

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) $[Ar]4s^2 3d^1$.

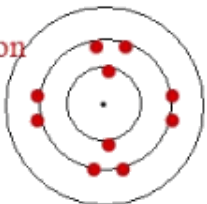
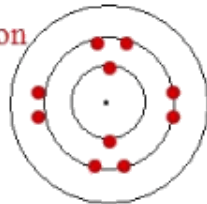
<p>Atomic Number: 8 Name: oxygen-16 ion Symbol: $^{16}_{8}O^{2-}$ mass # 16 # p 8 # n 8 # e 10 Electronic Configuration: $1s^2 2s^2 2p^6 3s^0$</p>		<p>Physical Properties: nonmetal anion negative ion 2- charge Chemical Properties: combines w/ cations Lewis Dot: $[\ddot{O}]^{2-}$</p>	<p>Atomic Number: 11 Name: sodium-23 ion Symbol: $^{23}_{11}Na^{1+}$ mass # 23 # p 11 # n 12 # e 10 Electronic Configuration: $1s^2 2s^2 2p^6 3s^0$</p>		<p>Physical Properties: metal cation positive ion 1+ charge Chemical Properties: combines w anions Lewis Dot: $[Na]^{1+}$</p>
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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.

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

(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.

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

(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.

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

(d) F^- ion

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

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

(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).

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

\therefore Atomic number of the element = 15

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



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

\therefore Atomic number of the element = 21

Hence, the element with the electronic configuration $[\text{Ar}]4s^2 3d^1$ 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.