elements	p-block elements
i.	Groups 1 and 2 elements are included in s-block.	Groups 13 to 18 elements are included in p-block.
ii.	These elements contain 1 or 2 electrons in their outermost shell.	These elements contain 3 to 8 electrons in their outermost shell.
iii.	s-block elements are metals (except hydrogen).	p-block elements include all types of elements i.e. metals, non-metals and metalloids.

6. Alkali metals and Alkaline earth metals

Ans:

	Alkali metals	Alkaline earth metals
i.	In the modern periodic table, the elements in Group 1 (group IA), excluding hydrogen, are called alkali metals.	In the modern periodic table, the elements in Group 2 (group IIA) 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.

7. d-block elements and f-block elements

Ans:

	d-block elements	f-block elements
i.	Elements placed in groups 3 to 12 in the middle of the modern periodic table are called d-block elements.	Elements placed at the bottom of the modern periodic table are called f-block elements.
ii.	These include transition elements.	These include inner transition elements (lanthanides and actinides).
iii.	They have two incomplete outermost shells.	They have three incomplete outermost shells.

8. Normal elements and Transition elements

Ans:

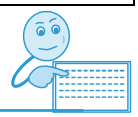
	Normal elements	Transition elements
i.	In the atoms of normal elements, only the outermost shell is incomplete.	In the atoms of transition elements, there are two incomplete outermost shells.
ii.	These elements are placed in groups 1, 2 and 13 to 17 of the modern periodic table.	These elements are placed in groups 3 to 12 in the middle of the modern periodic table.
iii.	They are included in s-block and p-block of the modern periodic table.	They are included in d-block of the modern periodic table.

9. Metallic character and Non-metallic character

Ans:

	Metallic character	Non-metallic character
i.	It is the tendency of an atom to lose electrons.	It is the tendency of an atom to accept or share electrons.
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.
iv.	Elements having metallic character are said to be electropositive.	Elements having non-metallic character are said to be electronegative.

Define the following terms



1. Periods

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

2. Groups

Ans: Vertical columns of elements in the modern periodic table are called groups.

3. Inert gases

Ans: Elements of group 18 (or zero group) having the outermost shell completely filled are called inert gases.

4. Normal elements

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

6. Inner transition elements

Ans: Elements placed at the bottom of the modern periodic table with three incomplete outermost shells 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 element having different atomic masses but same atomic number are called isotopes.

10. Atomic radius (Atomic size)

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

11. Metalloids

Ans: Elements which show the properties of both metals and non-metals are called as metalloids.

State the following laws

1. Newlands' Octaves law [Mar 15]

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."

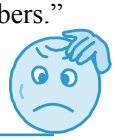
2. Mendeleev's Periodic law [Sept 14]

Ans: Mendeleev's Periodic law states that "The physical and chemical properties of elements are a 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."

Miscellaneous



1. Classify the following elements into metals, non-metals and metalloids:
C, Mg, Si, S, Hg, As. [Mar 15]

Ans:

Metals	Non-metals	Metalloids
Mg, Hg	C, S	Si, As

***2. Name:**

i. Three elements having a single electron in their outermost shell

ii. Three elements with filled outermost shell

iii. Three elements having 7 electrons in their outermost shell

Ans: i. Hydrogen, Sodium, Potassium

ii. Helium, Neon, Argon

iii. Chlorine, Bromine, Iodine

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. at proper places so that we can retrieve them easily, when required.

iv. In the library, books of various subjects are classified and placed in separate counters so that librarian as well as students can access these books easily when required.

v. For keeping books in library, librarian uses specified method of 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 approximately the mean of the atomic masses of other two elements.

Activity 1.3 (Text Book Page 4)

Ans: i. No, in Mendeleev's table, there was no proper place 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 element have different atomic masses but same atomic number. They occupy the same position in the modern periodic table.

ii. a. Hydrogen has 1 electron in the outermost 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.

iii.

Name	Symbol	Atomic No.	Electronic configuration (K,L,M,N)
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:

Element	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
Phosphorus	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 and 2nd shell.

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, the elements Mg and Ca contain same number of valence electrons. Similarly, F and Cl contain same number of valence electrons.

vi.

Element	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.

Element	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

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

ii.

Element	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($_1$H) b. Beryllium ($_4$Be)
c. Scandium ($_{21}$Sc) d. Titanium ($_{22}$Ti)
e. Vanadium ($_{23}$V) f. Chromium ($_{24}$Cr)
g. Manganese ($_{25}$Mn) h. Iron ($_{26}$Fe)
i. Cobalt ($_{27}$Co) j. Nickel ($_{28}$Ni)
k. Copper ($_{29}$Cu) l. Zinc ($_{30}$Zn)
m. Boron ($_5$B) n. Carbon ($_6$C)
o. Nitrogen ($_7$N) p. Oxygen ($_8$O)
q. Fluorine ($_9$F) r. Neon ($_{10}$Ne)
s. Cerium ($_{58}$Ce) t. Thorium ($_{90}$Th)

ii. **s-block elements:** Hydrogen($_1$H), Beryllium ($_4$Be)
p-block elements: Boron ($_5$B), Carbon($_6$C), Nitrogen ($_7$N), Oxygen ($_8$O), Fluorine ($_9$F), Neon ($_{10}$Ne)
d-block elements: Scandium ($_{21}$Sc), Titanium ($_{22}$Ti), Vanadium ($_{23}$V), Chromium ($_{24}$Cr), Manganese ($_{25}$Mn), Iron ($_{26}$Fe), Cobalt ($_{27}$Co), Nickel ($_{28}$Ni), Copper ($_{29}$Cu), Zinc ($_{30}$Zn)
f-block elements: Cerium ($_{58}$Ce), Thorium ($_{90}$Th).

iii. Elements with their corresponding groups are given below:

Element	Group	Element	Group
$_1$H	1 or I A	$_{29}$Cu	11 or I B
$_4$Be	2 or II A	$_{30}$Zn	12 or II B
$_{21}$Sc	3 or III B	$_5$B	13 or III A
$_{22}$Ti	4 or IV B	$_6$C	14 or IV A
$_{23}$V	5 or V B	$_7$N	15 or V A
$_{24}$Cr	6 or VI B	$_8$O	16 or VI A
$_{25}$Mn	7 or VII B	$_9$F	17 or VII A
$_{26}$Fe	8 or VIII	$_{10}$Ne	18 or Zero
$_{27}$Co	9 or VIII	$_{58}$Ce	3 or III B
$_{28}$Ni	10 or VIII	$_{90}$Th	3 or III B

Activity 1.8 (Text Book Page 7)

Ans: i. a. Valency is determined by the number of valence electrons present in the outermost shell (or valence shell) of an atom.

b. Eg. Mg has electronic configuration (2, 8, 2). It can lose two valence electrons to achieve stable electronic configuration. 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 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 (second and third periods), valency of elements increases from 1 to 4 then decreases from 4 to 0.

Variation of valency in a group: As we move from top to bottom in a group, valency of elements remains same because number of valence 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 3 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 having highest atomic radius is of sodium (Na), i.e. 190 pm and atom having lowest atomic radius is of chlorine (Cl), i.e. 99 pm.

d. In a period, the atomic radius decreases from left to right.

ii. a. **Increasing order of atomic radii of 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 having highest atomic radius is of iodine (I) i.e. 133 pm and atom having lowest atomic radius is of fluorine (F) i.e. 72 pm.

d. Atomic radius increases in a group from top to bottom.

HOTS

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

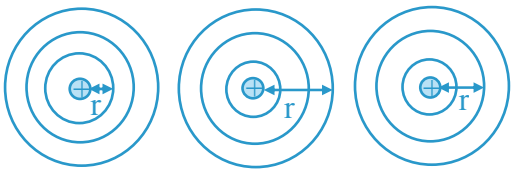


Figure A Figure B Figure C

Ans: Figure B correctly depicts the atomic radius of a certain atom having three shells.

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

i. Atomic radius
ii. Metallic character
iii. Valence electrons
iv. Number of shells

Ans: iii. Valence electrons

3. Write the electronic configuration of K and Ne. [Mar 14]

Ans: i. Electronic configuration of K (Potassium) is (2,8,8,1).
ii. Electronic configuration of Ne (Neon) is (2,8).

4. 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 their atomic numbers 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

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

Ans: i. G is a noble gas (Neon) because its electronic configuration is (2,8).
ii. F is a halogen (chlorine) because its atomic number is 17 and electronic configuration is (2,8,7).
iii. 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.
iv. Electronic configuration of C = (2,8,2) and that of E = (2,6).

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

i. Give the formula of the compound.
ii. Classify X and Y as metal, non-metal or metalloid.
iii. What will be the formula of oxide of element Y?

Ans: i. X has atomic number 17 i.e. Cl and its electronic configuration is (2,8,7). Thus, its valency is 1.
Y has atomic number 20 i.e. Ca and its electronic configuration is (2,8,8,2). Thus, its valency is 2.
∴ The compound will be YX_2 i.e. $CaCl_2$
ii. X accepts electron, therefore, it is a non-metal; Y donates electrons, so it is a metal.
iii. Y has valency 2 and oxygen also has valency 2.
∴ Formula of oxide of Y is YO i.e. CaO.

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

Ans: As chlorine (Cl), bromine (Br) and iodine (I) form a triad, atomic mass of Br should be the mean of atomic mass of Cl and I.

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

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

7. Classify the following elements into metals and non-metals. Justify your answer.

i. Element 'X' with atomic number 11.
ii. Element 'Y' with atomic number 16.

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

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

i. Calculate the average atomic mass of elements A and C.

ii. Compare the average atomic mass with atomic mass of B.

iii. What could the elements A, B and C be?

[Mar 13]

Ans: i. Average atomic mass of A and C

$= \frac{7+39}{2} = \frac{46}{2} = 23$

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

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

9. What will happen? If –

i. inert elements lose one of the outermost electrons.

ii. atomic size of metals decreases.

iii. maximum capacity of outermost shell 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 decreases, the electrostatic force of attraction between the nucleus and the outermost electrons will increase as the distance between them decreases. Thus, it will be difficult for the metal atom to lose its outermost electron. Hence, their metallic character will decrease.

iii. If the maximum capacity of outermost shell of an atom becomes seven, then the eighth electron in the outermost shell of an inert gas (excluding He) will shift to the next shell. Thus, the inert gases will no longer be inert and new set of elements (halogens) will have stable electronic configuration.

10. With the help of information given below, state the main characteristics of the elements:

i. Element P is zero group element.

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

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

iv. Element S is f-block element.

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 shell.

iii. Element 'R' is a transition metal.

iv. Element 'S' is an inner transition metal. It has three incomplete outermost shells. It is placed separately at the bottom of the periodic table as a member of either lanthanide or actinide series.

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

Ans: The element is Aluminium. Its atomic number is 13. It is placed in Group 13 as it has 3 valence electrons in its outermost shell (2, 8, 3). It is placed in 3rd period because it has three shells.

12. Read the paragraph and answer the questions given below:

In the modern periodic table, the elements are arranged in the increasing order of their atomic numbers. This arrangement is based on the modern periodic law, which states that the chemical and physical properties of elements are a periodic function of their atomic numbers. In the modern periodic table, each column is called a group and each row is called a period. Elements within the same group have similar chemical and physical properties. This is due to the same number of electrons in the outermost shell. For instance, alkali metals (Group 1 elements) have one electron in the outermost shell. They readily lose this electron to achieve stable electronic configuration and hence, alkali metals are very reactive. Similarly, all the noble gases (Group 18 elements) have completely filled outermost shell, which gives them extraordinary stability.

Questions:

i. State the law on which modern periodic table is based.

ii. Why are alkali metals very reactive?

iii. Which pair of elements do you think will have similar properties?

a. Sodium and Argon

b. Sodium and Potassium

c. Potassium and Neon

Answers:

i. The modern periodic table is based on the modern periodic law, which states that 'the chemical and physical properties of elements are a periodic function of their atomic numbers'.

ii. Alkali metals are very reactive because they have only one electron in the outermost shell which they can readily lose to achieve stable electronic configuration.

iii. Sodium and potassium are alkali metals. They are placed in group 1 of the modern periodic table. Elements that are placed in the same group have similar properties. Hence, sodium and potassium will have similar properties.

Additional Theory Questions

1. Give any two merits and two demerits of Mendeleev's periodic table.

Ans: *Refer Answer the following Questions Q.8 and Q.9.*

2. Name two elements having a single electron in their outermost shell. [Sept 14]

Ans: *Refer Miscellaneous Q.2 (i).*

3. Zero group elements do not take part in chemical reactions. Give reason.

Ans: *Refer Answer in brief Q.2 (iii) to (v).*

4. Noble gases are also called zero group elements. Explain

Ans: *Refer Write short notes on Q.7 (i) to (v).*

Memory Map