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Class: XI
Subject: Chemistry
Topic: Structure of Atom
No. of Questions: 27

Q1. The orbital configuration of Cr (24) is $3d^5 4s^1$. The number of unpaired electrons in Cr^{3+} is

A. 4
B. 2
C. 1
D. 3

Right Answer Explanation: D
The electronic configuration of Cr is [Ar] $3d^5$ $4s^1$. Here Cr is in +3 oxidation state, thus number of unpaired electrons is 3.

Q2. How many quantum numbers are required to define an electron in an atom?

A. Two
B. Three
C. One
D. Four

Right Answer Explanation: D
To completely describe an electron in an atom, four quantum numbers are needed: energy, angular momentum, magnetic moment and spin.

Q3. In Schrodinger's wave equation ψ represents

A. orbit
B. wave function
C. wave
D. radial probability

Right Answer Explanation: B
In Schrodinger's wave equation the symbol ψ represents wave function.

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Q4. What is the electronic configuration of Mn^{2+}?

A. [Ne] $3d^5$ $4s^0$
B. [Ar] $3d^5$ $4s^2$
C. [Ar] $3d^5$ $4s^0$
D. [Ne] $3d^5$ $4s^2$

Right Answer Explanation: C
Electronic configuration of Mn (25) is
$1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $4s^2$ $3d^5$
∴ Electronic configuration of Mn^{2+} is [Ar] $3d^5$ $4s^0$.

Q5. Which orbital is non-directional?

A. s-orbital
B. d-orbital
C. p-orbital
D. f-orbital

Right Answer Explanation: A
Only s-orbitals are non-directional and are spherical in shape.

Q6. 1.6×10^{-24} g represents the mass of _____.

A. proton
B. proton or a neutron
C. neutron
D. proton and an electron

Right Answer Explanation: A
Mass of proton = 1.6×10^{-24} g

Q7. If atomic number of a neutral element is 20, how many electrons are present in that element?

A. 10
B. 20
C. 11
D. 15

Right Answer Explanation: B
Atomic number = Number of protons = Number of electrons (in neutral atom)
According to the question,

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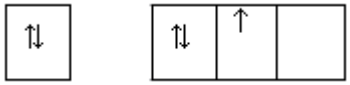
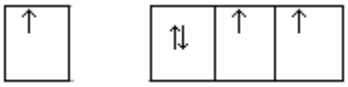
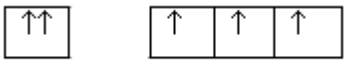
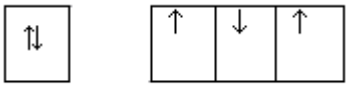
Atomic number = 20
Therefore, number of electrons = 20

Q8. The electronic configuration 2, 8, 8, 2 represents the element

A. argon
B. potassium
C. calcium
D. chlorine

Right Answer Explanation: C
For the electronic configuration 2, 8, 8, 2 there are 20 electrons. As we know,
Atomic number = Number of protons = Number of electrons
Therefore, the element will be calcium (20).

Q9. In which of the following orbital diagrams is Aufbau principle violated?

A. 
B. 
C. 
D. 

Right Answer Explanation: B
Aufbau principle states that electrons are filled in the orbitals in increasing order of energy of the orbitals. It is governed by (n + ℓ) rule.

Q10. Which of the following atoms has the lowest valency?

A. Oxygen
B. Magnesium
C. Aluminium
D. Chlorine

Right Answer Explanation: D
Chlorine (17) has lowest valency. Its configuration is 2, 8, 7
Therefore, its valency will be 8 – 7 = 1

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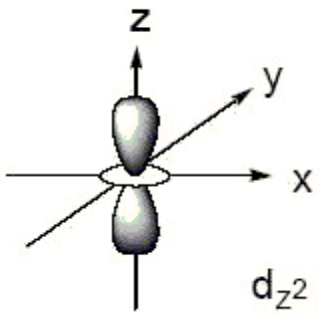
Q11. Which d-orbital does not have four lobes?

A. d_{x^2-y2}
B. d_{xy}
C. d_{yz}
D. d_{z^2}

Right Answer Explanation: D
Only d_{z^2} orbital does not contain four lobes. Its structure is:



Q12. Any p-orbital can accommodate up to

A. ten electrons
B. three electrons
C. six electrons
D. three electrons with opposite spins

Right Answer Explanation: C
Any p-orbital can be accommodated up to six electrons. Because, each p-subshell has 3 orbitals, and each orbital can hold up to 2 electrons, so each p-subshell can hold up to 6 electrons.

Q13. When 3d orbitals are completely filled. The new electron will enter in

A. 4s-orbital
B. 4p-orbital
C. 4d-orbital
D. 3p-orbital

Right Answer Explanation: B

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When 3d orbitals are completely filled. The new electron will enter in 4p orbital.
Fill the orbitals in this order:
$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 4f^{14}\ 5d^{10}\ 6p^6\ 7s^2\ 5f^{14}\ 6d^{10}7p^6$

Q14. The mass of a neutron is of the order of

A. 10^{-23} kg
B. 10^{-24} kg
C. 10^{-26} kg
D. 10^{-27} kg

Right Answer Explanation: D
The mass of a neutron is of the order of 10^{-27} kg.

Q15. The value of Planck's constant is

A. 6.6256×10^{-27} erg-sec
B. 66.256×10^{-27} erg-sec
C. 6.02×10^{-15} erg-sec
D. 3.01×10^{-23} erg-sec

Right Answer Explanation: A
The value of Planck's constant is 6.6256 x 10^{-27} erg-sec.

Q16. The principle quantum number 'n' describes

A. shape of orbital
B. subshell of electron
C. main energy shell of electrons
D. spin of electrons

Right Answer Explanation: C
The principle quantum number 'n' describes main energy shell of electrons.

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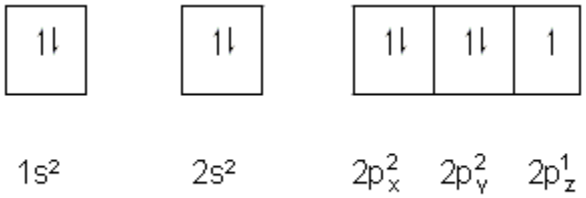
Q17. The number of unpaired electrons in electron configuration of $1s^2$, $2s^2$, $2p^5$ is

A. 1
B. 2
C. 3
D. 0

Right Answer Explanation: A



Q18. Which of the following options are not a part of atomic nucleus?

A. Electrons
B. Protons
C. Neutrons
D. Both (2) and (3)

Right Answer Explanation: A
Electrons are not a part of atomic nucleus.

Q19. Which of the following options is not true about anode rays?

A. Anode rays consist of positively charged particles.
B. Anode rays are also called canal rays.
C. Anode rays travel in the direction of cathode rays.
D. None of these

Right Answer Explanation: C
In 1836, E. Goldstein discovered the presence of new radiations in the glass discharge tube moving from anode to cathode, i.e. these rays travelled in opposite direction to the cathode rays (which were moving from cathode to anode). These rays were called 'canal rays' because they passed through the holes or canals in the cathode. Further on application of electric field, these rays deflected toward negative field of the electric field indicating that they are positively charged.

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Q20. Which of the following electronic configurations is not possible according to Hund's rule?

A. $1s^2, 2s^2$
B. $1s^2, 2s^1$
C. $1s^2, 2s^2, 2p^1_x, 2p^1_y, 2p^1_z$
D. $1s^2, 2s^2, 2p^2_x$

Right Answer Explanation: D

According to Hund's rule, " eletron pairing will not take place in orbitals of same energy (same sub- shell) until each orbital is first singly filled with parallel spin. " Hence, electronic configuration (4) is no possible according to hund's rule.

Q21. Calculate the number of protons, neutrons and electrons in $_{35}Br^{80}$

Ans: No of protons = no of electrons = 35; no of neutrons = 80-35=45

Q22. Which of the following are isoelectronic species i.e., those having the same number of electrons? Na^+ , K^+ , Mg^{2+} , Ca^{2+} , S^{2-} , Ar.

Ans: (i) Na^+, Mg^{2+} ,
(ii) Ca^{2+} , S^{2-} , Ar are isoelectronic.

Q23. The Vividh Bharati station of All India Radio, Delhi, broadcasts on a frequency of 1,368 kHz (kilo hertz). Calculate the wavelength of the electromagnetic radiation emitted by transmitter. Which part of the electromagnetic spectrum does it belong to ?

Ans: $v = 1.368X10^6 = c/\lambda => \lambda = 3X10^8/1.368X10^6 = 219m.$

Q24. Electrons are emitted with zero velocity from a metal surface when it is exposed to radiation of wavelength 6800 A^0. Calculate threshold frequency .(v_o) and work function (W_o) of the metal.

Ans: work function = $hc/\lambda = 6.6X10^{-34}\,X\,3X10^8/6.8X10^{-7} = 2.912X10^{-19}\,Joules$

$Thershold\ \ frequency = c/\lambda = 3X10^8 6.8X10^{-7} = 4.4X10^{14}$

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Q25. Calculate the wave number for the longest wavelength transition in the Balmer series of atomic hydrogen.

Ans: $\bar{v} = 109,677\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right) cm^{-1}$ longest wavelength is minimum energy ie 3 → 4 transition

= 109677(1/3^2-1/2^2)

=109677X5/36=15233cm^{-1}

Q26. The velocity associated with a proton moving in a potential difference of 1000 V is 4.37 x 10^5 ms^{-1}. If the hockey ball of mass 0.1 kg is moving with this velocity, Calculate the wavelength associated with this velocity.

$$\lambda = h / mv = 6.6X10^{-34} / 0.1X4.37X10^5 = 1.51X10^{-38} m$$

Q27. If the position of the electron is measured within an accuracy of + 0.002 nm, calculate the uncertainty in the momentum of the electron. Suppose the momentum of the electron is h/4∏ x 0.05 nm. Is there any problem in defining this value.

Ans:

$$\triangle x \triangle p \geq \frac{h}{4\pi}$$

$$\triangle p = h / 4\pi X \triangle x$$

$$\triangle p = 6.6X10^{-34} / 4X3.14X0.002X10^{-9}$$

$$\triangle P = 2.69X10^{-22} kgm / s$$