PHYSICAL CHEMISTRY

NEET

CRASH COURSE

ATOMIC STRUCTURE

SMART ACHIEVERS

JEE | NEET | FOUNDATION

ATOMIC STRUCTURE

Q.1 (i) $_{26}Fe^{54}, _{26}Fe^{56}, _{26}Fe^{57}, _{26}Fe^{28}$ (a) Isotopes

(ii) $_1H^3, _2He^3$ (b) Isotones

(iii) $_{32}Ge^{76}, _{33}As^{77}$ (c) Isodiaphers

(iv) $_{92}U^{235}, _{90}Th^{231}$ (d) Isobars

(v) $_1H^1, _1D^2, _1T^3$

Match the above correct terms:-

(1) [(i), - a], [(ii) - d], [(iii) - b], [(iv) - c], [(v) - a]

(2) [(i) - a]   [(ii) - d], [(iii) - d] [(iv) - c] [v - a]

(3) [v -a] [(iv) - c]. [(iii) - d] [(ii) - b] [(i) - a]

(4) None of them

Q.2 Select iso electronic set :-

(a) Na^+, H_3O^+, NH_4^+ (b) $CO_3^{-2}, NO_3^-, HCO_3^-$

(c) $P^{-3}, HCl, C_2H_6, PH_3$ (d) N^{-3}, O^{-2}, F

(1) a, b, d   (2) b, c, d   (3) a, b, c, d   (4) a, b, c

Q.3 The charge on the atom containing 17 protons, 18 neutrons and 18 electrons is :-

(1) +1   (2) –2   (3) –1   (4) Zero

Q.4 Atom's $_6C^{13}$ and $_8O^{17}$ are related to each other as:-

(1) Isotone's   (2) Isoelectronic

(3) Isodiapher's   (4) Isoster's

Q.5 No. of wave in fourth orbit :–

(1) 4   (2) 5   (3) 0   (4) 1

Q.6 The four quantum numbers for the valence shell electron or last electron of sodium (Z = 11) is

(1) $n = 2, \ell = 1, m = -1, s = -\dfrac{1}{2}$ (2) $n = 3, \ell = 0, m = 0, s = +\dfrac{1}{2}$

(3) $n = 3, \ell = 0, m = -0, s = \pm\dfrac{1}{2}$ (4) $n = 3, \ell = 2, m = 2, s = +\dfrac{1}{2}$

Q.7 Energy of atomic orbitals in a particular shell is in order:-

(1) s < p < d < f   (2) s > p > d > f   (3) p < d < f < s   (4) f > d > s > p

Q.8 In an atom, for how many electrons, the quantum numbers will be , $n = 3, \ell = 2, m = +2, s = +\dfrac{1}{2}$:-

(1) 18   (2) 6   (3) 24   (4) 1

Q.9 When the value of principal quantum number n is 3, the permitted value of azimuthal quantum numbers ℓ and magnetic quantum numbers 'm' are:-

(1)
ℓ	**m**
0	0
1	+1, 0, –1
2	+2, +1, 0, –1, –2

(2)
ℓ	**m**
0	1
2	+2, 1, –2
3	+3, +3, +2, 1, –2, –3

(3)
ℓ	**m**
0	0
1	1 2 3 2 0, 1, 2
2	+3, +2, 1, –2, –3

(4)
ℓ	**m**
1	0, 1
2	0, 1, 2
3	0, 1, 2, 3

Q.10 AIR service on Vividh Bharati is transmitted on 219 m band. What is its transmission frequency in Hertz?
(1) 1.3×10^6 Hz (2) 1.9×10^6 Hz (3) 1×10^6 Hz (4) 6.5×10^6 Hz

Q.11 Which of the following statements is false :
(1) The energy of red photon is more than the energy of violet photon
(2) The momentum of photon is inversely proportional to its wave length
(3) The energy of a photon is inversely proportional to its wave length
(4) The particle nature of electromagnetic radiations is able to explain the photoelectric effect

Q.12 Calculate the frequency of a photon of wavelength 4000 Å
(1) 7.5×10^{14} s^{-1} (2) 7.5×10^{-16} s^{-1}
(3) 8×10^{-14} s^{-1} (4) 6.5×10^{-15} s^{-1}

Q.13 Calculate the wavelength of a photon having an energy of 2 electron volt
(1) 6.204×10^{-7} m (2) 6.206×10^{-6} m
(3) 6.204×10^{-9} m (4) 6.204×10^{-8} m

Q.14 The ionization energy of H-atom is 13.6 eV. The ionization energy of Li^{+2} ion will be :
(1) 54.4 eV (2) 122.4 eV (3) 13.6 eV (4) 27.2 eV

Q.15 Which of the following electron transition in a hydrogen atom will require the largest amount of energy ?
(1) From n = 1 to n = 2 (2) From n = 2 to n = 3
(3) From n = ∞ to n = 1 (4) From n = 3 to n = 5

Q.16 S_1 : Bohr model is applicable for Be^{2+} ion.
S_2 : Total energy coming out of any light source is integral multiple of energy of one photon.
S_3 : Number of waves present in unit length is wave number.
S_4 : e/m ratio in cathode ray experiment is independent of the nature of the gas.
(1) F F T T (2) T T F F (3) F T T T (4) T F F F

Q.17 If r_1 is the radius of the first orbit of hydrogen atom, then the radii of second, third and fourth orbits in terms of r_1 are :
(1) r_1^2, r_1^3, r_1^4 (2) $8r_1, 27r_1, 64r_1$ (3) $4r_1, 9r_1, 16r_1$ (4) $2r_1, 6r_1, 8r_1$

Q.18 The radius of hydrogen in ground state is 0.53 Å. In normal state the radius of Li^{2+} (atomic number = 3) in ground state will be :
(1) 1.06 Å (2) 0.265 Å (3) 0.17 Å (4) 0.53 Å

Q.19 An α-particle is accelerated through a potential difference of V volts from rest. The de-Broglie's wavelength associated with it is
(1) $\sqrt{\dfrac{150}{V}}$Å (2) $\dfrac{0.286}{\sqrt{V}}$Å (3) $\dfrac{0.101}{\sqrt{V}}$Å (4) $\dfrac{0.983}{\sqrt{V}}$Å

Q.20 Which of the following has least de Broglie λ
(1) e^- (2) p (3) CO_2 (4) SO_2

Q.21 A helium molecule is moving with a velocity of 2.40×10^2 ms^{-1} at 300k. The de-Broglie wave length is about
(1) 0.416 nm (2) 0.83 nm (3) 803 Å (4) 8000 Å

Q.22 Which of the following represents the correct set of quantum numbers of a 4d electron ?
(1) $4, 3, 2, +\dfrac{1}{2}$ (2) $4, 2, 1, 0$ (3) $4, 3, -2, +\dfrac{1}{2}$ (4) $4, 2, 1, -\dfrac{1}{2}$

Q.23 Which of the following set of quantum numbers represents the highest energy of an atom ?

(1) $n = 3, l = 0, m = 0, s = +\frac{1}{2}$ (2) $n = 3, l = 1, m = 1, s = +\frac{1}{2}$

(3) $n = 3, l = 2, m = 1, s = +\frac{1}{2}$ (4) $n = 4, l = 0, m = 0, s = +\frac{1}{2}$

Paragraph for Question Nos. 24 to 26

The hydrogen-like species Li^{2+} is in a spherically symmetric state S_1 with one radial node. Upon absorbing light the ion undergoes transition to a state S_2. The state S_2 has one radial node and its energy is equal to the ground state energy of the hydrogen atom.

Q.24 The state S_1 is :
(1) 1s   (2) 2s   (3) 2p   (4) 3s

Q.25 Energy of the state S_1 in units of the hydrogen atom ground state energy is :
(1) 0.75   (2) 1.50   (3) 2.25   (4) 4.50

Q.26 The orbital angular momentum quantum number of the state S_2 is :
(1) 0   (2) 1   (3) 2   (4) 3

Q.27 The work function (ϕ) of some metas is listed below. The number of metals which will show photoelectric effect when light of 300 nm wavelength falls on the metal is

Metal	Li	Na	K	Mg	Cu	Ag	Fe	Pt	W
ϕ (eV)	2.4	2.3	2.2	3.7	4.8	4.3	4.7	6.3	4.75

(1) 4   (2) 3   (3) 5   (4) 9

Q.28 The maximum number of electrons that can have principal quantum number, $n = 3$, and spin quantum number, $m_s = -1/2$, is
(1) 3   (2) 9   (3) 6   (4) 1

Q.29 The electrons identified by quantum numbers n and ℓ :-
(a) $n = 4$, $\ell = 1$ (b) $n = 4$, $\ell = 0$
(c) $n = 3$, $\ell = 2$ (d) $n = 3$, $\ell = 1$
Can be placed in order of increasing energy as
(1) (a) < (c) < (b) < (d)   (2) (c) < (d) < (b) < (a)
(3) (d) < (b) < (c) < (a)   (4) (b) < (d) < (a) < (c)

Q.30 Energy of H-atom in the ground state is -13.6 eV, hence energy in the second excited state is
(1) $- 6.8$ eV   (2) $- 3.4$ eV   (3) $- 1.51$ eV   (4) $- 4.53$ eV

ASSERTION AND REASON

Directions : Each of these questions contains an Assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(1) If both assertion and reason are true and reason is the correct explanation of assertion.

(2) If both assertion and reason are true but reason is not the correct explanation of assertion.

(3) If Assertion is true but reason is false.

(4) If both assertion and reason are false.

Q.31 **Assertion :** The number of radial nodes in 3s and 4p orbitals is are equal.

Reason : The number of radial nodes in any orbital depends upon the values of 'n' and 'l' which are different for 3s and 4p orbitals.

Q.32 **Assertion :** The atoms of different elements having same mass number but different atomic number are known as isobars.
Reason : The sum of protons and neutrons in isobars is always different. **[AIIMS 2000]**

Q.33 **Assertion :** K and Cs are used in photo–electric cells.
Reason : K and Cs emit electrons on exposure to light. **[AIIMS 2002]**

Q.34 **Assertion :** A beam of electrons deflects more than a beam of α – particles in an electric field.
Reason : Electrons possess negative charge while α – particles possess positive charge.

[AIIMS 2002]

Q.35 **Assertion :** In Lyman of H–spectra, the maximum wavelength of lines is 121.65 nm.

[AIIMS 2009]

Reason : Wavelength is maximum if there is transition from the very next level.

Q.35 According to Bohr's theory, which of the following correctly represents the variation of energy and radius of an electron in nth orbit of H-atom? **[AIIMS 2016]**

(1) $E_n \propto \dfrac{1}{n^2}$, $r \propto \dfrac{1}{n^2}$

(2) $E_n \propto \dfrac{1}{n^2}$, $r \propto n^2$

(3) $E_n \propto n^2$, $r \propto n^2$

(4) $E_n \propto n$, $r \propto \dfrac{1}{n}$

Q.36 Which one is the wrong statement? **[NEET 2017]**

(1) de-Broglie's wavelength is given by $\lambda = \dfrac{h}{m\upsilon}$, where m = mass of the particle, v = group velocity of the particle

(2) The uncertainty principle is $\Delta E \times \Delta t \geq \dfrac{h}{4\pi}$

(3) Half filled and fully filled orbitals have greater stability due to greater exchange energy, greater symmetry and more balanced arrangement

(4) The energy of 2s orbital is less than the energy of 2p orbital in case of Hydrogen like atoms.

ANSWER KEY

ATOMIC STRUCTURE

Q.1	1	Q.2	4	Q.3	3	Q.4	3	Q.5	1	Q.6	2	Q.7	1
Q.8	4	Q.9	1	Q.10	1	Q.11	1	Q.12	1	Q.13	1	Q.14	2
Q.15	3	Q.16	3	Q.17	3	Q.18	3	Q.19	3	Q.20	4	Q.21	1
Q.22	4	Q.23	3	Q.24	2	Q.25	3	Q.26	2	Q.27	1	Q.28	2
Q.29	3	Q.30	3	Q.31	1	Q.32	3	Q.33	3	Q.34	2		
Q.35	1												