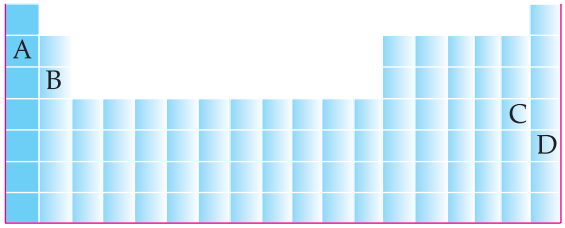
Periodic Classification of Elements

(A) Objective Type Questions — 1 Mark Each

Stand Alone MCQs (1 Mark Each)

1. The positions of four elements A, B, C and D in the modern periodic table are shown below. Which element is most likely to form an acidic oxide?

A [CBSE SQP 2020]



(A) A **(B)** B
(C) C **(D)** D

Ans. Option (C) is correct.

Explanation: Element C is most likely to form an acidic oxide because it lies in non-metal category.

2. Elements P, Q, R and S have atomic numbers 11, 15, 17 and 18 respectively. Which of them are reactive non-metals? U [CBSE SQP 2020]

(A) P and Q **(B)** P and R
(C) Q and R **(D)** R and S

Ans. Option (C) is correct.

Explanation: Element Q and R are reactive non-metals because they have great tendency to accept the electrons to occupy the stable electronic configuration.

3. Consider the following statements about an element 'X' with number of protons 13.

U [CBSE, 2020]

(I) It forms amphoteric oxide.
(II) Its valency is three.
(III) The formula of its chloride is XCl.

(A) only (I) **(B)** only (II)
(C) (I) and (III) **(D)** (I) and (II)

Ans. Option (D) is correct.

Explanation: The element is Al. It forms amphoteric oxide Al_2O_3, its valency is three and the formula of chloride is $AlCl_3$.

4. Upto which element, the Law of Octaves was found to be applicable ? A

(A) Oxygen **(B)** Calcium
(C) Cobalt **(D)** Potassium

Ans. Option (B) is correct.

Explanation: It was found that the Law of Octaves was applicable only upto calcium, as after calcium every eighth element did not possess properties similar to that of the first.

5. According to Mendeleev's Periodic Law, the elements were arranged in the periodic table in the order of

(A) increasing atomic number
(B) decreasing atomic number
(C) increasing atomic masses
(D) decreasing atomic masses R

Ans. Option (C) is correct.

Explanation: Mendeleev arranged the known elements according to increasing order of their atomic masses because according to him, fundamental property of an element was atomic mass.

AI **6. In Mendeleev's periodic table, gaps were left for the elements to be discovered later. Which of the following elements found a place in the periodic table later ?** U

(A) Germanium **(B)** Chlorine
(C) Oxygen **(D)** Silicon

Ans. Option (A) is correct.

Explanation: Many gaps for the undiscovered elements were left in the periodic table by Mendeleev. For instance, the elements scandium (Sc), gallium (Ga), and germanium (Ge) were not known at Mendeleev's time, but he had predicted their existence in advance of their discovery.

7. What type of oxide would Eka– aluminium form? R

(A) EO_3 **(B)** E_2O_2
(C) E_2O_3 **(D)** EO

Ans. Option (C) is correct.

Explanation: Eka-aluminium belongs to group 13. Hence, formula of oxide in group 13 is E_2O_3.

8. Which of these does not represent Dobereiner's triad? C

(A) Li, Na, K **(B)** Cl, Br, I
(C) Be, Mg, Ca **(D)** N, P, As

Ans. Option (D) is correct.

Explanation: N, P and As will not represent Dobereiner's triad. It is because; the average of atomic masses of Nitrogen and Arsenic is not equal to atomic mass of phosphorus.

9. An element 'X' is forming an acidic oxide. Its position in modern periodic table will be: U

(A) Group 1 and Period 3
(B) Group 2 and Period 3

(C) Group 13 and Period 3
(D) Group 16 and Period 3

Ans. Option (D) is correct.

> ***Explanation:*** Elements of Group 16 and Period 3 are non-metals that form acidic oxides.

10. Where would you locate the element with electronic configuration 2, 8 in the Modern Periodic Table? U

(A) Group 8 **(B)** Group 2
(C) Group 18 **(D)** Group 10

Ans. Option (C) is correct.

> ***Explanation:*** Element with electronic configuration 2, 8 has complete octet so must be placed in group 18.

11. Which of the following is the outermost shell for elements of period 2? U

(A) K shell **(B)** L shell
(C) M shell **(D)** N shell

Ans. Option (B) is correct.

> ***Explanation:*** The elements of 2^{nd} period contain two shells, K and L shell.

12. Arrange the following elements in the order of their decreasing metallic character: Na, Si, Cl, Mg, Al. A

(A) Cl > Si >Al > Mg >Na
(B) Na >Mg >Al >Si > Cl
(C) Na > Al > Mg > Cl > Si
(D) Al > Na> Si > Ca> Mg

Ans. Option (B) is correct.

> ***Explanation:*** As we move from left to right in periodic table, metallic characters decreases and non-metallic characters increases.

13. Which of the following elements will form an acidic oxide? U

(A) An element with atomic number 7
(B) An element with atomic number 3
(C) An element with atomic number 12
(D) An element with atomic number 19

Ans. Option (A) is correct.

> ***Explanation:*** Formation of acidic oxides is a characteristic of non-metals. Here, element with atomic number 7 is a non-metal *i.e.*, nitrogen. Rest three elements are metals and hence metals form basic oxide.

14. Which of the following set of elements is written in order of their increasing metallic character? A

(A) Be, Mg, Ca **(B)** Na, Li, K
(C) Mg, Al, Si **(D)** C, O, N

Ans. Option (A) is correct.

> ***Explanation:*** As we move down in a group, metallic nature increases due to increase in electron losing tendency. Be, Mg and Ca belong to same group *i.e.*, Group 2 of Modern Periodic table.

15. Which of the following are the characteristics of isotopes of an element? R

(i) Isotopes of an element have same atomic masses.
(ii) Isotopes of an element have same atomic number.
(iii) Isotopes of an element show same physical properties.
(iv) Isotopes of an element show same chemical properties.

(A) (i), (iii) and (iv) **(B)** (ii), (iii) and (iv)
(C) (ii) and (iii) **(D)** (ii) and (iv)

Ans. Option (D) is correct.

> ***Explanation:*** Isotopes are the atoms of the same element which have same atomic number because of same number of valence electrons but different number of neutrons hence their atomic masses are different. This leads to similar chemical properties but different physical properties.

AI **16. Which of the following statements is not a correct statement about the trends when going from left to right across the periods of periodic table?** R

(A) The elements become less metallic in nature
(B) The number of valence electrons increases
(C) The atoms lose their electrons more easily
(D) The oxides become more acidic.

Ans. Option (C) is correct.

> ***Explanation:*** On moving from left to right across the periods of the periodic table, the non-metallic character increases. Hence, the tendency to lose electrons decreases.

Assertion and Reason Based MCQs
(1 Mark Each)

Directions : In the following questions, A statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as.

(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is NOT the correct explanation of A.
(C) A is true but R is false.
(D) A is false and R is true.

1. Assertion (A): Mendeleev arranged element in horizontal rows and vertical columns.
Reason (R): Mendeleev ignored the order of atomic weight thinking that the atomic measurements might be incorrect.

Ans. Option (A) is correct.

> ***Explanation:*** Mendeleev arranged elements in horizontal rows and vertical columns. He ignored the order of atomic weight thinking that the atomic measurements might be incorrect and placed the elements with similar properties.

2. **Assertion (A):** Mendeleev left the gaps under aluminium and silicon and called these Eka-aluminium and Eka-silicon, respectively.
Reason (R): Dobereiner arranged elements on the basis of increasing atomic number.

Ans. Option (C) is correct.

Explanation: Dobereiner arranged elements on the basis of increasing atomic weights in a triad.

3. **Assertion (A):** In a triad, the three elements have same gaps between their atomic masses.
Reason (R): Elements in a triad have similar properties.

Ans. Option (D) is correct.

Explanation: In a triad, the atomic mass of the middle element is the mean of the atomic masses of the first and third elements. These elements have similar physical and chemical properties.

4. **Assertion (A):** According to Mendeleev, periodic properties of elements is a function of their atomic number.
Reason (R): Atomic number is equal to the number of protons.

Ans. Option (D) is correct.

Explanation: According to Mendeleev, periodic properties of elements is a function of their atomic masses. Atomic number is defined by the number of protons present in the nucleus of atoms of the element.

5. **Assertion (A):** Sixth and seventh periods in the periodic table contains 14 elements.
Reason (R): In the periodic table, 14 elements of sixth and seventh periods are known as lanthanoids and actinoids respectively.

Ans. Option (D) is correct.

Explanation: Sixth and seventh period contains 32 elements. Out of 32 elements 14 are the lanthanoids in period 6 and actinoids in period 7.

6. **Assertion (A):** Be and Al show similar properties.
Reason (R): The metallic radius of Be is less than the metallic radius of Al.

Ans. Option (B) is correct.

Explanation: Be and Al show diagonal relationship because Be resembles in its properties with Al. Metallic radius of the Be (111 pm) is less than the metallic radius of Al (143 pm). Although smaller size is the reason for the anomalous behaviour of Be but not a reason for its diagonal relation with Al.

7. **Assertion (A):** The atomic and ionic radii generally decreases towards right in a period.
Reason (R): The ionisation enthalpy increases on moving towards left in a period.

Ans. Option (C) is correct.

Explanation: The ionisation enthalpy increases on moving towards the extreme right element in period due to increase in effective nuclear charge and atomic and ionic radii decreases in a period from left to right.

8. **Assertion (A):** Smaller the size of an atom, greater is the electronegativity.
Reason (R): Electronegativity refers to the tendency of atom to share electrons with other atom.

Ans. Option (C) is correct.

Explanation: Electronegativity refers to the tendency of an atom to attract shared pair of electrons toward itself. Down the group electronegativity decrease with increase in size.

9. **Assertion (A):** Noble gases are highly reactive.
Reason (R): Noble gases have stable closed shell electronic configuration.

Ans. Option (D) is correct.

Explanation: Inert gases (noble gases) are least reactive due to stable closed shell electronic configuration like $1s^2$ or ns^2, np^6 (Here $n \leq 2$)

Case-based MCQs (1 Mark Each)

I. Read the passage and answer the questions given below :

Mendeleev was a Russian chemist, who contributed the most for the development of periodic table of elements wherein the elements were arranged on the basis of their fundamental property, the atomic mass and also on the similarity of chemical properties. Only 63 elements were known at his time. He arranged the 63 elements in the increasing order of their atomic masses and found that there was a periodic recurrence of elements with similar physical and chemical properties. He observed that elements with similar properties fall in the same vertical column. These vertical columns are called groups and horizontal rows of elements are called periods. Mendeleev predicted the existence of certain elements not known at that time and named two of them as Eka-silicon and Eka-aluminium

1. **Mendeleev arranged the periodic table on the basis of which fundamental property?** U
(A) Atomic mass
(B) Atomic number
(C) Number of neutrons
(D) Valence electrons

Ans. Option (A) is correct.

Explanation: Mendeleev arranged the known elements according to increasing order of their atomic masses because according to him, fundamental property of an element was atomic mass.

2. **Eka aluminium and eka silicon were later replaced respectively as :** U
(A) Germanium and gallium
(B) Gallium and scandium

(C) Gallium and germanium
(D) Germanium and scandium

Ans. Option (C) is correct.

> ***Explanation:*** Mendeleev defined unnamed elements as eka- Boron, eka- Aluminium and eka- Silicon which were later replaced as Scandium, Gallium, and Germanium respectively.

3. The elements eka aluminium and eka silicon discovered by Mendeleev later found place in periodic table. Both of these elements belong to: R

(A) Period 2 **(B)** Group 13
(C) Group 14 **(D)** Period 4

Ans. Option (D) is correct.

> ***Explanation:*** Eka silicon replaced with Germanium : Group 14, Period 4 and Eka aluminium replaced with Gallium : Group 13, Period 4.

4. How do we classify these newly discovered elements (eka-aluminium and eka-silicon)? R

(A) Metals **(B)** Non metals
(C) Metalloids **(D)** Inert gases

Ans. Option (C) is correct.

> ***Explanation:*** The newly discovered elements were metalloids. A metalloid is an element that has properties that are intermediate between those of metals and non-metals.

AI II. Using the given part of the periodic table, answer the questions given below :

Group → Period ↓	1	2	13	14	15	16	17	18
3	X		B	C	D	E		
4	Y							
5	Z							

1. Which of these elements have smallest atomic size? U

(A) B **(B)** C
(C) D **(D)** E

Ans. Option (D) is correct.

> ***Explanation:*** Element E has the smallest atomic size because moving left to right of a period, atomic size decreases.

2. What is the valency of element E? U

(A) 1 **(B)** 3
(C) 2 **(D)** 0

Ans. Option (C) is correct.

> ***Explanation:*** The valency of element E is 2 as E belong to Group 16 and valency in Group 16 is always 2.

3. Identify the elements which have similar chemical properties as the element X. A

(A) Y and Z. **(B)** Y and B
(C) All Y, Z and B **(D)** None of these

Ans. Option (A) is correct.

> ***Explanation:*** Y and Z have similar physical and chemical properties as X.

4. Which of them will have largest atomic radii? U

(A) E **(B)** X
(C) C **(D)** D

Ans. Option (B) is correct.

> ***Explanation:*** X has the largest atomic radii. It is because atomic radii decrease from left to right along a period.

III. Read the passage and answer the questions given below :

> Atoms of eight elements A, B, C, D, E, F, G and H have the same number of electronic shells as K, L and M. But are different in their outermost shells. It was found that elements A and G combine to form an ionic compound which can also be extracted from sea water. Oxides of the elements A and B are basic in nature while those of E and F are acidic. The oxide of elements D is almost neutral.

1. To which period the listed elements belong? U

(A) 2^{nd} **(B)** 7^{th}
(C) 8^{th} **(D)** 3^{rd}

Ans. Option (D) is correct.

> ***Explanation:*** The eight elements belong to the 3^{rd} period as they have the same number of electronic shells *i.e.*, K, L and M but different number of electrons in their outermost shells. The number of valence electrons in these elements increases from 1 to 8, on moving from left to right in this period.

2. Which two of these elements could definitely be metals ? A

(A) E and F **(B)** A and B
(C) D **(D)** G

Ans. Option (B) is correct.

> ***Explanation:*** A, B and C are definitely metals because in the 3^{rd} period, at the extreme left, only metals are placed whose oxides are basic, D is a metalloid that have amphoteric oxides while E, F and G are non-metals that have acidic oxide.

3. Which two elements amongst these are likely to be the non–metals ? U

(A) A and G **(B)** D and F
(C) E and F **(D)** A and B

Ans. Option (C) is correct.

> ***Explanation:*** E and F belong to group 15 and 16 as they form acidic oxides.

4. Which one of the following is most likely to be found in gaseous state at room temperature ? R

(A) A **(B)** H
(C) D **(D)** B

Ans. Option (B) is correct.

> ***Explanation:*** The element H is most likely to be found in gaseous state at room temperature. It is because the last group elements in the periodic table are all in a gaseous state at room temperature.

AI IV. From the following table of the periodic table, answer the questions given:

1 Lithium	2	13	14 Carbon	15	16 Oxygen	17 Fluorine
X			P			Q
Y						R
Z						T

1. Which is the most reactive metal ? U

(A) Lithium **(B)** X
(C) Y **(D)** Z

Ans. Option (D) is correct.

Explanation: Z is the most reactive metal as moving down the group electrons can be losed easily.

2. Name the family of fluorine, Q, R, T: A

(A) Alkali metals **(B)** Noble gas
(C) Halogens **(D)** Alkaline metals

Ans. Option (C) is correct.

Explanation: The family of fluorine Q, R and T are Halogen because they belong to 17th group.

3. Which of the following element belongs to group 2? R

(A) Sodium **(B)** Magnesium
(C) Aluminium **(D)** Carbon

Ans. Option (B) is correct.

Explanation: Magnesium belong to group 2, Sodium, Carbon and aluminium belong to group 1, group 14, group 13 respectively.

4. Which other element is likely to present in the group in which fluorine is present? U

(A) Neon **(B)** Aluminium
(C) Chlorine **(D)** None of the above

Ans. Option (C) is correct.

Explanation: The halogen elements are fluorine (F), chlorine (Cl), bromine (Br), iodine (I), astatine (At), and tennessine (Ts).

(B) Subjective Questions

Very Short Answer Type Questions
(1 Mark Each)

1. How many horizontal rows are present in modern periodic table? What are they called? [O.E.B.] R

Ans. There are seven horizontal rows in the modern periodic table. These rows are called periods. ½ + ½

2. How many vertical columns are present in modern periodic table? What are they called? [O.E.B. R

Ans. There are 18 vertical columns in the modern periodic table and these are known as groups. ½ + ½

3. State the formula to fill up the maximum number of electrons in a shell. [O.E.B.] R

Ans. $2n^2$, where n is the number of shell. **1**

4. Write the total number of periods in modern periodic table. R [CBSE Term II, 2015]

Ans. The total number of periods in modern periodic table is seven. [CBSE Marking Scheme, 2015] **1**

AI 5. State one reason that explains the position of Hydrogen in group I. [O.E.B.] U

Ans. Hydrogen should be placed in group I, since it has only one electron in its outermost shell. **1**

AI 6. Why noble gases are placed in a separate group in modern periodic table? [O.E.B.] A

Ans. It is because they resemble with each other but do not resemble with other group elements. **1**

AI 7. How does valency of an element vary across a period? R [CBSE SQP, 2020]

Ans. The valency of an element first increases and then decreases across a period. [CBSE Marking Scheme, 2020] **1**

8. Define electropositivity. R [OD 2020]

Ans. Electropositivity is the tendency of an element to lose electrons and form positive ions in a chemical reactions. **1**

9. The atomic radii of first group elements are given below: [CBSE OD 2020]

Group I element	Atomic radii (pm)
Na	86
K	231
Rb	244
Cs	282

State the reason behind the observed trend in the above elements. U

Ans. In a group, as we move from top to bottom, the number of shells increases. Hence, the atomic radius increases.

10. State one reason for placing Mg and Ca in the same group of the periodic table. U [CBSE Term II, 2015]

Ans. Due to the presence of 2 electrons in the valence shell and similar chemical properties. [CBSE Marking Scheme, 2015] **1**

11. How many elements are in 2nd and 5th period of Modern Periodic table. [O.E.B.] U

Ans. 2nd period has 8 elements, 5th period has 18 elements. ½ + ½

12. Name any two elements that have two electrons in their valence shell. [O.E.B.] U

Ans. (i) Magnesium: 2, 8, 2 ½
(ii) Calcium : 2, 8, 8, 2. ½

13. If the atomic number of three element X, Y and Z are 3, 11 and 17 respectively. Which two elements will show similar chemical properties. Justify.

[O.E.B.] C

Ans. X and Y will show similar chemical properties as these have same valence electrons.

X = 2, (1)

Y = 2, 8, (1) ½ + ½

Short Answer Type Questions-I

(2 Marks Each)

1. How it can be proved that the basic structure of the Modern Periodic Table is based on the electronic configuration of atoms of different elements ?

U [CBSE Delhi, 2019]

Ans. Modern periodic table consists of groups and periods, where number of valence electrons determines the group and number of shells determines the period.

[CBSE Marking Scheme, 2019] 1 + 1 = 2

2. Write the name, symbol and electronic configuration of an element X whose atomic number is 11. R [CBSE Delhi, 2019]

Ans. Name – Sodium ½

Symbol – Na ½

Electronic configuration – 2, 8, 1 **1**

[CBSE Marking Scheme, 2019] 2

3. Can the following groups of elements be classified as Dobereiner's triad ?

(a) Na, Si, Cl

(b) Be, Mg, Ca

Atomic mass of Be-9; Na-23, Mg-24, Si-28, Cl-35, Ca-40.

Justify your answer in each case. [O.E.B.] C

Ans. **(a)** Na, Si, Cl – Average of atomic masses of Na and Cl is not equal to the atomic mass of Si. ½

(b) Be, Mg, Ca – The average of atomic masses of Be and Ca is equal to the atomic mass of Mg. ½

Atomic mass of Mg = $\frac{\text{Atomic mass of Be} + \text{Atomic mass of Ca}}{2}$

$= \frac{9+40}{2} = \frac{49}{2} = 24.5$

[CBSE Marking Scheme, 2019] 1

4. An element 'X' has mass number 35 and 18 number of neutrons. Therefore, electronic configuration of X= 2, 8, 7. Write atomic number and electronic configuration of 'X'. Also write group number, period number and valency of 'X'.

AE [CBSE O.D., 2016]

Ans. Atomic number of X = Mass number of X – Number of neutrons

35 –18 =17

Therefore, Electronic configuration of X= 2, 8, 7

Group number =17

Period number = 3

Valency = 8 – 7 = 1 **2**

5. The atomic number of an element is 14. Examine if this element will have metallic properties or not. Give reason to justify your answer.

A [CBSE 2019]

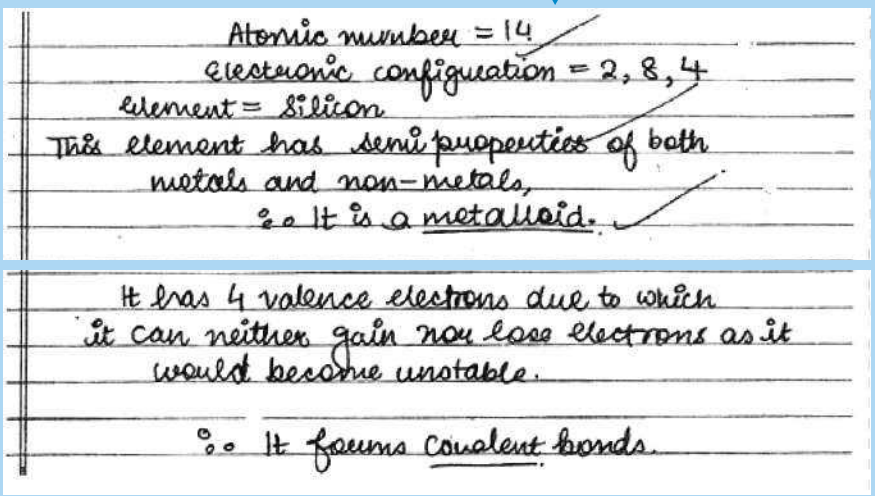
Ans. Atomic number =14

Electronic configuration = 2, 8, 4

Hence, the element is silicon. This element exhibit the properties of both metals and non-metals. Hence, it is semi-metal or metalloid. **2**

Topper Answer, 2019

Ans.



6. The electronic configuration of an element is 2, 8, 4. State its: (a) group and period in the Modern Periodic Table. (b) name and write its one physical property. AE **[Delhi 2019]**

Ans. (a) Group – 14, Period – 3 ½ + ½

(b) Silicon ½

Metalloid / poor conductor of electricity

½ (or any other property)

[CBSE Marking Scheme, 2019] 2

7. The electronic configuration of an element 'X' is 2, 8, 6. To which group and period of the modern periodic table does 'X' belong. State its valency.

[O.E.B.] A

Ans. X: 2, 8, 6

(a) Since 'X' has three energy shells and period number of an element is equal to the number of energy shells, X belongs to 3rd period.

(b) X has 6 valence electrons it belongs to group 16.

(c) Valency will be 2. To acquire noble gas configuration it will gain 2 electrons.

8. Define the following terms ? (i) Valency, (ii) Atomic size. **[O.E.B.]** R

Ans. (i) Valency: The combining power or the combining capacity of an atom is called its valency.

(ii) Atomic size: Atomic size or atomic radius is the distance between the centre of the nucleus and the outermost shell of an isolated atom.

Short Answer Type Questions-II

(3 Marks Each)

1. Study the data of the following three categories A. B and C.

Category	Name of the element	Atomic mass
A	Li	7
	Na	23
	K	39
B	N	14
	P	31
	As	74
C	B	10.8
	Al	27
	Ga	69.7

[CBSE OD, 2020]

(i) From the given three categories A, B and C, pick the one which forms Dobereiner's Triads.

(ii) Why did Mendeleev placed elements of category A, B and C in three different groups ?

(iii) Is Newland law of octaves applicable to all the three categories?
Give reason to justify your answer.

Ans. (i) Category A (Li, Na, K) shows Dobereiner's triads.

(ii) Mendeleev arranged the elements in increasing order of atomic mass and grouped them as per similar chemical property. The elements in A, B and C are similar among themselves but have different chemical properties.

(iii) No, Newland law of Octaves is not applicable because in the three categories every eighth element will not show same property as first. Also, Newland Octaves law is applicable only upto calcium.

2. Three elements 'X', 'Y' and 'Z' have atomic numbers 7, 8 and 9 respectively.

(a) State their positions (Group number and period number both) in the Modern Periodic Table.

(b) Arrange these elements in the decreasing order of their atomic radii.

(c) Write the formula of the compound formed when 'X' combines with 'Z'. [CBSE O.D. 2016/O.D. 2020]

Ans. (a) X (7) - 2,5 Group 15; Period 2

Y(8) - 2,6 Group 16; Period 2

Z(9) - 2,7 Group 17; Period 2 **1**

(b) X > Y > Z **1**

(c) XZ_3 **1**

AI **3. Two elements X and Y have atomic numbers 12 and 16 respectively. To which period of the modern periodic table do these two elements belong? What type of bond will be formed between them and why? Also give the chemical formula of the compound formed.** A **[CBSE SQP, 2019]**

Ans. Electronic configuration of X: 2, 8, 2, Y: 2, 8, 6

Both X and Y belongs to 3rd period.

Ionic bond will be formed.

Reason: X will lose 2 electrons and Y will gain 2 electrons to complete their octet and become stable.

Formula is XY.

[CBSE Marking Scheme, 2019] 1 + ½ + 1 + ½

4. The electronic configuration of an element 'X' is 2, 8, 6. To which group and period of the modern periodic table does 'X' belong. State its valency and justify your answer in each case.

AE **[CBSE SQP, 2018]**

Ans. X: 2, 8, 6

(a) Since 'X' has three energy shells and period number of an element is equal to the number of energy shells. X belongs to 3rd period. **1**

(b X has 6 valence electrons it belongs to group 16. **1**

(c) Valency will be 2. To acquire noble gas configuration it will gain 2 electrons. **1**

[CBSE Marking Scheme, 2018]

COMMONLY MADE ERROR

➲ Usually students get confused with the group and period to which they belong to. They also get confused with the valency.

ANSWERING TIPS

- Understand the basic concepts involved in the separation of periods and groups in the modern periodic table.
- After writing the electronic configuration, check the number of energy shells which should be equal to the period number.
- Then check for how many outermost (valence) electrons are there and then write the group to which it belongs.
- From the valence electrons we can write the valency of that element.

AI **5. Write the electronic configuration of two elements P (atomic number 17) and Q (atomic number 19) and determine their group numbers and period numbers in the Modern Periodic Table.**

C **[CBSE OD Comptt Set-I, 2017]**

Ans. Electronic configuration of 'P' — 2, 8, 7
Group number — 17
Period number — 3rd
Electronic configuration of 'Q' — 2, 8, 8, 1
Group number — 1
Period number — 4th

[CBSE Marking Scheme, 2017] 1 + 1 + 1

6. Consider the following elements (atomic numbers are given in parenthesis)
Ca(20); K(19); F(9); Be(4) **[CBSE OD Comptt Set-III, 2017]**

(a) Select:
(i) The elements having one electron in the outermost shell.
(ii) Two elements of the same group. Write the number of this group.
(b) Write the formula of the compound formed by the union of Ca(20) and the element X(2, 8, 7).

AE **[CBSE OD Comptt Set-III 2017]**

Ans. (a) (i) K (Potassium — 2, 8, 8, 1)
(ii) Be and Ca in same group because both have same number of valence electrons in their outermost shell. The number of this group is 2.

(b)	Ca	X
Valency	2	1

Thus, the formula of the compound is Ca_1X_2 = CaX_2 **1+1+1**

7. An element P (atomic number 20) reacts with an element Q (atomic number 17) to form a compound. Answer the following questions by giving reason: Write the position of P and Q in the Modern Periodic Table and the molecular formula of the compound formed when P reacts with Q.

C **[CBSE, Delhi Set-I, 2017]**

Ans.

Position of P	Group-2	Because it has 2 valence electrons/ 2, 8, 8, 2
	Period-4	Because it has 4 shells/2, 8, 8, 2
Position of Q	Group-17	Because it has 7 valence electrons/ 2, 8, 7
	Period-3	Because it has 3 shells/ 2, 8, 7
Formula	PQ_2	Because valency of P is 2 and that of Q is 1

[CBSE Marking Scheme, 2017] 3

COMMONLY MADE ERROR

- Students often write vague answer. It seems they are unaware of the concept of calculating group and period of an element.

ANSWERING TIP

- Follow the basic rule that the period number is equal to the number of shells in an atom and group number is equal to valence electrons for the first two groups.

8. The atomic number of an element is 20.
(a) Write its electronic configuration and determine its valency.
(b) Is it a metal or a non-metal ?
(c) Write the formula of its chloride.
(d) Is it more reactive or less reactive than Mg (atomic number 12) ? Give reason for your answer.

C **[Foreign Set 31/2/1 2017]**

Ans. (a) Electronic Configuration, $X_{(20)}$ – 2, 8, 8, 2 ½
Valence electrons- 2
Hence valency is 2 ½+½
(b) It is a metal ½
(c) XCl_2 ½
(d) It is more reactive than Mg as reactivity increases down the group. Mg- III Period and X_{20} (Ca)- IV Period. ½

9. Write the electronic configuration of two elements X and Y whose atomic numbers are 20 and 17 respectively. Write the molecular formula of the compound formed when element X reacts with element Y. Draw electron-dot structure of the product and also state the nature of the bond formed between both the elements.

AE **[CBSE O.D. Set-I 2017]**

Ans. X(20) – 2, 8, 8, 2 ½

Y(17) – 2, 8, 7 ½

XY_2 ½

$X + 2Y = X^{2+}\ [:\underset{\cdot\cdot}{\overset{\cdot\cdot}{Y}}:]^{2-}$ ½+½

Ionic/eletrovalent bond. ½

[CBSE Marking Scheme, 2017]

10. An element 'M' has atomic number 12.

(i) Write its electronic configuration and valency.

(ii) Is 'M' a metal or a non-metal ? Give reason in support of your answer.

(iii) Write the formula and nature (acidic/basic) of the oxide of M. AE **[CBSE Delhi Comptt. Set-I, 2017]**

Ans. (i) Electronic Configuration — 2, 8, 2

Valency — 2.

(ii) Metal

There are two electrons in its outermost shell and it easily loses them to form a positive ion.

(iii) Element : M O

Valency : 2 2

Chemical formula M_2O_2 = MO

It is a basic oxide. **1+1+1**

11. An element 'X' with electronic configuration (2, 8, 2) combines separately with two radicals, $(NO_3)^-$ and $(SO_4)^{2-}$.

(i) Is 'X' a metal or a non-metal ? Write the nature of its oxide.

(ii) Write the formula of the compounds of 'X' formed by the combination of these radicals. Are these compounds covalent or electrovalent ?

U **[CBSE O.D. Comptt. 2017]**

Ans. (i) X is a metal. Nature of its oxide is basic.

(ii) $X(NO_3)_2$, XSO_4

These compounds are ionic/electrovalent. **1+1+1**

AI **12. State the main aim of classifying elements. Which is more fundamental property of elements that is used in the development of Modern Periodic Table ? Name and state the law based on this fundamental property. On which side of the periodic table one can find metals, non-metals and metalloids ?**

U **[CBSE Borad Term II, Foreign Set-I, 2016]**

OR

Write the main aim of classifying elements. Name the basic property of elements used in the development of Modern Periodic Table. State the Modern Periodic Law. On which side (part) of the Modern Periodic Table do you find metals, metalloids and non-metals ?

R **[CBSE Board Term II, Delhi Set-II, 2015]**

Ans. (i) Aim of Classification: For systematic and simplified study of elements and their compounds. ½

(ii) Basic property: Atomic Number. ½

(iii) Modern periodic Law: The properties of elements are a periodic function of their atomic number. ½

(iv) Metals are found on the left side and centre of the Modern Periodic Table. ½

(v) Metalloids are found in a zig-zag manner between the metals and the non-metals. ½

(vi) Non-metals are found on the right side of the Modern Periodic Table. ½

[CBSE Marking Scheme, 2015]

13. An element 'X' belong to 3rd period and group 13 of the Modern Periodic Table.

(a) Determine the valence electrons and the valency of 'X'.

(b) Molecular formula of the compound formed when 'X' reacts with an element 'Y'(atomic number = 8).

(c) Write the name and formula of the compound formed when 'X' combines with chlorine.

A **[CBSE O.D., 2016]**

Ans. (a) Group 13 means valence electrons are 3 and valency is 3. ½ + ½

(b) Y (8) – 2, 6 X = 2, 8, 3

Valency – 2 Valency – 3

Compound formed – X_2Y_3 /Al_2O_3 **1**

(c) X Chlorine Cl

Valency -3 Valency -1

Compound formed – XCl_3 /$AlCl_3$ **1**

14. The following table shows the position of five elements A, B, C, D and E in the modern periodic table.

Group → / ↓ Period	1	2	3 to 12	13	14	15	16	17	18
2	A							B	C
3		D				E			

Answer the following giving reasons:

(i) Which element is a metal with valency two? **(ii) Which element is least reactive?**

(iii) Out of D and E which element has a smaller atomic radius? **[O.E.B.]**

Ans. (i) D, as it is on the left side of the table in group 2. **(ii)** C, as it is in the group 18/ Noble gas.
(iii) E, as we move from left to right across a period, atomic radius decreases. **1+1+1**

15. Define atomic size. Give its unit of measurement. In the modern periodic table what trend is observed in the atomic radius in a group and a period and why is it so?

U **[CBSE SQP Delhi, 2020]**

Ans. Atomic Size: The distance from centre of nucleus to outermost shell of an atom is atomic radius.

Atomic size is measured in Angstroms, (A°).

where 1 Angstroms = 10^{-10} metres. **1+1+1**

Along the period from left to right atomic radius decreases.

Reason: Nuclear charge increases which tends to pull the electrons closer to the nucleus.

Down the group: Atomic radius increases

Reason: Number of shells increases on going down the group.

16. Define groups in the Modern Periodic Table. How do valency, atomic size and metallic character vary in a group.

U **[CBSE 2019]**

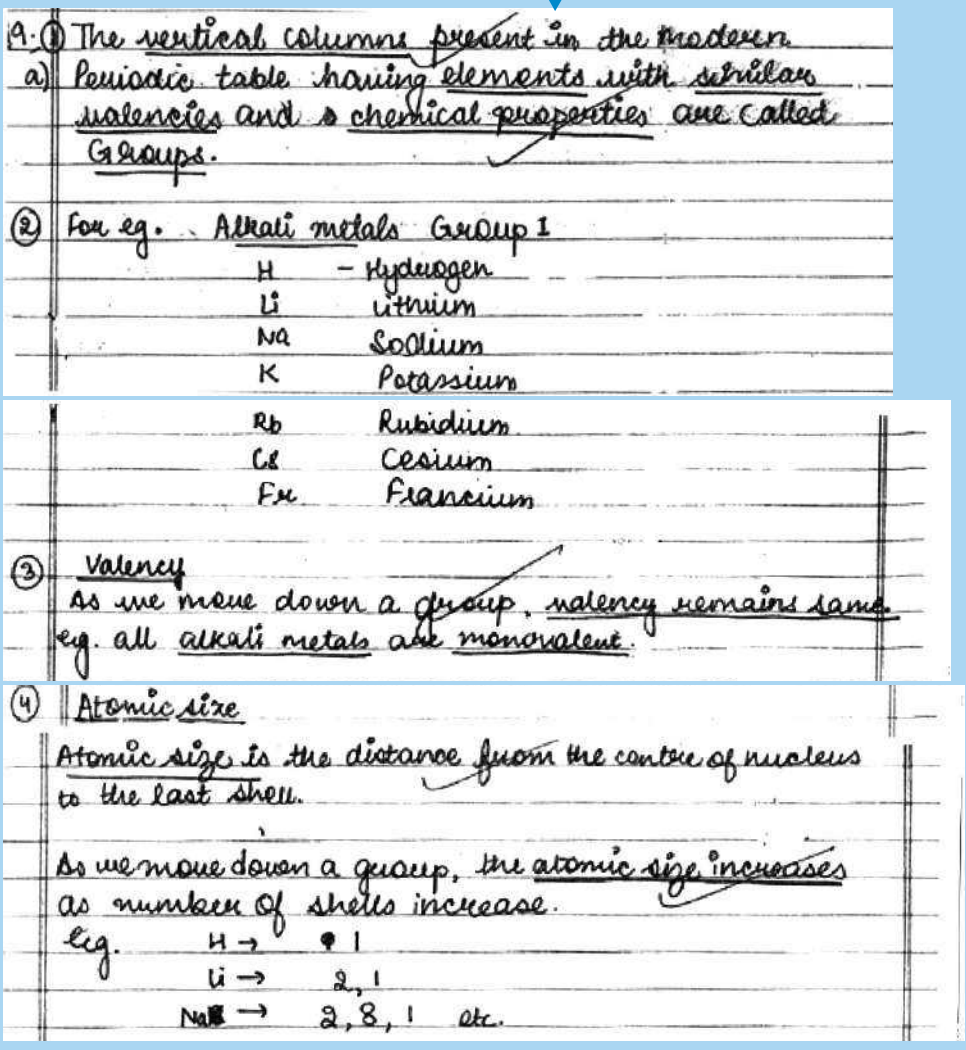
Ans. Group : Vertical columns in the modern periodic table are known as 'groups'. There are 18 groups.

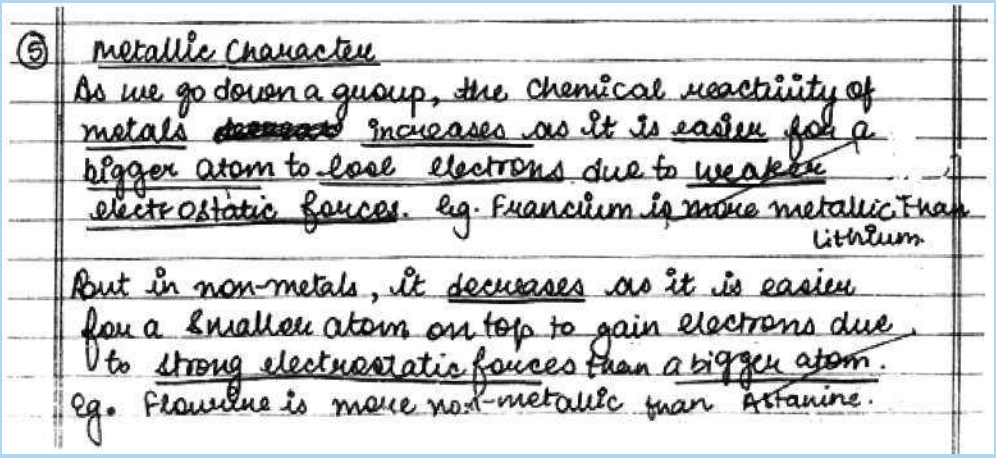
(i) Valency remain same in a group.

(ii) Atomic size increases from top to bottom in a group.

(iii) Metallic character also increases from top to bottom in a group. **1+1+1**

Topper Answer, 2019





17. How does the atomic radius of the elements change on going

(i) from left to right in a period, and

(ii) down a group

in the Modern Periodic Table ? Give reason in support of your answer.

A **[CBSE Delhi Comptt. Set-I, 2017]**

Ans. (i) Atomic radius decreases. ½

Reason: Nuclear charge increases which tends to pull the electrons closer to the nucleus. **1**

(ii) Atomic radius increases. ½

Reason: Number of shells increases on going down the group. **1**

[CBSE Marking Scheme, 2017]

18. Write the names given to the vertical columns and horizontal rows in the Modern Periodic Table. How does the metallic character of elements vary on moving down a vertical column ? How does the size of atomic radius vary on moving left to right in a horizontal row ? Give reason in support of your answer in the above two cases.

R **[CBSE Delhi Set-I, 2017]**

Ans. Vertical Column — Groups ½

Horizontal Rows — Periods ½

(i) Metallic character increases.

Reason: Ability to lose electrons increases on moving down the group due to increase in distance between the nucleus and the valence electrons/ decrease in the attraction between the nucleus and the valence electrons. **1**

(ii) Atomic radius decreases.

Reason: The nuclear charge increases on moving from left to right across a period resulting in increase in the attraction between the nucleus and the valence electrons. **1**

[CBSE Marking Scheme, 2017]

Detailed Answer:

In the modern periodic table, there are 18 vertical columns known as Groups and 7 horizontal rows known as Periods.

Metallic character increases on moving down a group in the Modern Periodic table. As we move down the group, the electrostatic attraction between the nucleus and the outermost electron decreases due to increase in the distance between them. This happens because on moving down the group a new shell is added. So, the valence electron can be easily lost by the element, thereby metallic character increases on moving down a group.

The size of atomic radius decreases on moving left to right in a horizontal row. When, we move across a period, the number of electrons in the same shell increases. This leads to greater electrostatic attraction between the nucleus and the outermost electron. This increased attraction pulls the outermost electron closer to the nucleus, thereby decreasing the atomic size. **1+1+1**

19. Na, Mg and Al are the elements of the 3rd period of the Modern Periodic Table having group number 1, 2 and 13 respectively. Which one of these elements has the

(a) highest valency,

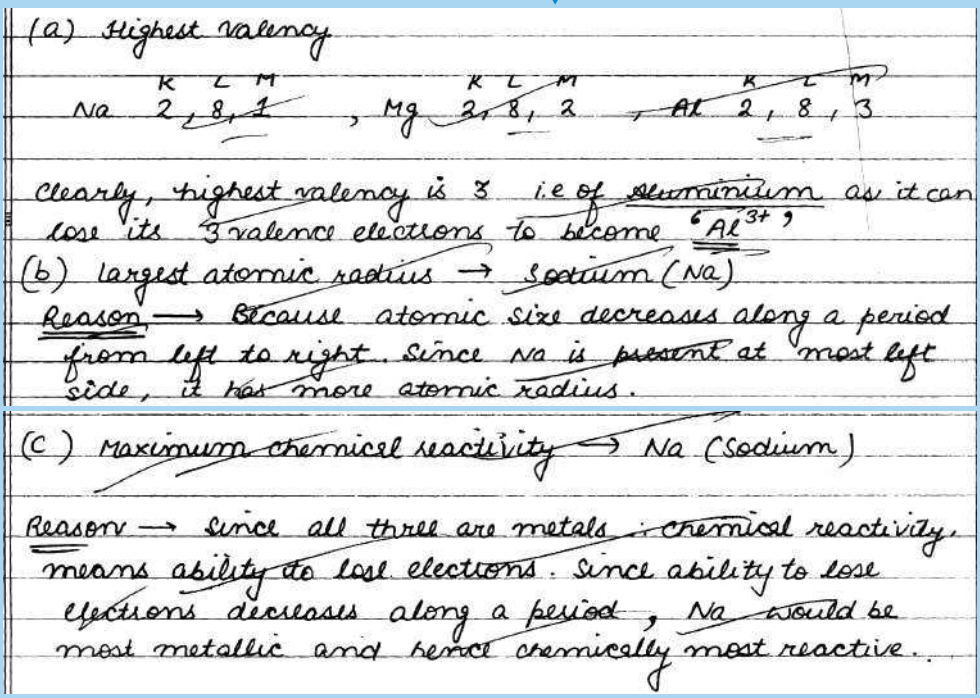
(b) largest atomic radius, and

(c) maximum chemical reactivity ?

Justify your answer stating the reason for each.

U **[CBSE Term-II, CBSE OD. Set-I, 2017]**

Topper Answer, 2017


(a) Highest valency

K L M
Na 2, 8, 1 , Mg 2, 8, 2 , Al 2, 8, 3

Clearly, highest valency is 3 i.e of aluminium as it can lose its 3 valence electrons to become Al^{3+}

(b) largest atomic radius → Sodium (Na)

Reason → Because atomic size decreases along a period from left to right. Since Na is present at most left side, it has more atomic radius.

(c) Maximum chemical reactivity → Na (Sodium)

Reason → Since all three are metals ; chemical reactivity, means ability to lose electrons. Since ability to lose electrons decreases along a period, Na would be most metallic and hence chemically most reactive.

20. What is periodicity in properties of elements with reference to the Modern Periodic Table? Why do all the elements of the same group have similar properties? How does the tendency of elements to gain electrons change as we move from left to right in a period? State the reason of this change.

A **[CBSE O.D. 2017]**

Ans. • Repetition of similar properties of elements after regular intervals. **1**

• Because of the same number of valence electrons. **1**

• It increases due to increase in effective nuclear charge which pulls the electrons towards it. **1**

[CBSE Marking Scheme, 2017]

21. Write the number of periods and groups in the Modern Periodic Table. How does the metallic character of elements vary on moving (i) from left to right in a period, and (ii) down a group ? Give reason to justify your answer.

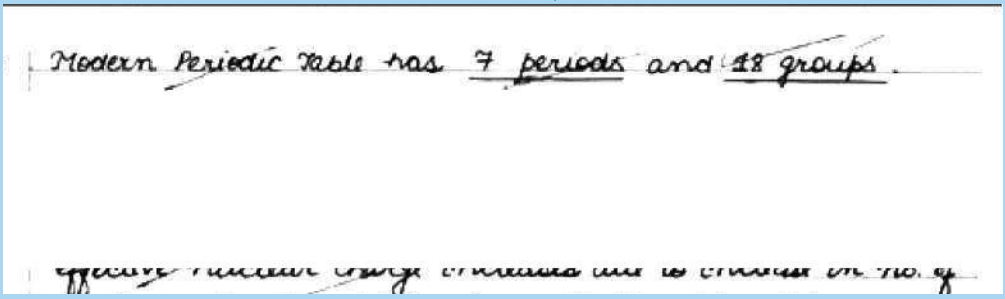
A **[CBSE O.D. 2017]**

Ans. • Periods – 7, Groups – 18 **1**

• Metallic character decreases along the period because effective nuclear charge increases on the valence electrons hence decrease in tendency to lose electrons. **1**

• Metallic character increases down a group because effective nuclear charge experienced by valence electrons decrease, hence tendency to lose electron increases. **1 [CBSE Marking Scheme, 2017]**

Topper Answer, 2017


Modern Periodic Table has 7 periods and 18 groups.

protons due to which forces of attraction between nucleus & valence electrons increases and ability to lose electrons (i.e metallic character) decreases.

(ii) Metallic character increases down a group.

Reason : Because atomic size increases down a group, the force of attraction between nucleus & valence electron decrease & electrons losing tendency increases. Therefore metallic character increases.

22. How does the tendency of the elements to lose electrons change in the Modern Periodic Table in (i) a group, (ii) a period and why ?

U **[CBSE Term II, Foreign Set-III, 2016]**

Ans. (i) Increases down a group. ½

Reason: At each succeeding element down a group, the number of shells increases, so the distance of the valence shell from the nucleus increases, the effective nuclear force of attraction decreases in the last shell, so it becomes easy for the atom to lose electrons. **1**

(ii) Decreases in a period from left to right. ½

Reason: As the effective nuclear charge on the valence electron increases, the attraction between the valence electron and nucleus increases, so it becomes difficult to lose electrons.

[CBSE Marking Scheme, 2016] 1

23. (i) Name the element with atomic number 17.

(ii) To which period does it belong ?

(iii) To which group does it belong ?

(iv) Write its electronic configuration.

U **[CBSE Term-II, Delhi, 2016]**

Ans. (i) Chlorine ½

(ii) 3rd period **1**

(iii) 17th group **1**

(iv) 2, 8, 7. **[CBSE Marking Scheme, 2016]** ½

24. Two elements 'A' and 'B' belong to the 3rd period of Modern periodic table and are in group 2 and 13 respectively. Compare their following characteristics in tabular form:

(i) Number of electrons in their atoms

(ii) Size of their atoms

(iii) Their tendencies to lose electrons

(iv) The formula of their oxides

(v) Their metallic character

(vi) The formula of their chlorides.

C **[CBSE Term-II, Delhi Set-III, 2016]**

Ans.

Sr. No.	Characteristics	A	B
(i)	Number of electrons in their atoms	12	13
(ii)	Size of their atoms	Bigger	Smaller
(iii)	Their tendencies to lose electrons	More	Less
(iv)	The formula of their oxides	AO	B_2O_3
(v)	Their metallic character	More metallic	Less metallic
(vi)	The formula of their chlorides	ACl_2	BCl_3

[CBSE Marking Scheme, 2016] 6 × ½ = 3

25. Name any two elements of group one and write their electronic configurations. What similarity do you observe in their electronic configurations ? Write the formula of oxide for any of the above said element.

R **[CBSE Term-II, Delhi Set-II, 2016]**

Ans. (i) Two elements of group 1 are Na, K / Sodium, potassium. **2×½**

Electronic configurations Na = 2,8,1; K = 2,8,8,1 **2×½**

(ii) Similarity: Both have one valence electron / One electron in outermost shell. ½

(iii) Oxide – Na_2O / K_2O. ½

[CBSE Marking Scheme, 2016]

26. An element 'X' has mass number 35 and number of neutrons 18. Write atomic number and electronic configuration of 'X'. Also write group number, period number and valency of 'X'.

U **[CBSE Term-II, O.D. Set-I, 2016]**

Ans. Atomic number of X = Mass number of X – No. of neutrons ½

= 35 – 18 = 17 ½

Therefore, Electronic configuration of

X = 2, 8, 7 ½

Group number = 17 ½

Period = 3

Valency = 8 – 7 = 1 ½ + ½

[CBSE Marking Scheme, 2016]

27. The position of eight elements in the modern periodic table is given below where atomic numbers of elements are given in the parenthesis.

Period No.	Elements	
2	Li(3)	Be(4)
3	Na(11)	Mg(12)
4	K(19)	Ca(20)
5	Rb(37)	Sr(38)

(i) State electronic configuration of Ca.

(ii) Predict the number of valence electrons in Rb.

(iii) What is the number of shells in Sr ?

(iv) Predict whether K is a metal or a non-metal.

(v) Which one of these elements has the largest atom in size ?

(vi) Arrange Be, Ca, Mg and Rb in the increasing order of the size of their respective atoms.

A **[CBSE Term-II, O.D. Set-III, 2016]**

Ans. (i) Ca = 2, 8, 8, 2 ½

(ii) Valence electrons in Rb = 1 ½

(iii) Five ½

(iv) Metal ½

(v) Rb is biggest in size. ½

(vi) Be < Mg < Ca < Rb. ½

[CBSE Marking Scheme, 2016]

28. Four elements A, B, C and D have atomic numbers 12, 13, 14 and 15 respectively.

Answer the following questions giving reasons:

(i) What is the number of valence electrons and valency of D ?

(ii) Which of them will have largest atomic radii ?

(iii) Which of these elements will form the most basic oxide ? AE **[CBSE Term-II, SQP, 2016]**

Ans. (i) Valence electrons in 'D' = 5 and Valency of 'D' = 3. **1**

(ii) 'A' will have largest atomic radii because atomic radius decreases across a period from left to right. **1**

(iii) 'A' will form the most basic oxide as it is most metallic. **[CBSE Marking Scheme, 2016] 1**

29. An element 'X' belongs to 3rd period and group 16 of the Modern Periodic Table.

(a) Determine the number of valence electrons and the valency of 'X'.

(b) Molecular formula of the compound when 'X' reacts with hydrogen and write its electron dot structure.

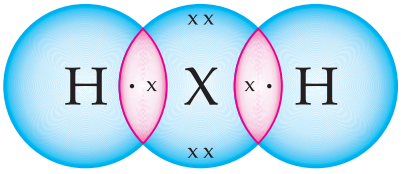
(c) Name the element 'X' and state whether it is metallic or non-metallic. A **[CBSE O.D. 2016]**

Ans. (a) Electronic Configuration of X -2, 8, 6

Valence electrons = 6 **1**

Valency = 8 - 6 = 2

(b) Formula with hydrogen- H_2X or H_2S **1**



(c) Sulphur; Non-metal

30. An element 'M' with electronic configuration (2, 8, 2) combines separately with $(NO_3)^-$, $(SO_4)^{2-}$ and $(PO_4)^{3-}$ radicals. Write the formula of the three compounds so formed. To which group and period of the Modern Periodic Table does the elements 'M' belong ? Will 'M' form covalent or ionic compounds? Give reason to justify your answer.

AE **[CBSE Delhi 2016]**

Ans. The electronic configuration (2, 8, 2) of the element 'M' suggests that it belongs to group 2 and period 3 of the Modern Periodic Table and its valency is 2.

The chemical formula of the compounds are:

$M(NO_3)_2$ /$Mg(NO_3)_2$: MSO_4 / $MgSO_4$: $M_3(PO_4)_2$ $Mg_3(PO_4)_2$

'M' will form ionic compounds by losing two electrons **1 + 1 + 1**

31. In the following table, the positions of six elements A, B, C, D, E and F are given as they are in the Modern Periodic Table:

Group→ Period↓	1	2	3–12	13	14	15	16	17	18
2	A			B		C			D
3					E				F

On the basis of the above table, answer the following questions:

(i) Name the element which forms only covalent compounds.

(ii) Name the element which is a non-metal with valency three.

(iii) Name the element which is a non-metal with valency three.

(iv) Out of B and C, whose atomic radius is bigger and why ?

(v) Write the common name for the family to which the elements D and F belong.

AE **[CBSE Board Term II, Delhi Set III, 2015]**

Ans. (i) E ½

(ii) B ½

(iii) C ½

(iv) B, because atomic radius decreases from left to right due to increase in the nuclear charge. **1**

(v) Noble gases. ½

AI **32. The elements $_4Be$, $_{12}Mg$ and $_{20}Ca$ each having two valence electrons in their valence shells are in periods 2, 3 and 4 respectively of the modern periodic table. Answer the following questions associated with these elements, giving reason in each case,**

(i) In which group should they be?

(ii) Which one of them is least reactive ?

(iii) Which one of them has the largest atomic size ?

U **[CBSE Term II, O.D. Set-I, 2015]**

Ans. (i) They all belong to group 2 because all three have 2 electrons in their outermost shell.

(ii) Be is least reactive because it has 2 shells and due to more nuclear change it is not easy to take electrons from it.

(iii) Ca is the element having largest atomic radius because it has 4 shells. {Hence, it has the largest atomic size.} **1+1+1**

[CBSE Marking Scheme, 2015]

COMMONLY MADE ERROR

- Usually students get confused element arranged in groups and periods in the periodic table and their periodic properties.

ANSWERING TIP

- Basically students should understand the basic concept of how the elements are arranged in the periodic table, across the period and down the group, their electronic configurations, stability, reactivity, family and other properties. Then they should recollect the element in the modern periodic table and answer the questions.

Long Answer Type Questions

(5 Marks Each)

1. The position of certain elements in the Modem Periodic Table are shown below:

Group → / ↓ Period	1	2	3 to 12	13	14	15	16	17	18
1	G								H
2	A			I			B		C
3		D			E				F

Using the above table answer the following questions giving reasons in each case:

(i) Which element will form only covalent compounds?

(ii) Which element is a non-metal with valency 2 ?

(iii) Which element is a metal with valency 2 ?

(iv) Out of H, C and F which has largest atomic size ?

(v) To which family does H, C and F belong ? U **[CBSE SQP 2020]**

Ans. (i) Element E is Silicon. It will form covalent bond only as it has four electrons in its outermost orbit and need only four more electrons to become stable.

(ii) Non-metal with valency 2 is B, which is Oxygen.

(iii) Element D is a metal with valency 2. Element D is Magnesium. Due to its low electronegativity, it has a higher tendency to donate electrons.

(iv) Element F has the largest atomic size. Element F is Argon. Argon occupies 3 energy shells compared to elements H and C, which occupies one and two energy shells. Due to this, the atomic radius of Argon is the largest.

(v) Elements H, C and F belong to Group number 18, which means according to their electronic configuration, their octet is complete and thus these elements are stable. They have very low tendency to react with other elements. Group 18 elements belong to noble gas family. **1 + 1 + 1 + 1 + 1**

2. (a) What was the basis of Mendeleev's classification of elements ?

(b) List two achievements of Mendeleev's Periodic table.

(c) List any two observations which posed a challenge to Mendeleev's periodic law.

R **[CBSE Comptt. Set-I, II, III, 2018]**

Ans. (a) Atomic mass **1**

(b) (i) He could classify all the 63 elements known at that time.

(ii) He left gaps for the yet to be discovered elements.

(iii) He predicted the properties of such elements. **(Any two) 1 × 2**

(c) (i) Position of isotopes

(ii) Irregular increase in atomic masses in going from one element to the next, making the prediction of undiscovered elements difficult.

(iii) Position of Hydrogen. **(any two) 1 × 2**

[CBSE Marking Scheme, 2018]

COMMONLY MADE ERROR

- Students write irrelevant answers. Be specific. Read question carefully and write only what is asked.

ANSWERING TIPS

- Do not overlook any part of a question and avoid being in a hurry to conclude the answer.
- Give answers in points.

3. (a) The modern periodic table has been evolved through the early attempts of Dobereiner, Newland and Mendeleev. List one advantage and one limitation of all the three attempts.

(b) Name the scientist who first of all showed that atomic number of an element is a more fundamental property than its atomic mass.

R **[CBSE Delhi/O.D., 2018]**

Ans. (a) (i) Dobereiner Periodic Table

Advantage: To predict the atomic mass of middle element in each triad.

Limitation: Dobereiner could identify only three triads.

(ii) Newland Periodic table

Advantage: Every eighth element had properties similar to that of first and co-related the properties of elements with their atomic mass.

Limitation: It was only applicable upto Calcium/ only 56 elements and no future element.

(iii) Mendeleev's Periodic Table

Advantage: Elements with similar properties could be grouped. He predicted the existence of new elements that had not been discovered at that time.

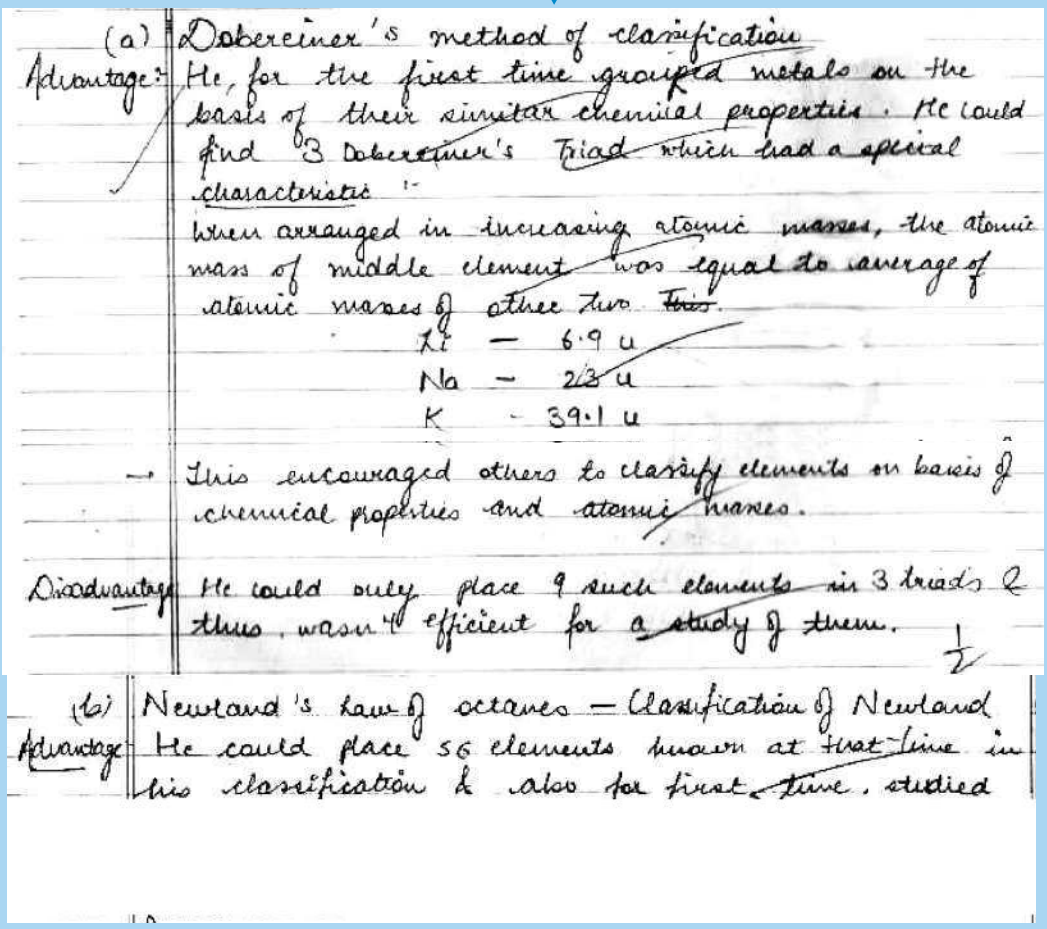
Limitation: No fixed position for hydrogen and isotopes. Atomic masses do not increase in a regular manner.

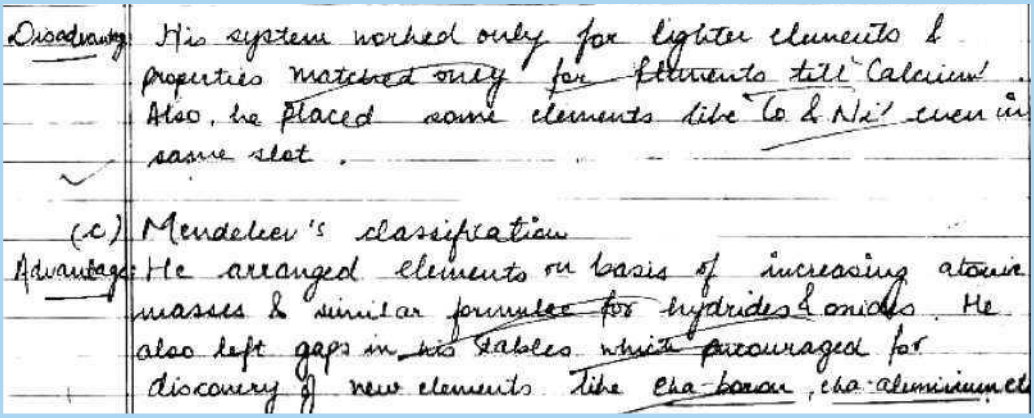
(b) Henry Moseley: Properties of elements are a periodic function of their atomic number. **3 + 1 + 1**

[CBSE Marking Scheme, 2018]

Topper Answer, 2018

Ans.


(a) Dobereiner's method of classification
Advantage: He, for the first time grouped metals on the basis of their similar chemical properties. He could find 3 Dobereiner's Triad which had a special characteristic :-
When arranged in increasing atomic masses, the atomic mass of middle element was equal to average of atomic masses of other two. ~~This~~.
Li — 6.9 u
Na — 23 u
K — 39.1 u
→ This encouraged others to classify elements on basis of chemical properties and atomic masses.
Disadvantage: He could only place 9 such elements in 3 triads & thus, wasn't efficient for a ~~study~~ of them. ½
(b) Advantage: Newland's law of octaves — Classification of Newland
He could place 56 elements known at ~~first~~ time in his classification & also for first time, studied



COMMONLY MADE ERROR

- Students get confused with the characteristics, merits and demerits of different periodic classifications.

ANSWERING TIP

- Learn and understand the basic concepts of each periodic classification, the person's name who is responsible for that periodic classification and make a list of differences.

AI **4. (i) Why do we classify elements ?**

(ii) What are the two criteria used in the development of Modern Periodic Table ?

(iii) State the position of (a) metals, (b) non-metals and (c) metalloids in the periodic table.

(iv) Would you place two isotopes of chlorine; Cl–35 and Cl–37 in different slots of the periodic table because of their different atomic masses or in the same slot because their chemical properties are same ? Justify your answer. [O.E.B.] U

Ans. (i) To study the properties of elements and to keep the elements with similar properties together. **1**

(ii) Chemical properties of elements and atomic number. **1**

(iii) Metals lie on extreme left, metalloids lie in the middle and non-metals lie on the right side. **2**

(iv) They should be placed in the same slot. Since they have same numbers of electrons/atomic number and Modern Periodic Table is based on atomic number and not on atomic mass. **1**

AI **5. (a) List any three observations which posed a challenge to Mendeleev's Periodic Law.**

(b) How does the metallic character of elements vary on moving from

(i) left to right in a period,

(ii) From top to bottom in a period of the Modern Periodic Table ? Given reason for your answer.

R [CBSE O.D., Set-I, 2019]

Ans. (a) (i) No fixed position of H in the periodic table. **1**

(ii) Position of isotopes not clear. **1**

(iii) Atomic mass does not increase in a regular manner (or any other). **1**

(b) (i) Left to right metallic character decreases. ½
Reason: Effective nuclear charge increases / tendency to loose electrons decrease / electropositivity decreases. **(any one reason)** ½

(ii) Top to bottom metallic character increases. ½
Reason: Size of atom increase/tendency to loose electron increases(any one reason). ½

[CBSE Marking Scheme, 2019]

AI **6. The electrons in the atoms of four elements A, B, C and D are distributed in three shells having 1, 3, 5 and 7 electrons respectively in their outermost shells. Write the group numbers in which these elements are placed in the Modern Periodic Table, configuration of the atoms of B and D and the molecular formula of the compound formed when B and D combine.**

A [CBSE Board Outside Delhi, Set-I, 2019]

Ans.

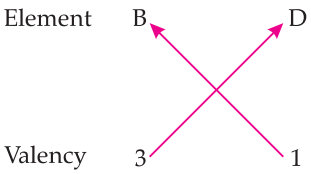
	A	B	C	D
	1	3	5	7
• Group no.	1st	13th	15th	17th

½ × 4

- Electronic Configuration B = 2, 8, 3 D = 2 , 8 , 7 **1 + 1**
- BD_3 [CBSE Marking Scheme, 2019] **1**

Detailed Answer:

Electronic configuration of D: 2, 8, 7



So, the molecular formula will be BD_3. **5**

7. Explain giving justification the trends in the following properties of elements, on moving from left to right in a period, in the Modern periodic Table:

(a) Variation of valency.

(b) Change of atomic radius.

(c) Metallic to non-metallic character.

(d) Electronegative character.

(e) Nature of oxides.

R + U **[Comptt. Set-I, II, III, 2018]**

Ans. (a) Valency first increases, then decreases

(b) Decreases

(c) Increase

(d) Increases

(e) Change from basic to acidic

[CBSE Marking Scheme, 2018] 5

Detailed Answer:

(a) Valency is the combining capacity of an element. Valence electrons are the number of electrons in the outermost shell. Valency and valence electrons are same till the number of outermost electrons is 4, but when it goes beyond 4, then the outermost electrons are subtracted from 8 and valency is determined. Thus, valency first increases along the period and then decreases. **1**

(b) Along the period, from left to right effective nuclear charge increases as the number of protons increase, due to which force of attraction between nucleus and the valence electron increases therefore, atomic radius decreases. **1**

(c) Along the period, from left to right effective nuclear charge increases as the number of protons increases, due to which force of attraction between nucleus and the valence electron increases thus, it becomes difficult to lose electron across the period and metallic to non-metallic character increases. **1**

(d) Along the period, from left to right effective nuclear charge increases as the number of protons increases, due to which force of attraction between nucleus and the valence electron increases. Hence the electron from the outermost orbit is difficult to remove, atomic size decreases therefore electronegativity increases. **1**

(e) Along the period, from left to right effective nuclear charge increases as the number of protons increases, due to which force of attraction between nucleus and the valence electron increases, hence the electron from the outermost orbit is difficult to remove. Therefore, across the period the metallic to non-metallic character increases. So nature of oxide formation across the period changes from basic to acidic. **1**

COMMONLY MADE ERROR

- Usually students get confused with variation in periodic properties across the period and down the group.

ANSWERING TIP

- Students should understand the basic concept of how the elements are arranged in the periodic table, across the period and down the group, their electronic configurations etc. Then they should learn the variation of periodic properties and how it varies.

SELF ASSESSMENT TEST

Maximum Time: 1 hour **MM: 30**

(A) Objective Type Questions — 1 Mark Each

Stand Alone MCQs (1 Mark Each)

Q. 1. Study the given statements.

X is a non-metal, which exists in two different forms Y and Z.

Y is the hardest natural substance.

Z is a good conductor of electricity.

The X, Y and Z are :

(A) X- Carbon, Y- Graphite, Z-Diamond

(B) X- Carbon, Y- Diamond, Z- Graphite

(C) X- Oxygen, Y- Ozone, Z- Fullerene

(D) X- Oxygen, Y- Fullerene, Z- Ozone **1**

Q. 2. Butane with the molecular formula C_4H_{10} has:

(A) 10 covalent bonds

(B) 13 covalent bonds

(C) 9 covalent bonds

(D) 8 covalent bonds **1**

Q. 3. Out of these, the metal which is most reactive is:

(A) Li **(B)** Na

(C) K **(D)** Rb **1**

Q. 4. Elements with ____I____ and _____II____ atomic number have similar chemical properties. 1

(A) Element I- 3, Element II- 11

(B) Element I- 3, Element II- 9

(C) Element I- 11, Element II- 9

(D) Element I- 2, Element II- 3

Assertion and Reason Based MCQs (1 Mark Each)

Directions : In the following questions, A statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as.

(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is NOT the correct explanation of A.

(C) A is true but R is false.

(D) A is false and R is true.

Q. 5. Assertion (A): Hexane is an alkane with the formula as C_6H_{14}

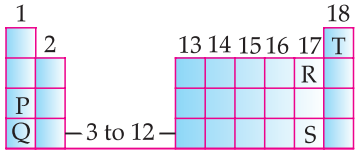
Reason (R): The general formula of alkane is C_nH_{2n}. **1**

Q. 6. Assertion (A): According to Law of Octaves, every eighth element has similar physical and chemical properties.

Reason (R): The law of octaves was given by Newland. **1**

Case-based MCQs (1 Mark Each)

In the given periodic table, the position of five elements P, Q, R, S and T is shown. Study the given table and answer the questions given below:



Q. 7. The element _____I_____ has maximum tendency to lose electron and ____II_____ has the maximum tendency to gain electrons.

	I	II
(A)	P	R
(B)	S	R
(C)	Q	S
(D)	Q	R

1

Q. 8. Which of these elements have no tendency to gain or lose electrons?

(A) S **(B)** T

(C) P **(D)** Q **1**

Q. 9. Choose the correct statements about the group 18 elements.

I. They are non metallic in nature.

II. Because of their full outer shells, they are very inert.

III. They are radioactive in nature.

IV. They rarely react with other elements since they are already stable.

(A) I and II only **(B)** II and III only

(C) I, II and III only **(D)** I, II and IV only **1**

Q. 10. Study the given statements carefully.

Element A: Has two electron shells both of which are completely filled.

Element B: Has three electron shells in total and there are four electrons in the valence shell.

Element C: Has three electron shells in total and first and third shell have two electrons each.

Element D: Has twice as many electrons in its second shell as in its first shell and second shell is the valence shell.

Identify the elements A, B, C and D.

	Element A	Element B	Element C	Element D
(A)	B	Al	N	Ne
(B)	Li	K	Ca	Si
(C)	Ne	Si	Mg	C
(D)	Na	Al	Si	Ne

1

(B) Subjective Questions

Very Short Answer Type Questions
(1 Mark Each)

Q. 11. Name the unique ability of carbon to form bonds with other atoms of carbon. **1**

Q. 12. Why hydrogen is placed in group I ? **1**

Q. 13. Metallic character decreases as you move across a period in the periodic table from left to right. Give reason. **1**

Short Answer Type Questions-I
(2 Marks Each)

Q. 14. Write the molecular formula of two consecutive members of homologous series of aldehydes. State which part of these compounds determines their:

(i) physical and (ii) chemical properties. **2**

Q. 15. How does the valency of elements vary (i) in going down a group, and (ii) in going from left to right in a period of the periodic table? **2**

Q. 16. Which two criteria did Mendeleev use to classify the elements in his periodic table? **2**

Short Answer Type Questions-II
(3 Marks Each)

Q. 17. (a) Define the term 'structural isomerism'.

(b) Explain why propane cannot exhibit this property.

(c) Draw the structures of possible isomers of butane, C_4H_{10}. **3**

Q. 18. F, Cl and Br are the elements each having seven valence electrons. Which of these (i) has the largest atomic radius, (ii) is most reactive? Justify your answer stating reason for each. **3**

Long Answer Type Questions
(5 Marks Each)

Q. 19. (a) Elements forming ionic compounds attain noble gas configuration by either gaining or losing electrons from their outermost shells. Give reason to explain why carbon cannot attain noble gas configuration in this manner to form its compounds.

(b) Name the type of bonds formed in the compounds formed by carbon.

(c) Also give reason why carbon compounds are generally poor conductors of electricity. **5**

■■