CLASS 10TH WORKSHEET
CHAPTER – PERIODIC TABLE, PERIODIC PROPERTIES AND VARIATIONS OF PROPERTIES

Intext Questions 1

Question 1(i)

State modern periodic law.

Answer

The Modern Periodic Law is stated as, "the physical and chemical properties of elements are the periodic functions of their atomic number."

Question 1(ii)

Name the scientist who stated the law.

Answer

Henry Moseley.

Question 1(iii)

How many groups and periods does modern periodic table have?

Answer

Groups - 18

Period - 07

Question 2

What are horizontal rows and vertical columns in a periodic table known as?

Answer

Horizontal rows are known as Periods,

Vertical columns are known as Groups.

Question 3

Periodicity is observed due to similar ..... (number of valence electrons/atomic number/electronic configuration)

Answer

Periodicity is observed due to similar electronic configuration.

Question 4

How does the electronic configuration in atoms change

(i) in a period from left to right?

(ii) in a group from top to bottom?

Answer

(i) As we move across a period the number of shells remain same & number of valence electron increases by one.

(ii) As we go from top to bottom in a group the number of shells increases one by one but the number of electron remain the same.

Question 5

Name two elements in each case :

(i) Alkali metals

(ii) Alkaline earth metals

(iii) Halogens

(iv) Inert Gas

Answer

(i) Lithium (Li) and Sodium (Na).

(ii) Beryllium (Be) and Magnesium (Mg).

(iii) Fluorine (F) and Chlorine (Cl).

(iv) Helium (He) and Neon (Ne).

Question 6

Elements of group 1 and elements of group 17 both have valency 1. Explain.

Answer

Valency is equal to the number of electrons an atom can donate or accept or share. Hence, it depends on the number of electrons in the outermost shell (i.e. valence shell).

Group 1 (IA) elements have one electron in their outermost shell. So they donate this one electron to become stable hence their valency is one. On the other hand, Group 17 (VIIA) elements have seven electrons in their outermost shell. So they accept one electron to attain stable electronic configuration hence their valency is also one.

Question 7

Correct the statements.

(i) Elements in the same period have the same valency.

(ii) Valency depends upon the number of shells in an atom.

(iii) Copper and zinc are representative elements.

(iv) Transition elements are placed at extreme right of the periodic table.

Answer

(i) Elements in the same group have the same valency.

(ii) Valency depends upon the number of valence electrons in an atom.

(iii) Copper and Zinc are transition elements.

(iv) Noble gases are placed at the extreme right of the periodic table.

Question 8

What do you understand by ?

(i) Periodicity

(ii) Typical elements

(iii) Orbits

Answer

(i) The properties that reappear at regular intervals, or in which there is gradual variation (i.e. increase or decrease) at regular intervals, are called 'periodic properties' and the phenomenon is known as the periodicity of elements.

(ii) The third period elements are typical elements. They are Sodium (Na), Magnesium (Mg), Aluminium (Al), Silicon (Si), Phosphorus (P), Sulphur (S), Chlorine (Cl) .

(iii) Electrons revolve around the nucleus in certain definite circular paths called orbits.

Question 9

Name two elements that you would expect to show chemical reactions similar to calcium. What is the basis of your choice ?

Answer

Beryllium and Magnesium will show the similar chemical reactions as calcium. Since these elements belong to the same group 2 and also have same number of valence electrons as calcium.

Question 10

Name the (i) metals (ii) metalloids and (iii) non-metals in the first twenty elements.

Answer

1. **Metals** — Lithium (Li), Beryllium (Be), Sodium (Na), Magnesium (Mg), Aluminium (Al), Potassium (K), Calcium (Ca).
2. **Metalloids** — Boron (B), Silicon (Si).
3. **Non-Metals** — Hydrogen (H), Helium (He), Carbon (C), Nitrogen (N), Oxygen (O), Fluorine (F), Neon (Ne), Phosphorus (P), Sulphur (S), Chlorine (Cl), Argon (Ar).

Question 11

Fluorine, Chlorine and Bromine are put in one group on the basis of their similar properties.

(i) What are those similar properties ?

(ii) What is the common name of this group or family ?

Answer

(i) Similar properties of Fluorine, Chlorine and Bromine are:

1. They have same number of valence electrons (7).
2. They have non-metallic character.
3. They all try to gain one electron to obtain stable electronic configuration.
4. They all have same valency, which is equal to 1.

(ii) Halogens is the common name of this group elements.

Question 12

What is the main characteristic of the last element in each period of the Periodic Table? What is the general name of such elements?

Answer

Main characteristics of the last element in each period of the Periodic Table are:

1. They have valency equal to zero.
2. They react under very special condition otherwise they don't react.
3. They have stable gas electronic configuration.

General name of such elements is Inert Gases.

Question 13

According to atomic structure, what determines which element will be the first and which will be the last in a period.

Answer

Number of valence electrons determines which element will be the first and which element will be the last in a period.

Question 14

How do the following vary on moving from left to right in the third period of the periodic table :

(i) valence electrons and

(ii) valency

Answer

(i) The number of valence electron successively increases by one as we move from left to right in the third period.

(ii) Valency firstly increase from 1 to 4 from element sodium (Na) to silicon (Si) and then reduces to zero from element phosphorus (P) till chlorine (Cl) as we move from left to right in the third period.

Question 15

Name the type of elements, which have their

(i) outermost shell complete

(ii) outermost shell incomplete

(iii) two outermost shell incomplete

(iv) one electron short of octet

(v) two electrons in the outermost orbit.

Answer

(i) Inert Gas or Noble Gas Elements.

(ii) Representative Element.

(iii) Transition Element.

(iv) Halogens.

(v) Alkaline Earth Metals.

Question 16

An element has 2 electrons in its N shell.

(i) What is its atomic number ?

(ii) State its position in periodic table

(iii) Is it a metal or a non-metal ?

(iv) State the name assigned to this group.

(v) What is the valency of this element ?

Answer

(i) Atomic Number is 20.

(ii) It belongs to group 2 and fourth period.
(iii) It is a metal.
(iv) The name assigned to this group is IIA.
(v) Valency is 2.

Question 17

Answer the following in respect of element $^{32}_{16}S$.
(i) Give its electronic configuration.
(ii) To which group and period does it belong ?
(iii) What is its valency ?
(iv) Is it a metal or a non-metal ?
(v) Is it a reducing agent or an oxidising agent ?
(vi) Give its formula with hydrogen.

Answer

Electronic configuration of S is : 2, 8, 6
(ii) 16th group and 3rd period.
(iii) Valency of S = 8-6 = 2.
(iv) Non-metal.
(v) It is an oxidising agent.
(vi) Formula with Hydrogen = H_2S

Question 18

Name
(a) An alkali metal in period 3 and halogen in period 2.
(b) The noble gas with 3 shells.
(c) The non-metals present in period 2 and metals in period 3.
(d) The element of period 3 with valency 4.
(e) The element in period 3 which does not form oxide.
(f) The element of lower nuclear charge out of Be and Mg.

Answer

(a) Alkali metal in period 3 = Sodium
Halogen in period 2 = Fluorine
(b) Argon (Ar).
(c) Carbon (C), Nitrogen (N), Oxygen (O), Fluorine (F), Neon (Ne) are non-metals in period 2.
Sodium (Na), Magnesium (Mg) and Aluminium (Al)are metals in period 3.
(d) Silicon (Si).
(e) Argon (Ar).
(f) Be will have lower nuclear charge then Mg.

Question 19

The electronic configuration of the element T is 2, 8, 8, 1.
(i) What is the group number of T ?
(ii) What is the period number of T ?
(iii) How many valence electrons are there in an atom of T ?
(iv) What is the valency of T ?
(v) Is it a metal or a non-metal ?

Answer

(i) Group Number of T is 1.
(ii) Period of T is 4.
(iii) Their is 1 valence electron present in atom T.
(iv) Valency of T is 1.

(v) It is a Metal.

Question 20

Match the atomic number 19, 15, 8, 4, and 2 with each of the following :

(i) A metal of valency one.

(ii) A solid non-metal of period 3.

(iii) A rare gas.

(iv) A gaseous element with valency 2.

(v) An element of group 2.

Answer

(i) A metal of valency one — **Atomic number 19 (Potassium)**.

(ii) A solid non-metal of period 3 — **Atomic number 15 (Phosphorus)**.

(iii) A rare gas — **Atomic number 2 (Helium)**.

(iv) A gaseous element with valency 2 — **Atomic number 8 (Oxygen)**.

(v) An element of group 2 — **Atomic number 4 (Beryllium)**.

Intext Questions 2

Question 1

What do you understand by atomic size ? State its unit.

Answer

Atomic Size is the distance between the centre of the nucleus of an atom and its outermost shell.

Unit — Angstrom (Å) and Picometer (pm).

Question 2

Give the trends in atomic size on moving :

(i) Down the group,

(ii) Across the period left to right.

Answer

(i) On moving down the group the atomic size increases as the number of valence shell increases.

(ii) On moving across the period the size of an atom decreases from left to right. This is because the nuclear charge, i.e., the atomic number increases from left to right in the same period, thereby bringing the outermost shell closer to the nucleus.

Question 3

Arrange the elements of second and third period in increasing order of their atomic size (excluding noble gases).

Answer

Second Period — F < O < N < C < B < Be < Li.

Third Period — Cl < S < P < Si < Al < Mg < Na.

Question 4

Why is the size of (i) neon greater than fluorine ? (ii) sodium is greater than magnesium ?

Answer

(i) The size of neon is bigger compared to fluorine because the outer shell of neon have a complete octet. They have maximum number of electrons in their outermost orbit thus the electronic repulsions are maximum. So, the effect of nuclear pull over the valence shell electrons is not observed. Hence, the size of neon is greater then fluorine.

(ii) Magnesium is placed to the right of Sodium in period 3. As the atomic size decreases on moving from left to right across the period, hence, atomic size of Sodium is greater than Magnesium.

Question 5(i)

Which is greater in size ?

(a) An atom or a cation

(b) An atom or an anion

(c) Fe^{2+} or Fe^{3+}

(d) Fluorine or oxygen

Answer

(a) An atom.

Reason — An atom is greater in size than a cation because cation is formed by the loss of electron(s), hence proton(s) are more than electron(s) in a cation. So electrons are strongly attracted by the nucleus and are pulled inward. Hence, the size decreases.

(b) An anion.

Reason — An anion is greater in size than atom because anion is formed by the gain of electron(s). Thus, the number of electron(s) are more than proton(s). The effective positive charge in the nucleus is less, so less inward pull is experienced. Hence, the size increases.

(c) Fe^{2+}.

Reason — Fe^{2+} is greater in size than Fe^{3+} because Fe^{2+} has one more electron than Fe^{3+}. So, nuclear pull is more in Fe^{3+} than Fe^{2+}, thereby bringing the outermost shell closer to the nucleus. Hence, size decreases.

(d) Oxygen.

Reason — Oxygen is greater in size than fluorine. The position of oxygen in periodic table is before fluorine so, as we move from left to right in a period the outermost shell with more number of electrons is brought closer to the nucleus, decreasing the size of the atom.

Question 5(ii)

Which has maximum metallic character Na, Li or K.

Answer

Potassium (K) has the maximum metallic character as potassium belongs to the group 4 whereas sodium belongs to group 3 & lithium belongs to group 2, On moving down the group the metallic character increases. So, among Sodium (Na), Lithium (Li), and Potassium (K), Potassium (K) has the maximum metallic character.

Question 6

Arrange :

(i) Be, Li, C, B, N, O, F (in increasing metallic character).

(ii) Si, Na, Al, Mg, Cl, P, S (in decreasing non-metallic character).

Answer

(i) F < O < N < C < B < Be < Li .

(ii) Cl > S > P > Si > Al > Mg > Na.

Question 7

State the trend in chemical reactivity :

(i) Across the third period from left to right,

(ii) Down the group.

(a) in group IA (1) (b) in group VIIA (17)

Answer

(i) On moving from left to right in the third period, the chemical reactivity of elements first decreases until silicon as the tendency to lose electrons deceases and then starts to increase from phosphorus to chlorine, as the tendency to gain electrons increases.

(ii) Chemical reactivity in metals increases on going down the group, but in non-metals it decreases on going down the group.

(a) As group IA (1) contains metals, hence, chemical reactivity increases on going down the group IA (1).

(b) As group VIIA (17) contains non-metals, hence, chemical reactivity decreases on going down the group VIIA (17).

Question 8

A metal M forms an oxide having the formula M_2O_3. It belongs to third period. Write the atomic number and valency of the metal.

Answer

The metal is Aluminium. Its
Atomic Number = 13,
Valency = 3.
Valency of O is 2 so valency of M is 3. Therefore, M belongs to 13^{th} group. It is given that M belongs to 3^{rd} period, hence, it has atomic number 13.

Question 9

An element X belongs to 3^{rd} period and 17^{th} group, state
(i) No. of valence electrons in it.
(ii) Name of the element.
(iii) Name the family to which it belongs.
(iv) Write the formula of the compound formed when X reacts with $^{27}_{13}Y$.

Answer

(i) 7.
(ii) Chlorine (Cl).
(iii) Halogens Family.
(iv) XY_3 [$AlCl_3$ (Aluminium Chloride)].

Question 10

The given table shows elements with same number of electrons in its valence shell.

Elements	A	B	C
m.p.	63.0	180.0	97.0

State :
(i) Whether these elements belong to same group or period.
(ii) Arrange them in order of increasing metallic character.

Answer

(i) They belong to the same group as they have same number of electrons in their valence shell.
(ii) As m.p. decrease on going down the group, and metallic character increases on going down the group. Therefore, B < C < A.

Question 11

Which one of the following has the largest atomic radius ?

1. Sodium
2. Potassium
3. Magnesium
4. Aluminium

Answer

Potassium.
Reason — Sodium (Na), Magnesium (Mg) and Aluminium (Al) belong to period 3 whereas Potassium (K) belongs to period 4. As atomic size increases on moving down the group hence, Potassium has the largest atomic radius of the given elements.

Question 12

Which one has the largest size?

1. Br
2. I
3. I^-
4. Cl

Answer

I^-

Reason — Cl, Br and I belong to the same group (group 17) and between the three, I is the bottom most. As atomic size increases down the group hence, between Cl, Br and I, I has the largest atomic size. Between I and I^-, atomic size of I^- is larger as anion is larger than the parent atom. Hence, I^- has the largest atomic size in the given elements.

Question 13

The metals of group 2 from top to bottom are Be, Mg, Ca, Sr, and Ba

(i) Which one of these elements will form ions most readily and why ?

(ii) State the common feature in their electronic configuration.

Answer

(i) Barium forms ions more readily due to large atomic size and low ionisation energy. Among the given elements Barium has the largest atomic size because as we move down the group atomic size increases. With increase in atomic size, the ionisation energy decreases.

(ii) The common feature in their electronic configuration are:

1. There are two electrons in their valence shell.
2. They lose two electrons to gain stable gas electronic configuration.

Question 14

Write the number of protons, neutrons and electronic configuration of $^{39}_{19}K$, $^{31}_{15}P$. Also state their position in the periodic table.

Answer

For $^{39}_{19}K$:

No. of Protons = 19

No. of Neutrons = 39 - 19 = 20

Electronic Configuration = 2, 8, 8, 1

Position in periodic table = 4^{th} period (as it has 4 shells) & 1^{st} group (as it has one valence electron).

For $^{31}_{15}P$:

No. of Protons = 15

No. of Neutrons = 31 - 15 = 16

Electronic Configuration = 2, 8, 5

Position in periodic table = 3^{rd} period (as it has 3 shells) & 15^{th} group (as it has five valence electrons).

Question 15

Name the element which has :

(i) Two shells, both of which are completely filled with electrons ?

(ii) The electronic configuration 2, 8, 3 ?

(iii) A total of three shells with five electrons in its valence shell ?

(iv) A total of four shells with two electrons in its valence shell ?

(v) Twice as many electrons in its second shell as in its first shell ?

Answer

(i) Neon (Ne)

(ii) Aluminium (Al)

(iii) Phosphorus (P)

(iv) Calcium (Ca)

(v) Carbon (C)

Question 16

An element Barium has atomic number 56. Look up its position in the Periodic Table and answer the following questions.

(i) Is it a metal or a non-metal ?

(ii) Is it more or less reactive than calcium ?

(iii) What is its valency ?

(iv) What will be the formula of its phosphate ?
(v) Is it larger or smaller than caesium (Cs) in size ?

Answer

(i) Metal.
(ii) Barium is more reactive than calcium.
(iii) Valency = 2.
(iv) Barium Phosphate $Ba_3(PO_4)_2$.
(v) Barium is smaller in size then Caesium.

Question 17

In group I of the Periodic Table, three elements X, Y and Z have ionic radii 1.33 Å, 0.95 Å and 0.60 Å respectively. Giving a reason, arrange them in the order of increasing atomic numbers in the group.

Answer

Z < Y < X.
Atomic size increases as we move down the group and also the atomic no. increases on moving down the group.

Question 18

Explain why are the following statements not correct:
(i) All groups contain metals and non-metals.
(ii) Atoms of elements in the same group have the same number of electron(s).
(iii) Non-metallic character decreases across a period with increase in atomic number.
(iv) Reactivity increases with atomic number in a group as well as in a period.

Answer

(i) Incorrect — A few groups contain metalloids and inert gases also.
(ii) Incorrect — as we move down the group the number of electrons increases.
(iii) Incorrect — Non-metallic character increases across a period with increase in atomic number.
(iv) Incorrect — Chemical reactivity in metals increases on going down the group, but in non-metals decreases on going down the group.

Question 19(i)

State the number of elements in Period 1, Period 2, and Period 3 of the periodic table. Name them.

Answer

No. of elements in:
Period 1 = 2
Hydrogen (H) , Helium (He).
Period 2 = 8
Lithium (Li), Beryllium (Be), Boron (B), Carbon (C), Nitrogen (N), Oxygen (O), Fluorine (F), Neon(Ne).
Period 3 = 8
Sodium (Na), Magnesium (Mg), Aluminium (Al), Silicon (Si), Phosphorus (P), Sulphur (S), Chlorine (Cl), Argon (Ar).

Question 19(ii)

What is the common feature of the electronic configuration of the elements at the end of Period 2 and Period 3 ?

Answer

Common feature of the electronic configuration of the elements at the end of Period 2 and Period 3 are:

1. They have complete octet (8 electrons in valence shell).
2. They are stable so they don't react.

Question 19(iii)

If an element is in Group 17, it is likely to be ..... [metallic/non-metallic] in character, while with one electron in its outermost energy level (shell), then it is likely to be ..... [metallic/non-metallic].

Answer

Non-metallic , metallic.

Question 19(iv)

In Period 3, the most metallic element is ..... (sodium/magnesium/aluminium).

Answer

Sodium (Na).

Question 20

Complete the following sentences choosing the correct word or words from those given in brackets at the end of each sentence:

(i) The properties of the elements are a periodic function of their ..... (atomic number, mass number, relative atomic mass).

(ii) Moving across a ..... of the Periodic Table the elements show increasing ..... character (group, period, metallic, non-metallic).

(iii) The elements at the bottom of a group would be expected to show ..... metallic character than the element at the top (less, more).

(iv) The similarities in the properties of a group of elements are because they have the same ..... (electronic configuration, number of outer electrons, atomic numbers)

Answer

(i) Atomic Number.

(ii) Period, Non-metallic.

(iii) More.

(iv) Number of outer electrons.

Question 21

Give reasons for the following:

(i) The size of a Cl^- ion is greater than the size of a Cl atom.

(ii) Argon atom is bigger than chlorine atom.

(iii) Chlorine is less reactive than fluorine.

(iv) Inert gases do not form ion.

Answer

(i) Cl^- has one more electron then Cl atom. Anion is formed by the gain of electron(s). Thus, the number of electron(s) are more than proton(s). The effective positive charge in the nucleus is less, so less inward pull is experienced. Hence, the size increases.

(ii) Argon is an inert gas and its outermost shell is complete. They have maximum number of electrons in their outermost orbit. Thus, the electronic repulsions are maximum. The effect of nuclear pull over the valence electrons is not seen. Hence, the size of the argon is greater then chlorine.

(iii) The chemical reactivity of non-metals decreases on going down the group as it depends upon the tendency to gain electrons, which decreases down the group. As fluorine is present at the top of the group it is more reactive than chlorine

(iv) Inert gases do not form ion due to their stable electronic configuration, inert gases find it difficult to accept or lose electrons hence they do not form ion.

Intext Questions 3

Question 1(a)

Define the term 'ionisation potential'.

Answer

The energy required to remove an electron from a neutral isolated gaseous atom and convert it into a positively charged gaseous ion is called Ionisation Potential (I.P.) or Ionisation Energy (I.E.).

Question 1(b)

Represent it in the form of an equation. In which unit it is measured ?

Answer

$M(g) + I.E. \longrightarrow M^+(g) + e^-$

where, M is any element
Unit : electronvolts per atom (eV/atom)
SI Unit : kilojoule per mole (kJ/mole).

Question 2

Ionisation Potential values depends on (a) atomic size (b) nuclear pull. Explain.

Answer

(a) The greater the atomic size the lesser the force of attraction. Since the electrons of the outermost shell lie further away from the nucleus, it makes their removal easier. Thus, Ionisation Potential decreases with increase in atomic size.
(b) The greater the nuclear charge, greater is the attraction for the electrons of the outermost shell. Therefore, the electrons in the outermost shell are more firmly held because of which greater energy is required to remove the electron(s). Thus, Ionisation Potential increases with increase in nuclear pull.

Question 3

State the trends in ionisatioin energy:
(a) across the period,
(b) down the group.

Answer

(a) On moving left to right across a period, the ionisation energy tends to increase as the atomic size decreases.
(b) On moving down a group the ionisation energy decrease as the atomic size increases.

Question 4

Name the elements with highest and lowest ionisation energies in first three periods.

Answer

Helium has the highest I.E. and Sodium has the lowest I.E. in the first three period.

Question 5(a)

Arrange the elements of second and third periods in increasing order of their ionisation energy.

Answer

Second Period : Li < Be < B < C < N < O < F < Ne.
Third Period : Na < Mg < Al < Si < P < S < Cl < Ar.

Question 5(b)

The element with the highest ionisation potential is:
A. Hydrogen
B. Caesium
C. Radon
D. Helium

Answer

Helium
Reason — Helium has highest ionization potential because Ionization Potential increases from left to right across a period and decreases down a group.

Question 6(a)

Define the term 'electron affinity'. State its unit.

Answer

Electron affinity — The amount of energy released while converting a neutral gaseous isolated atom into a negatively charged gaseous ion (anion) by the addition of electron is called Electron Affinity (E.A.)
Unit : Electron volts per atom (eV/atom) or kJ mol^{-1}. It is represented by negative sign.

Question 6(b)

Arrange the elements of second period in increasing order of their electron affinity. Name the elements which do not follow the trend in this period.

Answer

Second Period : Li < B < C < O < F .

Ne , N , Be do not follow the trend.

Question 6(c)

Which has higher E.A., Fluorine or neon ?

Answer

Inert gases have zero or very low electron affinity because their outer shells are completely filled, making it difficult for them to gain electrons. Neon is an inert gas, so its electron affinity is nearly zero. Therefore, fluorine has a much higher electron affinity than neon.

Question 7

Electron affinity values generally ..... across the period left to right and ..... down the group top to bottom.

Answer

Increases , Decreases.

Question 8(a)

Define the term 'Electronegativity'. State its unit.

Answer

Electronegativity — The tendency of an atom in a molecule to attract the shared pair of electrons towards itself is called its electronegativity.

Electronegativity is a dimensionless property since it is only a tendency. As such, it has no unit.

Question 8(b)

Among the elements given below, the element with least Electronegativity is:

1. Lithium
2. Boron
3. Carbon
4. Fluorine

Answer

Lithium.

Reason — The given elements belong to period 2. Among these elements, Lithium is the left most and Fluorine is the right most. As electronegativity increases from left to right in a period, hence, Lithium is the least Electronegative.

Question 8(c)

The most electronegative element from the following element is:

1. Magnesium
2. Chlorine
3. Aluminium
4. Sulphur

Answer

Chlorine.

Reason — The given elements belong to period 3. Among these elements, Chlorine is the right most. As electronegativity increases from left to right in a period, hence, Chlorine is the most Electronegative.

Question 9

Explain the following:

(a) Group 17 elements are strong non-metals, while group 1 elements are strong metals.

(b) Metallic character of elements decreases from left to right in a period while it increases in moving down a group.

(c) Halogens have a high electron affinity.

(d) The reducing power of an element increases down in the group while decreases in a period.

(e) Size of atoms progressively becomes smaller when we move from Sodium (Na) to Chlorine (Cl) in the third period of the Periodic Table.

Answer

(a) Metals lose electrons whereas non-metals gain electrons to attain stable electronic configuration. Group 1 elements are placed on the left in the periodic table whereas Group 17 elements are towards right. Hence, the atomic size of

Group 1 elements is greater when compared to the corresponding Group 17 elements as atomic size decreases from left to right across a period due to increase in nuclear charge. Due to this Group 1 elements can easily lose electrons making them strong metals. It is difficult for Group 17 elements to lose electrons due to stronger nuclear pull but it helps in attracting electrons from other elements making them strong non-metals.

(b) On moving across a period from left to right, nuclear pull increases due to the increase in atomic number and thus the atomic size decreases. Hence, elements cannot lose electrons easily. Therefore, the metallic character decreases across a period.

On moving down the group, the atomic size increases and the nuclear charge also increases. The effect of an increased atomic size is greater as compared to the increased nuclear charge. Therefore, tendency to lose electron increases and elements can lose electrons easily. Thus, metallic character of elements increases in moving down a group.

(c) The atomic size of halogens is very small. The smaller the atomic size, the greater the electron affinity, because the effective attractive force between the nucleus and the valence electrons is greater in smaller atoms, and so the electrons are strongly held with the atom.

(d) Greater the tendency to lose electrons, stronger is the reducing power. On moving down the group, the atomic size and nuclear charge increases but the effect of increased atomic size is greater. Therefore, the tendency to lose electrons increases which increases the reducing power of elements on moving down in a group.

On moving across the period, nuclear pull increases due to increase in atomic number and thus the atomic size decreases. Hence, elements cannot lose electrons easily. Therefore, reducing power of elements decreases on moving across a period from left to right.

(e) Size of atoms progressively becomes smaller when we move from Sodium (Na) to Chlorine (Cl) in the third period of the periodic table because on moving from left to right in a period nuclear pull increases because of increase in atomic number and so the atomic size decreases.

Question 10

Name the periodic property which relates to the:

(a) amount of energy required to remove an electron from an isolated gaseous atom,

(b) character of element which loses one or more electrons when supplied with energy,

(c) tendency of an atom in a molecule to attract the shared pair of electrons.

Answer

(a) Ionisation Energy (I.E.)

(b) Metallic Character.

(c) Electronegativity.

Question 11

This question refers to the elements of the Periodic Table with atomic numbers from 3 to 18. Some of the elements are shown by letters, but the letters are not the usual symbols of the elements.

3	4	5	6	7	8	9	10
A	B	C	D	E	F	G	H
11	12	13	14	15	16	17	18
I	J	K	L	M	N	O	P

Which of these :

(a) is the most electronegative element ?

(b) is a halogen ?

(c) is an alkali metal ?

(d) is an element with valency 4 ?

(e) has the least Ionisation Energy ?

(f) has the least atomic size in period 3 ?

Answer

(a) The most electronegative elements are **G(9)** & **O(17)**.
(b) **G(9)** & **O(17)** are halogens.
(c) **A(3)** & **I(11)** are alkali metals.
(d) **D(6)** & **L(14)** are elements with valency 4.
(e) **I(11)** have least Ionisation Energy.
(f) **O(17)** have least atomic size in period 3.

Question 12

A group of elements in the Periodic Table are given below (boron is the first member of the group and Thallium is the last).
Boron, Aluminium, Gallium, Indium, Thallium
Answer the following questions in relation to the above group of elements :
(a) Which element has the most metallic character ?
(b) Which element would be expected to have the highest electronegativity ?
(c) If the electronic configuration of aluminium is 2, 8, 3, how many electrons are there in the outer shell of thallium ?
(d) The atomic number of boron is 5. Write the chemical formula of the compound formed when boron reacts with chlorine.
(e) Will the elements in the group to the right of this boron group be more metallic or less metallic in character ? Justify your answer.

Answer

(a) Thallium has the most metallic character as metallic character increases on moving down the group.
(b) Boron has the highest electronegativity because the electronegativity decrease on moving down the group.
(c) There are 3 electrons in the outer shell of thallium because all the elements in a group have same number of valence electrons.
(d) BCl_3 (Boron Chloride).
Boron needs 3 electrons while each chlorine atom can donate one electron. So 3 chlorine atoms donate 1 electron each to react with 1 Boron atom forming BCl_3 (Boron Chloride).
(e) The elements in the group to the right of this boron group are less metallic because on moving left to right in a period metallic character decreases as atomic size decreases the electrons are strongly bound with the atom so it becomes more difficult to lose an electron.

Exercise 1 — Multiple Choice Type

Question 1

In the periodic table, alkali metals are placed in the group:

1. 1
2. 11
3. 17
4. 18

Answer

1
Reason — The elements placed in group 1 of the periodic table are known as alkali metals (except hydrogen) as they form strong alkalis with water.

Question 2

Which of the following properties does not match with the elements of the halogen family ?

1. They have seven electrons in their valence shell.
2. They are highly reactive chemically.
3. They are metallic in nature.
4. They are diatomic in their molecular form.

Answer

They are metallic in nature.

Reason — Halogens are non-metallic in nature.

Question 3

With reference to the variation of properties in the Periodic Table, which of the following is generally true?

1. Atomic size increases from left to right across a period.
2. Ionization potential increases from left to right across a period.
3. Electron affinity increases going down a group.
4. Electronegativity increases going down a group.

Answer

Ionization potential increases from left to right across a period.

Reason — On moving from left to right across a period, the atomic size decreases due to increase in the nuclear charge, and thus, more energy is required to remove the electrons. Hence, ionization potential increases from left to right across a period.

Question 4

An element in period 3 whose electron affinity is zero is :

1. Neon
2. Sulphur
3. Sodium
4. Argon

Answer

Argon

Reason — Argon is the noble gas in period 3 having an electron affinity of zero.

Question 5

The number of electrons in the valence shell of a halogen is :

1. 1
2. 3
3. 5
4. 7

Answer

7

Reason — Halogens have 7 valence electrons.

Question 6

Among period 2 elements, the element which has highest electron affinity is :

1. Lithium
2. Carbon
3. Chlorine
4. Fluorine

Answer

Fluorine

Reason — Electron affinity increases from left to right in a period. Out of the given options, Lithium, Carbon and Fluorine are period 2 elements in that order. Hence, Fluorine has the highest electron affinity among period 2 elements.

Question 7

Ionisation potential increases over a period from left to right because :

1. Atomic radius and nuclear charge increase
2. Atomic radius and nuclear charge decrease
3. Atomic radius increases and nuclear charge decreases

4. Atomic radius decreases and nuclear charge increases

Answer

Atomic radius decreases and nuclear charge increases

Reason — On moving from left to right across a period, the atomic radius decreases due to increase in the nuclear charge, and thus, more energy is required to remove the electrons. Hence, ionization potential increases from left to right across a period.

Question 8

An element A belonging to period 3 and group II will have :

1. 3 shells and 2 valence electrons
2. 2 shells and 3 valence electrons
3. 3 shells and 3 valence electrons
4. 2 shells and 2 valence electrons

Answer

3 shells and 2 valence electrons

Reason — The number of shells present in an atom determines its period and valence electrons determine its group.

Question 9

Among the elements given below, the element with the least electronegativity is :

1. Lithium
2. Carbon
3. Boron
4. Fluorine

Answer

Lithium

Reason — Lithium, Boron, Carbon, Fluorine is the order of given elements from left to right in period 2. As electronegativity increases from left to right in a period, hence, Lithium has the least electronegativity in the given elements.

Question 10

An element with atomic number 19 will most likely combine chemically with the elements whose atomic number is :

1. 17
2. 11
3. 28
4. 20

Answer

17

Reason — Element with atomic number 19 has an electronic configuration of 2, 8, 8, 1. It is a metal with one valence electron. Element with atomic number 17 has an electronic configuration of 2, 8, 7. It is a non-metal. Hence, element with atomic number 19 will donate its one valence electron to element with atomic number 17. Both will achieve stable octet. Hence, these two elements are most likely to combine chemically.

Question 11

Parts (i) to (iv) refer to changes in the properties of elements on moving from left to right across a period of the Periodic Table. For each property, choose the correct answer.

(i) The non-metallic character of the elements :

1. decreases,
2. increases,
3. remains the same,
4. depends on the period

(ii) The electronegativity :

1. depends on the number of valence electrons,

2. remains the same,
3. decreases,
4. increases

(iii) The ionization potential :

1. goes up and down
2. decreases
3. increases
4. remains the same

(iv) The atomic size :

1. decreases,
2. increases,
3. remains the same,
4. sometimes increases and sometimes decreases

Answer

(i) increases.

Reason — On moving across a period from left to right, nuclear pull increases due to increase in atomic number and thus atomic size decreases. Hence, elements cannot lose electrons easily. Therefore, non-metallic character increases.

(ii) increases.

Reason — On moving across a period from left to right, nuclear charge increases due to an increase in atomic number. Hence, electronegativity increases from left to right in a period.

(iii) increases.

Reason — On moving from left to right across a period, the atomic radius decreases due to increase in the nuclear charge, and thus, more energy is required to remove the electrons. Hence, ionization potential increases from left to right across a period.

(iv) decreases.

Reason — On moving across a period from left to right, nuclear pull increases due to increase in atomic number and thus atomic size decreases.

Question 12

In the periodic table while going down in the halogen group :

1. reactivity will increase
2. electronegativity will increase
3. ionic radius will increase
4. ionisation potential will increase

Answer

ionic radius will increase

Reason — On going down in the halogen group, number of shells increases, hence, ionic radius also increases. Reactivity, electronegativity and ionisation potential decreases while going down in the halogen group.

Question 13

Electron affinity is the :

1. Power of an atom to attract an electron to itself.
2. Energy released when an electron is added to an isolated atom in the gaseous state.
3. Energy absorbed when an electron is added to an isolated atom in the gaseous state.
4. Energy required to remove an electron from an isolated gaseous atom.

Answer

Energy released when an electron is added to an isolated atom in the gaseous state.

Reason — The amount of energy released while converting a neutral gaseous isolated atom into a negatively charged gaseous ion (anion) by the addition of electron is called Electron Affinity (E.A.).

Question 14

Which of these statements gives the correct picture regarding halogens and alkali metals with respect to an increase in the atomic number ?

1. Reactivity decreases in alkali metals but increases in halogens.
2. Reactivity increases in both.
3. Reactivity decreases in both.
4. Reactivity increases in alkali metals but decreases in halogens.

Answer

Reactivity increases in alkali metals but decreases in halogens.

Reason — Atomic number increases while going down the group in alkali metals and halogens. The tendency of losing electrons increases down the group. Reactivity of metals depends on tendency to lose electrons, thus reactivity of alkali metals increases while going down the group. Reactivity of non-metals depends on tendency to gain electrons, thus reactivity of halogens decreases while going down the group.

Question 15

The correct order of increasing ionisation energy of Be, Mg, Ca, Sr is :

1. Be, Mg, Ca, Sr
2. Ca, Mg, Be, Sr
3. Sr, Ca, Mg, Be
4. Mg, Ca, Sr, Be

Answer

Sr, Ca, Mg, Be

Reason — Ionisation energy decreases on moving down the group.

Question 16

An element $_{13}X$ combines with $_{17}Y$ to form a compound. which of the following is true ?

P → X is a metal, Y is a metal.

Q → X is a metal, Y is a non-metal.

R → X losses electron(s), y gains electron(s).

1. Only P
2. Only Q
3. Both P and Q
4. Both Q and R

Answer

Both Q and R

Reason — Element X with an atomic number of 13 is Aluminium (Al), which is a metal. Element Y with an atomic number of 17 is Chlorine (Cl), which is a non-metal.

X being a metal tends to lose electrons to achieve a stable electron configuration and Y being a non-metal tends to gain electrons to achieve stable electron configuration. Hence, statements Q and R are true whereas statement P is false.

Question 17

Assertion (A): Second period consists of 8 elements.

Reason (R): Number of elements in each period is four times the number of atomic orbitals available in energy level that is being filled.

1. Both A and R are true and R is the correct explanation of A.
2. Both A and R are true but R is not the correct explanation of A.
3. A is true but R is false.
4. A is false but R is true.

Answer

A is true but R is false.

Explanation — The second period includes the elements from lithium (Z=3) to neon (Z=10): Li, Be, B, C, N, O, F, Ne → 8 elements. Hence assertion is true. Reason given is incorrect. In the first period, electrons are being added to the K electronic configuration.
The number of available electronic configuration or orbital for elements of first period is 1.
The number of elements present in the first period is 2, which is not four times the number of atomic orbitals available. Hence the (R) statement is false.

Question 18

Assertion (A): In a Dobereiner's triad, the three elements present have the same difference of atomic masses.
Reason (R): Elements in a triad have similar properties.

1. Both A and R are true and R is the correct explanation of A.
2. Both A and R are true but R is not the correct explanation of A.
3. A is true but R is false.
4. A is false but R is true.

Answer

A is false but R is true.

Explanation — In Dobereiner's triads, the atomic mass of the middle element is approximately the average of the atomic masses of the other two. Hence, Assertion (A) is false.
Dobereiner grouped elements into triads because they had similar chemical properties. Hence, Reason (R) is true.

Question 19

Assertion (A): Smaller the size of an atom greater is its electronegativity.
Reason (R): Electronegativity is the tendency of an atom to attract shared pair of electrons towards itself in a molecule.

1. Both A and R are true and R is the correct explanation of A.
2. Both A and R are true but R is not the correct explanation of A.
3. A is true but R is false.
4. A is false but R is true.

Answer

Both A and R are true but R is not the correct explanation of A.

Explanation — Assertion (A) is true because smaller atoms attract electrons more strongly. Reason (R) correctly defines electronegativity but does not explain why smaller atoms have higher electronegativity.

Question 20

Assertion (A): Hydrogen is placed in group I.
Reason (R): Hydrogen can gain an electron to achieve noble gas configuration.

1. Both A and R are true and R is the correct explanation of A.
2. Both A and R are true but R is not the correct explanation of A.
3. A is true but R is false.
4. A is false but R is true.

Answer

Both A and R are true but R is not the correct explanation of A.

Explanation — Hydrogen is placed in Group I with alkali metals because, like them, it has one electron in its outermost shell and forms (H^+) ions by losing this electron. Although hydrogen can also gain an electron to form the hydride ion (H^-) similar to halogens. Hence, Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

Question 21

Assertion (A): Atomic size increases along a period.
Reason (R): Effective nuclear charge increases with atomic number.

1. Both A and R are true and R is the correct explanation of A.
2. Both A and R are true but R is not the correct explanation of A.

3. A is true but R is false.
4. A is false but R is true.

Answer

A is false but R is true.

Explanation — Atomic size decreases across a period (from left to right) in the periodic table. This is because, although electrons are being added, they are added to the same shell, and the increasing effective nuclear charge pulls the electrons closer to the nucleus. Hence, Assertion (A) is false.

As atomic number increases, the number of protons increases, which increases the effective nuclear charge. Hence, Reason (R) is true.

Question 22

Assertion (A): Elements in the same vertical column have similar properties.

Reason (R): Properties depend upon the number of electrons in the valence shell.

1. Both A and R are true and R is the correct explanation of A.
2. Both A and R are true but R is not the correct explanation of A.
3. A is true but R is false.
4. A is false but R is true.

Answer

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

Explanation — Elements in the same vertical column i.e., a group in the periodic table, have the same number of valence electrons. Since chemical properties of elements depend upon the number of valence electrons, thus elements in the same group have similar properties. Hence, Reason (R) correctly explains the Assertion (A).

Exercise 1 — Very Short Answer Type

Question 1

Fill in the blanks by selecting the correct word from the brackets :

(a) The element below sodium in the same group would be expected to have a ..... (lower/higher) electro-negativity than sodium and the element above chlorine would be expected to have a (lower/higher) ionization potential than chlorine.

(b) On moving down a group, the number of valence electrons ..... (remains the same/increases/ decreases).

(c) Metals are good ..... (oxidising agent/ reducing agent) because they are electron ..... (acceptors/donors).

(d) Down the group, electron affinity ..... [increases, decreases, remains same].

(e) Electronegativity across the period ..... [increases/ decreases].

(f) Non-metallic character down the group ..... [increases/ decreases].

(g) In a period, increase in electron affinity increases ..... (oxidation/reduction).

(h) On descending a group, ... (increase/decrease) in ionisation potential as well as electron affinity ..... (increases/decreases) oxidising capacity.

(i) If an element has a low ionization energy then it is likely to be ..... (metallic/non metallic).

(j) If an element has seven electrons in its outermost shell then it is likely to have the ..... (largest/smallest) atomic size among all the elements in the same period.

Answer

(a) The element below sodium in the same group would be expected to have a ***lower*** (lower/higher) electro-negativity than sodium and the element above chlorine would be expected to have a ***higher*** (lower/higher) ionization potential than chlorine.

(b) On moving down a group, the number of valence electrons ***remains the same*** (remains the same/increases/ decreases).

(c) Metals are good ***reducing agent*** (oxidising agent/ reducing agent) because they are electron ***donors*** (acceptors/donors).

(d) Down the group, electron affinity ***decreases*** [increases, decreases, remains same].

(e) Electronegativity across the period ***increases*** [increases/ decreases].

(f) Non-metallic character down the group ***decreases*** [increases/ decreases].
(g) In a period, increase in electron affinity increases ***reduction*** (oxidation/reduction).
(h) On descending a group, ***decrease*** (increase/decrease) in ionisation potential as well as electron affinity ***decreases*** (increases/decreases) oxidising capacity.
(i) If an element has a low ionization energy then it is likely to be ***metallic*** (metallic/non metallic).
(j) If an element has seven electrons in its outermost shell then it is likely to have the ***smallest*** (largest/smallest) atomic size among all the elements in the same period.

Question 2

Rewrite the following sentences by using the correct symbol > (greater than) or < (less than) in the blanks given :
(i) The ionization potential of potassium is ..... that of sodium.
(ii) The electronegativity of iodine is ..... that of chlorine.

Answer

(i) The ionization potential of potassium is **< *(less than)*** that of Sodium.
(ii) The electronegativity of iodine is **< *(less than)*** that of chlorine.

Question 3

In Period 3 of the Periodic Table, element B is placed to the left of element A. On the basis of this information, choose the correct word from the brackets to complete the following statements:
(i) The element B would have (lower/higher) metallic character than A.
(ii) The element A would probably have (lesser/higher) electron affinity than B.
(iii) The element A would have (greater/smaller) atomic size than B.

Answer

If the element are placed as B and then A in the 3rd period of the periodic table then
(i) The element B would have ***higher*** metallic character than A as metallic character decreases across a period.
(ii) The element A would probably have ***higher*** electron affinity than B as electron affinity increases across a period.
(iii) The element A would have ***smaller*** atomic size than B as atomic size decreases across a period.

Question 4

There are three elements E, F and G with atomic numbers 19, 8 and 17, respectively.
Classify the elements as metals and non-metals.

Answer

The electronic configuration of the given elements is as follows :
E = 19 = 2, 8, 8, 1
F = 8 = 2, 6
G = 17 = 2, 8, 7
We observe that E has 1 electron in the outer most shell, hence it will try to lose it's electron and attain a stable state. Therefore, it is a metal.
On the other hand, F and G will try to gain 2 and 1 electron respectively in order to attain a stable state. Hence, they are non-metals.

Question 5

Arrange the following as per instructions given in the brackets.
(a) Mg, Cl, Na, S, Si (decreasing order of atomic size)
(b) Cs, Na, Li, K, Rb (increasing metallic character)
(c) Na, K, Cl, S, Si (increasing ionisation potential)
(d) Cl, F, Br, I (increasing electron affinity)
(e) Cs, Na, Li, K, Rb (decreasing electronegativity)
(f) K, Pb, Ca, Zn (increasing reactivity)
(g) Li, K, Na, H (decreasing order of their potential ionisation)

Answer

(a) Na > Mg > Si > S > Cl.

(b) Li < Na < K < Rb < Cs.
(c) K < Na < Si < S < Cl.
(d) I < Br < F* < Cl.
Flourine (F) in group 17 is an exception. It has lower electron affinity than Chlorine (Cl).
(e) Li > Na > K > Rb > Cs.
(f) Pb < Zn < Ca < K.
(g) H > Li > Na > K.

Question 6

The electronegativities (according to Pauling) of the elements in Period 3 of the Periodic Table are as follows with the elements arranged in alphabetical order :

Al	Cl	Mg	Na	P	S	Si
1.5	3.0	1.2	0.9	2.1	2.5	1.8

Arrange the elements in the order in which they occur in the Periodic Table from left to right.
(The group 1 element first, followed by the group 2 element and so on, up to group 7).

Answer

We know that electronegativity increases from left to right in a period. Hence, the order of the elements in the periodic table is:
Na, Mg, Al, Si, P, S, Cl.

Question 7

Name : A metal present in period 3, group 1 of the periodic table.

Answer

Sodium is a metal present in period 3 and group 1 of the periodic table.

Question 8

Give one word or a phrase for : Amount of energy released when an atom in the gaseous state accepts an electron to form an anion.

Answer

Electron affinity is the amount of energy released when an atom in the gaseous state accepts an electron to form an anion.

Question 9

The formula of an ion of an element A is A^{2+}. Element A probably belongs to which group?

Answer

2^{nd} Group.
Reason — Since A loses 2 electrons to form an anion, A^{2+} so its valency is 2. Hence, it belongs to the 2^{nd} group.

Question 10

State the group and period of the element having three shells with three electrons in the valence shell.

Answer

The element having three shells with three electrons in the valence shell is in **group 13 [III A] and period 3**.

Exercise 1 — Short Answer Type

Question 1

What is the significance of atomic number in the modern periodic table ?

Answer

Modern periodic table is based on Henry Moseley's modern periodic law which states that "the physical and chemical properties of elements are the periodic functions of their atomic number".

Question 2

Arrange the following in order of :
(i) increasing radii.

(a) Cl^-, Cl
(b) Mg^{2+}, Mg, Mg^+
(c) N, O, P
(ii) increasing ionisation energy.
(a) P, Na, Cl
(b) F, O, Ne
(c) Ne, He, Ar
Explain your choice.

Answer

(i) In order of increasing radii:

(a) Cl < Cl^-.

Reason — Anion is greater in size than its parent atom.

(b) Mg^{2+} < Mg^+ < Mg.

Reason — Cation is smaller in size than its parent atom.

(c) O < N < P.

Reason — Between Oxygen (O) and Nitrogen (N), atomic size of Nitrogen (N) is more as it is to the left of Oxygen (O) in period 2. Between Nitrogen (N) and Phosphorus (P), Phosphorus (P) has larger atomic size as it comes after Nitrogen (N) in group 5A.

(ii) In order of increasing ionisation energy:

(a) Na < P < Cl

Reason — Ionisation energy increases when moving across a period from left to right.

(b) O < F < Ne

Reason — Ionisation energy increases when moving across a period from left to right.

(c) Ar < Ne < He

Reason — Ionisation energy decreases when moving down the group.

Question 3

Atomic numbers of elements A, B, C, D, E, F, are 8, 7, 11, 12, 13 and 9 respectively. State the type of ions they form.

Answer

The electronic configuration of the given elements are:

A(8) = (2, 6) — A forms **anion**.

B(7) = (2, 5) — B forms **anion**.

C(11) = (2, 8, 1) — C forms **cation**.

D(12) = (2, 8, 2) — D forms **cation**.

E(13) = (2, 8, 3) — E forms **cation**.

F(9) = (2, 7) — F forms **anion**.

Question 4

Give reasons for the following assertions :

(a) The oxidising power of elements increases from left to right along a period.

(b) Ionisation potential of elements increases across a period from left to right.

(c) Alkali metals are good reducing agents.

Answer

(a) The oxidising power of elements increases from left to right along a period because electro-negativity and the non metallic character increases from left to right. As oxidising power depends on tendency to gain electrons and non-metals are good oxidising agents hence oxidising power of elements increases across a period.

(b) The ionisation potential of element increases across a period because the atomic size decreases due to an increase in nuclear charge and electrons in the outermost shell are more strongly held because of which greater energy is required to remove the electron.

(c) Alkali metals have one electron in their valence shell. In order to be stable, they easily lose this electron and get oxidised. Hence, they are good reducing agents.

Exercise 1 — Long Answer Type

Question 1

Chlorine in the Periodic Table is surrounded by the elements with atomic number 9, 16, 18, and 35.

(a) Which of these have Physical and Chemical properties resembling chlorine ?

(b) Which is more electronegative than chlorine ?

Answer

(a) The elements with atomic number 9 (fluorine) & 35 (bromine) have physical properties resembling chlorine because they belong to the same group.

(b) The element with atomic number 9 (fluorine) is more electronegative than chlorine because on moving down the group electronegativity decreases.

Question 2

First ionisation enthalpy of two elements X and Y are 500 kJ mol^{-1} and 375 kJ mol^{-1} respectively. Comment about their relative position in a group as well as in a period.

Answer

It is given that,

X = 500 kJ mol^{-1}

Y = 375 kJ mol^{-1}

Their relative position in a group is X & Y as ionisation enthalpy decreases on moving down the group.

Their relative position in a period is Y & X as ionisation enthalpy increases on moving across a period.

Question 3

The elements of one short period of the Periodic Table are given below in order from left to right :

Li Be B C O F Ne

(a) To which period do these elements belong ?

(b) One element of this period is missing. Which is the missing element and where should it be placed ?

(c) Place the three elements fluorine, beryllium and nitrogen in the order of increasing electronegativity.

(d) Which one of the above elements belongs to the halogen series ?

Answer

(a) These elements belong to the **2^{nd} period**.

(b) The missing element is **Nitrogen**. It belongs to the **Group 15** and should be placed as shown below:

Li Be B C ***N*** O F

(c) Beryllium < Nitrogen < Fluorine.

(d) Fluorine.

Question 4

The atomic number of an element Z is 16. State

(a) the period to which it belongs.

(b) the number of valence electron(s) in the element.

(c) whether the element is a metal or a non-metal.

(d) State the formula of the compound between Z and hydrogen.

Answer

(a) The element belongs to 3^{rd} period.

Reason — The element Z has atomic number 16 and so the electronic configuration will be 2, 8, 6. The number of shells present in an atom determines it's period. Hence, Z will belong to 3^{rd} period as it has three shells.

(b) 6 [∵ electronic configuration is 2, 8, 6]

(c) Z is a non metal.

(d) H_2Z

Question 5

M is a metal and its oxide has the formula M_2O. This oxide when dissolved in water forms the corresponding hydroxide which is a good conductor of electricity. In the above context, answer the following :

(i) State the number of electrons in the outermost shell of M ?

(ii) Name the group to which M belongs.

(iii) which element has more electronegativity, M or O?

Answer

Given, M is a metal

(i) Number of electrons in the outer most shell of M is **1**. It is so because the valency of O is -2 and as 2 atoms of M combine with O to form M_2O, hence we can say that M has 1 valence electron.

(ii) M belongs to group **1 [1A]** because there is 1 electron in the outer most shell.

(iii) M is a metal which belongs to group 1 whereas oxygen is a non metal with higher electronegativity compared to a M.

Question 6

The metals of Group 2 in the periodic table from top to bottom are — Be, Mg, Ca, Sr, and Ba.

(i) Which one of these elements will form ions most readily and why?

(ii) State the common feature in the electronic configuration of all these given elements.

Answer

(i) **Ba** - Elements at the bottom of a group are most metallic, have large atomic size and lowest ionisation potential. So, the outer electrons are loosely held and will form ions from metals most readily and thus are more reactive.

(ii) As the elements belong to group 2 thus they all have 2 electrons in the valence shell.

Question 7

In the table below, H does not represent hydrogen. Some elements are given in their own symbol and position in the periodic table while others are shown with a letter.

1A **1**	**IIA** **2**	**IIIA** **13**	**IVA** **14**	**VA** **15**	**VIA** **16**	**VIIA** **17**	**O** **18**
Li		D			O	J	Ne
A	Mg	E	Si		H	K	
B	C		F	G			L

Answer the following questions.

1. Identify the most electronegative element.
2. Identify the most reactive element of group IA or 1.
3. Identify the element from period 3 with the smallest atomic size.
4. Identify the element with the highest ionization potential.
5. How many valence electrons are present in G ?
6. Which element from group 2 will have the least ionization energy ?
7. Identify the noble gas of the fourth period.
8. In the compound between A and H, what type of bond is formed ? Give its molecular formula.

Answer

1. J is the most electronegative element.
2. B is the most reactive element of group IA or 1.
3. K is the element from period 3 with smallest atomic size.
4. Ne the highest ionization potential.
5. 5 valence electrons present in G.
6. C is the element from group 2 which has least ionization energy.

7. L is the noble gas of the fourth period.
8. ionic bond is formed between A and H.
   The molecular formula is :
   $2A + H \longrightarrow A_2H$