

Question Bank

Periodic Table and Periodic Properties

1. Name the following with reference to the elements of Modern Periodic Table. (1×26)
- (a) An alkali metal in period 2.
Ans. Lithium
- (b) A halogen in period 3.
Ans. Chlorine
- (c) A noble gas having duplet arrangement of electrons.
Ans. Helium
- (d) A noble gas having electronic configuration 2, 8
Ans. Neon
- (e) Valency of elements in group I.
Ans. One positive or monovalent positive.
- (f) The number of electron shells in elements of period 3.
Ans. 3 shells
- (g) The metals present in the period 3.
Ans. Sodium, magnesium and aluminium.
- (h) The non-metals present in period 2
Ans. Carbon, nitrogen, oxygen and fluorine.
- (i) The group of elements having zero valency.
Ans. Group 18 or zero group.
- (j) A non-metal in period 3, having valency 1.
Ans. Chlorine (Monovalent negative).

(k) Formula of hydride of a halogen in period 3

Ans. HCl

(l) Formula of sulphite of an element present in group 1, period 3.

Ans. Na_2SO_3

(m) Formula of hydroxide of element having electronic configuration 2, 8, 2.

Ans. $\text{Mg}(\text{OH})_2$

(n) The element in period-3, which does not form an oxide.

Ans. Argon

(o) An element with least atomic size amongst carbon, nitrogen, boron and beryllium

Ans. Nitrogen

(p) The element from elements Li, Na and K having maximum number of electron shells.

Ans. Potassium.

(q) The element from elements C, O, N and F having maximum nuclear charge.

Ans. Fluorine.

(r) The element from elements Be, Mg, Ca, having lowest nuclear charge.

Ans. Beryllium

(s) The element from elements fluorine and neon, having higher electron affinity.

Ans. Fluorine.

(t) Period and group of an element X, having electronic configuration 2, 8, 8, 2.

Ans. Period : 4, Group : 2

(u) The most electronegative element amongst period three elements.

Ans. Chlorine.

(v) The element which has the largest atomic size amongst elements of group 1, 2 and 13.

Ans. Sodium

(w) The element, amongst, Li, Na, K, which has maximum metallic character.

Ans. Potassium

(x) The element with maximum non-metallic character from the element of period-2

Ans. Fluorine

(y) The most non-metallic element from elements S, P, Cl and Ar.

Ans. Chlorine

(z) The element with highest ionisation potential from the elements of period 1, 2, and 3

Ans. Fluorine.

2. Fill in the blank spaces with appropriate word/words : (1×25)

(a) Periods are _____ horizontal rows of elements in the periodic table.

Ans. Seven.

(b) An element with three electron shells and two valence electrons belongs to period _____ and group _____.

Ans. (i) three, (ii) 2 A

(c) From left to right in a period, the number of shells _____.

Ans. remain same

(d) Across a period the _____ electrons increase by 1, while down the subgroup they remain _____.

Ans. (i) valence, (ii) same.

(e) Across the period the electropositive character _____ and down the group the electronegative character _____.

Ans. (i) decreases, (ii) decreases.

(f) Elements at the extreme left of the Modern Periodic Table are _____ reactive, while the elements on the extreme right are _____.

Ans. (i) most, (ii) unreactive.

(g) Elements of group IA are strong _____ agents since they _____ electron easily.

Ans. (i) Reducing, (ii) lose (donate)

(h) An element in group VIIA (or 17), which is in liquid state at room temperature is _____.

Ans. Bromine

(i) Periodicity in properties is observed in elements after definite intervals due to similar _____.

Ans. Number of valence electrons.

(j) Across a period the nature of oxides and hydrides varies from _____ to _____.

Ans. (i) basic, (ii) acidic.

(k) Nuclear charge of an atom is the _____ charge on the nucleus of an atom, and is equivalent to atomic _____ of an atom.

Ans. (i) Positive, (ii) number.

(l) Atomic size of argon is _____ than atomic size of chlorine

Ans. Less

(m) Atomic size across a period _____ with the increase in nuclear charge of the element.

Ans. decreases.

(n) With the increase in nuclear charge the nuclear attraction of outer electrons _____, hence the ionisation potential _____.

Ans. (i) increases, (ii) increases

(o) Increase in nuclear charge of an atom _____ the tendency of atoms to lose electrons.

Ans. decreases.

(p) An atom with a small atomic radii takes up electrons _____ readily than an atom with large radii.

Ans. more.

(q) If the combining atoms of compound have nearly similar electronegativities, the bond between them is _____.

Ans. Covalent

(r) Elements with low electronegativity are usually _____.

Ans. metallic

(s) An atom is said to be a non-metal, if it _____ one or more electrons.

Ans. Gains.

(t) Atoms with _____ atomic radii and _____ ionisation potential tend to gain electrons.

Ans. (i) small, (ii) high

(u) An element 'E' in period 3 has high electronegativity and high electron affinity. The element is likely to be a _____.

Ans. non-metal (chlorine)

(v) An element 'E' in period 2 is to the right of element 'F'. The element 'E' is likely to be _____ non-metallic in character than element F.

Ans. more

(w) Element P is sub-group IIA is below the element Q in the same sub-group. The element P will be expected to have _____ atomic size and _____ metallic character than Q.

Ans. (i) higher (bigger), (ii) more

(x) Argon in period 3 is likely to have _____ atomic size than chlorine and its electron affinity value would be _____ compared to chlorine.

Ans. larger (more, bigger), zero

(y) Down a group, the atomic size and metallic character _____.

Ans. increases

3. The list below represents some elements of the periodic table : [1×8]

Chlorine, helium, lithium, magnesium and iron.

Answer the following questions :

(i) Which element belongs to period 1? [1]

(ii) Which element belongs to group 2? [1]

(iii) Which element is an alkali metal? [1]

(iv) Which element is a halogen? [1]

(v) Which element is a transition element? [1]

(vi) Which element is a noble gas?

(vii) Which elements have two electrons in their valence shell? Which amongst the elements named by you is a metal? [2]

(viii) Which of these elements are in the same period of the periodic table? Which amongst the elements named by you is a non-metal? [2]

Ans. (i) Helium **(ii)** Magnesium

(iii) Lithium **(iv)** Chlorine

(v) Iron **(vi)** Helium

(vii) Magnesium and helium. Magnesium is a metal.

(viii) Magnesium and chlorine. Chlorine is a non-metal.

4. Choose the correct word/words from the brackets to complete the sentences given below.

(i) The chemical properties of an element is the periodic function of its _____. (mass number/atomic number). [1]

(ii) The serial number of an element in a periodic table is also its _____. (mass number/atomic number) [1]

(iii) The number of electrons in the valence shell of an element represents its _____. (period/group) [1]

(iv) The number of electron shells around the nucleus of an atom represents its _____. (period/group) [1]

(v) The strongly active _____ (metals/non-metals) are placed in groups IA and IIA. [1]

(vi) The _____ (metals/non-metals) are placed on the right hand side of the periodic table. [1]

(vii) The elements placed in the extreme right hand side group are called _____. (noble gases/light gases). [1]

(viii) The elements occupying the right and left wing vertical columns are called _____ (normal/transition) elements. [1]

- (ix) The _____ (normal/transition) elements are accommodated in the middle of the periodic table. [1]
- (x) Hydrogen is a non-metal which is placed at the head of a group of most active _____ (non-metals/metals). [1]

- Ans.** (i) Atomic number (ii) Atomic number
(iii) Group (iv) Period
(v) Metals (vi) Non-metals
(vi) Noble gases (viii) Normal
(ix) Transition (x) Metals

5. Fill in the blank spaces by choosing the words from the list given below :

List : two, eight, eighteen, thirty-two, very long, lanthanides, 89, 103, 71, outside, very long, incomplete, short, long, very short.

- (i) The first period has _____ elements and is called _____ period. [2]
- (ii) The second and third periods have _____ elements and are called _____ periods. [2]
- (iii) The fourth and fifth periods have _____ elements and are called _____ periods. [2]
- (iv) The sixth period has _____ elements and is called _____ period. [2]
- (v) The seventh period is also _____ period, but is _____. [2]
- (vi) _____ are the elements from atomic number 57 to _____ and are placed _____ the periodic table. [2]
- (vii) Actinides are the elements from atomic number _____ to _____ and are radioactive. [2]

Ans. (i) (1) two (2) very short

(ii) (1) Eight (2) short

(iii) (1) eighteen (2) long

(iv) (1) thirty-two (2) very long

(v) (1) very long (2) incomplete

(vi) (1) lanthanides (2) 71 (3) outside

(vii) (1) 89 (2) 103

6. Give the name and the symbol of the elements which occupy the following positions in the Periodic Table.

(i) Period 4, group II A [1]

(ii) Period 2, group III A [1]

(iii) Period 3, group zero [1]

(iv) Period 2, group VI A [1]

(v) Period 3, group IV A [1]

Ans. (i) Calcium [Ca]

(ii) Boron [B]

(iii) Argon [Ar]

(iv) Oxygen [O]

(v) Silicon [Si]

7. (i) Name three alkali metals and state their group number. [2]

(ii) Name three alkaline earth metals and state their group number.

(iii) Name three halogens and state their group number. [2]

(iv) Name three noble gases and state their group. [2]

- Ans. (i)** Three alkali metals are lithium, sodium and potassium. They belong to group IA.
- (ii)** Three alkaline earth metals are beryllium, magnesium and calcium. They belong to group II A.
- (iii)** Three halogens are fluorine, chlorine and bromine. They belong to VII A group.
- (iv)** Three noble gases are helium, neon and argon. They belong to the zero group.
- 8. (i)** What do you understand by the term “transition elements”? [2]
- (ii)** Select transition elements from the following list :
List : potassium, calcium, manganese, chromium, copper, calcium, iron, platinum. [2]
- Ans. (i)** The elements which have valence shell and the shell next to it incomplete are called transition elements.
- (ii)** Manganese, chromium, copper, iron and platinum are transition elements.
- 9.** Phosphorus (at. number 15) and Silicon (at. number 14) are non-metals. Answer the following questions :
- (i)** Write down the electronic configuration of phosphorus and silicon. [2]
- (ii)** To which group does the phosphorus belong and why? [2]
- (iii)** To which group does silicon belong? [1]
- (iv)** To which period phosphorus and sulphur belong and why? [2]
- (v)** Which element is more non-metallic and why? [2]
- (vi)** Which element has smaller atomic radii? [1]

- Ans. (i)** Electronic configuration of phosphorus is [2, 8, 5]
Electronic configuration of silicon is [2, 8, 4]
- (ii)** Phosphorus belongs to V A group as it has 5 electrons in the valence shell.
- (iii)** Silicon belongs to IV A group.
- (iv)** Phosphorus and sulphur belong to the 3rd period. It is because both of them have 3 electron shells.
- (v)** Phosphorus is more non-metallic. It is because the non-metallic character increases as one moves from left to right in the periodic table.
- (vi)** Phosphorus has smaller atomic radii. Number of atomic shells is same in both P and S but P has more protons. Therefore, P attracts the electron cloud closer.

10. An element has atomic number 19. Where would you expect this element in the Periodic Table and why? [2]

Ans. The electronic configuration of the element is (2, 8, 8, 1)

- (i)** As the element has four electron shells, it belongs to 4th period.
- (ii)** As the element has one electron in the valence shell, it belongs to I A group.

Thus, element is expected to be in I A group of the 4th period.

11. An element with atomic number 18 is a noble gas. Into which families you shall place elements with atomic numbers 17 and 19 and why? [4]

- Ans. (i)** The electronic configuration of element with atomic number 17 is (2, 8, 7). As the element has 7 electrons in its valence shell, it belongs to the *halogen family*.
- (ii)** The electronic configuration of element with atomic number 19 is (2, 8, 8, 1). As the element has 1 electron in its valence shell, it belongs to the *alkali metal family*.

12. (a) (i) Which period in the Periodic Table is the shortest?
(ii) Name all the elements present in this period.
- (b) (i) Which period in the Periodic Table is the longest and complete?
(ii) How many elements are present in it? [4]

- Ans. (a) (i) The first period is the shortest.
(ii) The elements of first period are hydrogen and helium.
- (b) (i) The sixth period is complete and longest.
(ii) It has 32 elements.

13.

<i>Elements</i>	<i>P</i>	<i>Q</i>	<i>R</i>
<i>Mass number</i>	23	20	35
<i>Number of neutrons</i>	12	10	18

Study the table above and answer the following questions carefully :

- (i) Write the atomic number and electronic configuration of elements P, Q and R. [3]
- (ii) To which groups do P, Q and R belong? [3]
- (iii) To which periods do P, Q and R belong? [3]
- (iv) Which amongst P, Q and R is (i) an alkali metal (2) noble gas (3) halogen? [3]

- Ans. (i) The atomic number of P
= (Mass number – number of neutrons)
= (23 – 12) = 11
Electronic configuration of P = (2, 8, 1)
- The atomic number of Q
= (Mass number – number of neutrons)

$$= (20 - 10) = 10$$

Electronic configuration of Q = (2, 8)

The atomic number of R

$$= (\text{Mass number} - \text{number of neutrons})$$

$$= (35 - 18) = 17$$

Electronic configuration of R = (2, 8, 7)

(ii) P belongs to I A group.

Q belongs to zero group.

R belongs to VII A group.

(iii) P belongs to the 3rd period.

Q belongs to 2nd period.

R belongs to 3rd period.

(iv) P is an alkali metal.

Q is a noble gas.

R is a halogen.

14. Metallic properties of the elements change to non-metallic properties as one moves from left to right in a period of the periodic table. Explain. [3]

Ans. If an element donates its valence electrons with ease so as to form positively charged ions, it is said to be a metallic element. Conversely, if an element accepts electrons in its valence shell so as to form negatively charged ions, the element is said to be non-metallic.

On progressing in a period from left to right, there is a gradual increase in the nuclear charge which results in the decrease in volume of elements. This results in more tightly bound electrons in the valence shell and makes it difficult for the atoms of elements to

donate electrons. Thus, the character of elements gradually changes from metallic to non-metallic.

- 15.** The bigger the atomic volume, more metallic is an element. Explain the statement. [3]

Ans. Bigger atomic volume means more number of shells around the nucleus of an atom. The outermost shell is far removed from the nucleus. Thus, the electrons are held very weakly in the outermost shell. These electrons can be easily donated by the atom to acquire a stable octet structure and hence it becomes more metallic in character.

- 16. (i)** What do you understand by the term electronegativity? [1]
(ii) Li, Be, B, C, N, O, F, Ne, Na, Mg, Al, Si, P, S, Cl, Ar, K and Ca.

Amongst the list of elements given above pick out.

- (1) Most electropositive element (2) Most electronegative element (3) Noble gases. [3]

- Ans. (i)** The property of an element to attract electrons in itself, when combined to form a compound is called electronegativity.
(ii) (1) Most electropositive element is potassium (K).
(2) Most electronegative element is fluorine (F).
(3) The noble gases are neon (Ne) and argon (Ar).

- 17.** Why do the halogen atoms have a very strong electron affinity? Explain. [3]

Ans. In case of halogens, for any period, the nuclear charge is maximum and atomic volume is minimum. The above factors favour an increase in the force of attraction exerted by the nucleus on the electrons. Thus, halogen atoms have a maximum tendency to attract an extra electron in their valence shell and hence have strong electron affinity.

- 18.** (i) What do you understand by the term electron affinity?
(ii) Does electron affinity represent energy released or absorbed?
(iii) Name an element having strong electron affinity.
(iv) Arrange Br, F, I and Cl in the order of increasing electron affinity. [4]

Ans. (i) It is defined as the amount of energy released on adding extra electron to isolated gaseous atom in its lowest state of energy.
(ii) It represents energy released.
(iii) Fluorine has strong electron affinity.
(iv) I, Br, Cl, F are in the increasing order of electron affinity.

- 19.** Explain why reducing power of elements increases as one goes down a group. [3]

Ans. When an atom loses an electron/electrons from its valence shell, the element is said to be reducing agent and the property of the element is called reducing property.

The reducing power of an element depends upon the ease with which it can lose electrons. In case of elements at the bottom of a group, the valence electrons are held very loosely by the nucleus. Thus, such elements easily lose their valence electrons and hence have a higher reducing power.

- 20.** Explain why the reducing power of the elements decreases as one moves from left to right in a period? [3]

Ans. The reducing power of an element depends upon the ease with which it can donate electrons from its valence shell.

As one moves from left to right in a period, the electrons in the valence shell are held more strongly because of increase in the nuclear charge. Thus, the tendency of atoms in a period to lose electrons gradually decreases. This results in the decrease of reducing power.

21. Why the elements lying on the extreme left hand side group, are very active metals? [3]

Ans. The elements which readily donate electrons from their valence shells are called metals. The elements lying on the extreme left hand side group of the periodic table have only one electron in their valence shell. Furthermore, this valence electron is far removed from the nucleus because the elements in this group have maximum atomic volume. As these elements can easily donate their valence electrons, therefore they are very active metals.

22. Why are the elements lying in a group prior to zero group of the Periodic Table very strong non-metals? [3]

Ans. The elements which readily accept an electron in their valence shell are called very strong non-metals.

The elements lying in the group prior to zero group have very small atomic volumes and their nuclear force is maximum. Thus, they readily pull extra electrons in their valence shell and hence are strong non-metals.

23. (a) (i) Name one most metallic element in the Periodic Table.
(ii) Name one most non-metallic element in the Periodic Table.
(b) How does electronegativity vary (i) in a period (ii) in a group? [4]

Ans. (a) (i) Francium is most metallic element.
(ii) Fluorine is most non-metallic element.
(b) (i) Electronegativity increases from left to right in a period.
(ii) Electronegativity decreases from top to bottom in a group.

24. (a) How does ionisation potential vary (i) in a period (ii) in a group. [2]
 (b) Table below shows a part of the Periodic Table. State what happens as one moves from left to right to (i) metallic character (ii) atomic radius of elements. [2]

<i>Li</i>	<i>Be</i>	<i>B</i>	<i>C</i>	<i>N</i>	<i>O</i>	<i>F</i>
<i>Na</i>	<i>Mg</i>	<i>Al</i>	<i>Si</i>	<i>P</i>	<i>S</i>	<i>Cl</i>

- Ans. (a) (i) The ionisation potential **increases** as one moves from left to right in a period.
 (ii) The ionisation potential **decreases** as one moves from top to bottom in a group.
 (b) (i) The metallic character gradually changes to non-metallic character.
 (ii) The atomic radius of the elements gradually decreases.

25. The atom of sodium (at no. 11) is bigger than the atom of chlorine (at no. 17). Why? [4]

Ans. The electronic configuration of sodium is (2, 8, 1) and that of chlorine is (2, 8, 7).

Thus, both have the same number of electron shells, but the nuclear charge in sodium is 11 units and that in chlorine is 17 units. The excessive nuclear charge in chlorine atom pulls the extra nuclear electron more strongly and consequently decreases its volume.

Thus, chlorine atom is smaller than sodium atom.

26. On the basis of electronic configuration around the nucleus, how will you identify :
- (i) chemically similar elements?
 - (ii) first element of a period?
 - (iii) a group of alkali metals?

(iv) a group of halogens?

(iv) a group of inert gases?

[5]

Ans. (i) The elements having the same number of valence electrons are chemically similar.

(ii) The element having one electron in its valence shell is the first element of a period.

(iii) The elements having one electron in their valence shells belong to alkali metals.

(iv) The elements having seven electrons in their valence shells belong to halogens.

(v) The elements having eight electrons in their valence shells belong to inert gases. Exception is helium which has only two electrons in its valence shell.

27. State two merits and two demerits of long form of the Periodic Table.

[4]

Ans. Merits

- (1) The classification is based on the fundamental property of elements, i.e., atomic number.
- (2) It relates the position of an element to its electronic configuration in the valence shell and hence the elements have similar chemical properties.

Demerits

- (1) The position of hydrogen is unresolved.
- (2) It fails to accommodate lanthanides and actinides in the main body of the table.

28. An element X belongs to III A group and another element E belongs to VII A group of the Periodic Table. Answer the following questions :

(i) How many valence electrons are in X?

(ii) How many valence electrons are in E?

(iii) Which amongst X and E is a metal?

(iv) What is the formula of the compound of X and E?

(v) What kind of bonding is between X and E? [5]

Ans. (i) X has three valence electrons.

(ii) E has seven valence electrons.

(iii) X is a metal.

(iv) The formula of X and E is XE_3 .

(v) X and E have ionic bonding.

29. (a) How does the atomic radius change in a period? [1]

(b)

<i>Element</i>	<i>P</i>	<i>Q</i>	<i>R</i>
<i>Atomic radius</i>	<i>1.86 Å</i>	<i>2.31 Å</i>	<i>1.52 Å</i>

Arrange the elements in the table above, such that the least metallic element comes first and the most metallic element comes last. [2]

Ans. (a) The atomic radius decreases as one moves from left to right in a period.

(b) R (1.52 Å), P (1.86 Å), Q (2.31 Å)

30. Amongst the elements P(at. no 14), Q (at. no. 6) and R(at. no. 15), which elements have similar chemical properties and why? [2]

Ans. P and Q have similar chemical properties.

It is because both P and Q have same number of electrons (4 electrons) in their valence shells.

31. Table below shows a part of the periodic table. Answer the following questions :

<i>Group VI A</i>	<i>Group VII A</i>
<i>O</i>	<i>F</i>
<i>S</i>	<i>Cl</i>
<i>Se</i>	<i>Br</i>
<i>Te</i>	<i>I</i>

- (i) Is chlorine a metal or a non-metal? [1]
 (ii) Is chlorine more/less reactive than fluorine? [1]
 (iii) What is the valency of chlorine with respect to hydrogen? [1]
 (iv) How does the atomic volume of chlorine compare with :
 (a) Sulphur (b) Bromine? [2]

Ans. (i) Chlorine is a non-metal.

(ii) Chlorine is less reactive than fluorine.

(iii) The valency of chlorine with respect to hydrogen is -1 .

(iv) (a) The atomic volume of chlorine is less than sulphur.

(b) The atomic volume of chlorine is less than bromine.

32. E (2, 6), F(2, 8), G(2, 7) and H(2, 8, 1) are the coded names of elements and their electronic configuration is shown within brackets. Answer the following questions :

- (i) Which element in the above list does not belong to the same period and why? [2]
 (ii) Which element is a noble gas? [1]
 (iii) Which element is absolutely essential for breathing? [1]
 (iv) Which element is a member of the halogen family? [1]

- Ans. (i)** The element H does not belong to the same period. It is because it has three electron shells, whereas E, F and G have two electron shells.
- (ii)** Element F is a noble gas.
- (iii)** Element E is essential for breathing as its electronic configuration corresponds to oxygen.
- (iv)** Element G belongs to the halogen family.