

## CHAPTER

## 5

PERIODIC  
CLASSIFICATION  
OF ELEMENTS

## Syllabus

Need for classification, early attempts at classification of elements (Dobereiner's Triads, Newland's Law of Octaves, Mendeleev's Periodic Table); Modern periodic table, gradation in properties, valency, atomic number, metallic and non-metallic properties.



## STAND ALONE MCQs

(1 Mark each)

Q. 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?

[Board SQP 2020]

- (A) A                      (B) B  
(C) C                      (D) D

Ans. Option (C) is correct.

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

Q. 2. Elements P, Q, R and S have atomic numbers 11, 15, 17 and 18 respectively. Which of them are reactive non-metals?  [Board 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 state configuration.

Q. 3. Consider the following statements about an element 'X' with number of protons 13.  [Board, 2020]

- (A) It forms amphoteric oxide.  
(B) Its valency is three.  
(C) The formula of its chloride is XCl.

(D) The correct statements(s) is/are:

- (A) only (A)                      (B) only (B)  
(C) (A) and (C)                      (D) (A), (B) and (C)

Ans. Option (A) and (B) is correct.

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

- (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.

Q. 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

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.

Q. 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 ?

- (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.

Q. 7. What type of oxide would Eka-aluminium form?

- (A)  $EO_3$                               (B)  $E_2O_2$   
(C)  $E_2O_3$                               (D) EO

Ans. Option (C) is correct.

**Explanation:** Since, Aluminium forms its oxide as  $Al_2O_3$ . Hence, Formula of oxide is  $E_2O_3$ .

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

- (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.

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

- (A) Group 1 and Period 3  
(B) Group 2 and Period 3  
(C) Group 13 and Period 3  
(D) Group 16 and Period 3

U

Ans. Option (D) is correct.

**Explanation:** Group 16 and Period 3. Non-metals form acidic oxides.

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

- (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 octet configuration, so must be placed in group 18.

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

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

U

Ans. Option (B) is correct.

**Explanation:** The elements of 2<sup>nd</sup> period contain two shells, K and L shell.

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

- (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.

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

- (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 that is nitrogen. Rest three elements are metals and hence it forms basic oxide.

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

- (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. Be, Mg and Ca belong to same group that is group 2 of Modern Periodic table.

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

- (i) Isotopes of an element have same atomic masses.  
(ii) Isotopes of an element have same atomic number.  
(iii) Isotopes of an element show same physical properties.  
(iv) Isotopes of an element show same chemical properties.  
(A) (i), (iii) and (iv)              (B) (ii), (iii) and (iv)  
(C) (ii) and (iii)                    (D) (ii) and (iv)

R

Ans. Option (D) is correct.

**Explanation:** Isotopes are the atoms of the same element which have same atomic number but different number of neutrons hence their atomic masses are different.

Q. 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?

- (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:** The atoms lose their electrons more easily. Because 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.

**Q. 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.

**Q. 2. Assertion (A):** Mendeleev left the gap 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.

**Q. 3. Assertion (A):** In triad, the three elements have same gaps of 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.

**Q. 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.

**Q. 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.

**Ans. Option (D) is correct.**

**Explanation:** Sixth period contains 32 elements and seventh period is incomplete and like sixth, the period would have 32 elements.

**Q. 6. Assertion (A):** Be and Al show some 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.

**Q. 7. Assertion (A):** The atomic and ionic radii generally decrease 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 and atomic and ionic radii decreases in a period from left to right.

**Q. 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 bonding electrons.

**Q. 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 very less reactive due to stable closed shell electronic configuration like  $ns^2$ ,  $np^6$  or  $ns^2$ .



## CASE-BASED MCQs

Attempt any 4 sub-parts from each question.  
Each sub-part carries 1 mark.

I. Read the passage and answer any four questions from Q.1. to Q.5.

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.

Q. 1. Mendeleev arranged the periodic table on the basis of their fundamental property:

- (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.

Q. 2. Eka aluminium and eka silicon were later replaced respectively as :

- (A) Germanium and gallium
- (B) Gallium and scandium
- (C) Gallium and germanium
- (D) Germanium and scandium

Ans. Option (C) is correct.

**Explanation:** Mendeleev name unnamed elements as EKA- Boron EKA- Aluminium and EKA Silicon which were later replaced as Scandium, Gallium, and germanium respectively.

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

- (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.

Q. 4. Mendeleev's periodic table has :

- (A) 8 groups and 7 periods
- (B) 7 groups and 8 periods
- (C) 7 groups and 7 periods
- (D) 8 groups and 8 periods

Ans. Option (A) is correct.

**Explanation:** Mendeleev's periodic table consists of 8 vertical columns called 'groups' and 7 horizontal rows called 'periods'.

Q. 5. How do we classify these newly discovered elements (eka-aluminium and eka-silicon)?

- (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 nonmetals.

II. Using the given part of the periodic table, answer any four questions from Q.1. to Q.5.

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

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

- (A) B                              (B) C
- (C) D                              (D) E

Ans. Option (D) is correct.

**Explanation:** Element E has the smallest atomic size.

Q. 2. Write valency of element E.

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

Ans. Option (C) is correct.

**Explanation:** The valency of element E is 2.

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

- (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.

Q. 4. The number of period that the modern periodic table has

- (A) Seven                        (B) Eight
- (C) Seventeen                  (D) Eighteen

Ans. Option (A) is correct.

**Explanation:** There are seven horizontal rows in the modern periodic table. These rows are called periods.

Q. 5. Which of them will have largest atomic radii:

- (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 any four questions from Q.1. to Q.5.

Atoms of eight elements A, B, C, D, E, F, G and H have the same number of electronic shells 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.

Q. 1. Which of the following is likely to be halogen?

- (A) D (B) G  
(C) H (D) A

Ans. Option (B) is correct.

**Explanation:** G belongs to group 17 as it has 7 valence electrons.

Q. 2. Which one of the following elements is likely to be a noble gas?

- (A) A (B) H  
(C) D (D) F

Ans. Option (B) is correct.

**Explanation:** H belongs to group 18.

Q. 3. Which two elements amongst these are likely to be the non-metals?

- (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.

Q. 4. Which one of the following will have largest atomic radii?

- (A) A (B) H  
(C) G (D) B

Ans. Option (A) is correct.

**Explanation:** A has largest atomic radii.

Q. 5. To which period the listed elements belong?

- (A) 2nd (B) 7th  
(C) 8th (D) 3rd

Ans. Option (D) is correct.

**Explanation:** A and B belong to group 1 and 2 because they form basic oxides. C belongs to group 13 as it has 3 valence electrons. D belongs to group 14 as it forms almost neutral oxide. E and F belong to group 15 and 16 as they form acidic oxides, G belongs to group 17 as it has 7 valence electrons, and H to group 18. They belong to 3rd period of the periodic table.

IV. From the following part of the periodic table, answer any four from Q.1. to Q.5.

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

Q. 1. Which is the most reactive metal?

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

Ans. Option (D) is correct.

**Explanation:** Z is the most reactive metal.

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

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

Ans. Option (C) is correct.

**Explanation:** The family of fluorine are Halogen.

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

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

Ans. Option (B) is correct.

**Explanation:** Magnesium belong to group 2.

Q. 4. Which other element is likely to present in the group in which fluorine is present:

- (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).

Q. 5. Name the element P placed below Carbon in group 14:

- (A) Aluminium (B) Silicon  
(C) Phosphorus (D) Sulphur

Ans. Option (B) is correct.

**Explanation:** Silicon is the element placed below carbon in group 14.