Chemistry Class 11 NCERT Solutions: Chapter 2 Structure of Atom Part 8

Q: 23 (i) Write the electronic configurations of the following ions: (a) H^- (b) Na^+ (c) O^{2-} (d) F^-

(ii) What are the atomic numbers of elements whose outermost electrons are represented by (a) $3s^1$ (b) $2p^3$ and (c) $3p^5$?

(iii) Which atoms are indicated by the following configurations?

(a) $[He]2s^1$ (B) $[Ne]\ 3s^2\ 3p^3$ (C) $[Ar]4s^2\ 3d^1$.

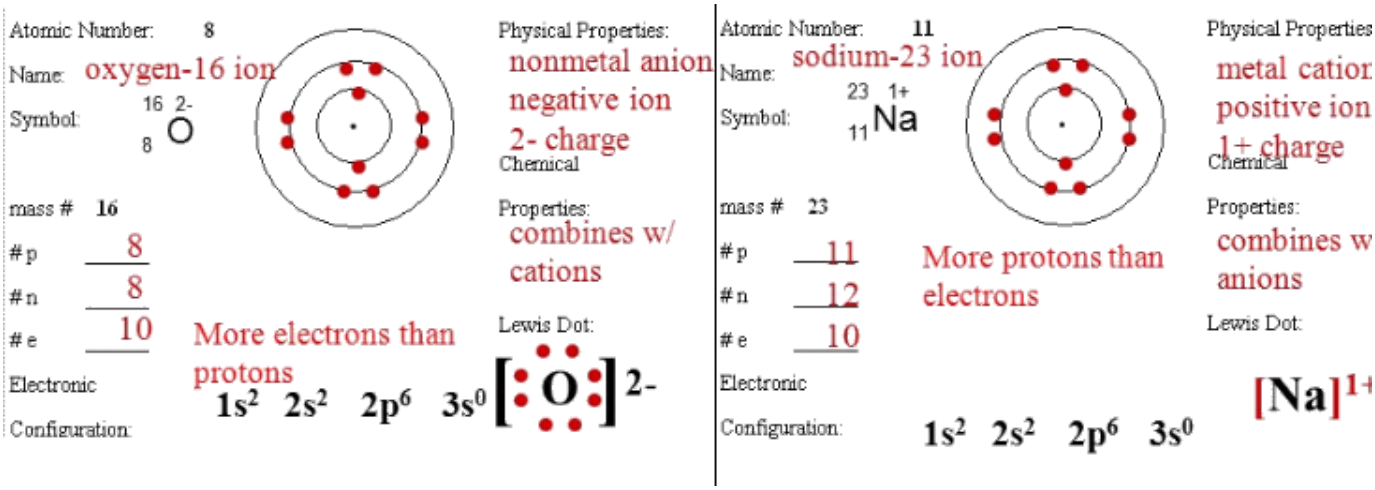

Image of Oxygen and Sodium Ion

Answer:

(i)

(A) H^- *ion*

The electronic configuration of H atom is $1s^1$.

A negative charge on the species indicates the gain of an electron by it.

$\therefore$ Electronic configuration of $H^- = 1s^2$

(B) Na^+ *ion*

The electronic configuration of Na atom is $1s^2\ 2s^2\ 2p^6\ 3s^1$.

A positive charge on the species indicates the loss of an electron by it.

$\therefore$ *Electronic configuration of* $Na^+ = 1s^2\ 2s^2\ 2p^6\ 3s^0$ *or* $1s^2\ 2s^2\ 2p^6$

(C) O^{2-} *ion*

The electronic configuration of O atom is $1s^2\ 2s^2\ 2p^4$.

A negative charge on the species indicates the gain of an electron by it.

$\therefore$ Electron configuration O^{2-} ion $= 1s^2\ 2s^2\ 2p^6$

$(d) F^-$ *ion*

The electronic configuration of F^- atom is $1s^2\ 2s^2\ 2p^5$

$\therefore$ Electron configuration F^- ion $= 1s^2\ 2s^2\ 2p^6$

(ii)

(A) $3s^1$

Completing the electron configuration of the element as

$1s^2\ 2s^2\ 2p^6\ 3s^1$.

$\therefore$ Number of electrons present in the atom of the element

$= 2 + 2 + 6 + 1 = 11$

$\therefore$ Atomic number of the element $= 11$

(B) $2p^3$

Completing the electron configuration of the element as

$1s^2\ 2s^2\ 2p^3$.

$\therefore$ Number of electrons present in the atom of element $= 2 + 2 + 3 = 7$

$\therefore$ Atomic number of the element $= 7$

(C) $3p^5$

Completing the electron configuration of element as

$1s^2\ 2s^2\ 2p^5$.

$\therefore$ Number of electrons present in the atom of the element $= 2 + 2 + 5 = 9$

$\therefore$ Atomic number of the element $= 9$

(iii)

(A) $[He]2s^1$

The electronic configuration of the element is $[He]\ 2s^1 = 1s^2\ 2s^1$.

$\therefore$ Atomic number of the element $= 3$

Hence, the element with the electronic configuration $[He]\ 2s^1$ lithium (Li).

(B) $[Ne]\ 3s^2\ 3p^3$

The electronic configuration of the element is $[Ne]3s^2\ 3p^3 = 1s^2\ 2s^2\ \ 2p^6\ 3s^2\ 3p^3$.

$\therefore$ Atomic number of the element $= 15$

Hence, the element with the electronic configuration $[Ne]3s^2\ 3p^3$ is phosphorus (P).

(C) $[Ar]4s^2\ 3d^1$

The electronic configuration of the element is $[Ar]\ 4s^2\ 3d^1 = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^1$.

$\therefore$ Atomic number of the element $= 21$

Hence, the element with the electronic configuration $[Ar]4s^2\ 3d^1$ is scandium (Sc).

Q: 24 what is the lowest value of n that allows g orbitals to exist?

Answer:

For $g-$ orbitals, $l = 4$.

As for any value 'n' of principal quantum number, the Azimuthal quantum number (l) can have a value from zero to (n-1).

$\therefore$ For $l\ = 4,$ minimum value of $n = 5$

Azimuthal Quantum Number

l	Sublevel	Orbital Shape
0	sharp - s	spherical
1	principal - p	dumbbell-shaped
2	diffused - d	cloverleaf
3	fundamental - f	too complex

Image Showing Azimuthal Quantum Number.