Atomic Structure

Exam-1

Sub: Chemistry | Syllabus: Complete Atomic Structure | NEET

A hero isn't the one who never falls—he rises each time, eyes fixed on the dream.

1. **For Li^{2+} ion, $r_2 : r_5$ will be:**
   (A) $9 : 25$
   (B) $4 : 25$
   (C) $25 : 4$
   (D) $25 : 9$

2. **If the kinetic energy of an electron is increased four times, the wavelength of the de Broglie wave associated with it would become:**
   (A) Two times
   (B) Half
   (C) One fourth
   (D) Four times

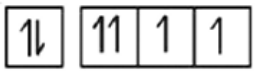
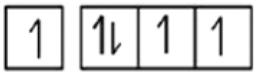
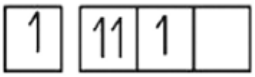
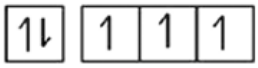
3. **The maximum number of electrons in a subshell is given by:**
   (A) $4\ell - 2$
   (B) $4\ell + 2$
   (C) $2\ell + 2$
   (D) $2n^2$

4. **The orbital angular momentum for an electron is given by $\sqrt{\ell(\ell+1)}\,\hbar$. This momentum for an s-electron is:**
   (A) $2\pi h$
   (B) $2\pi \dfrac{h}{2}$
   (C) **zero**
   (D) πh

5. **Which of the following sets of quantum numbers is correct for an electron in $4f$ orbital?**
   (A) $n = 3,\ \ell = 1,\ m = +1,\ s = +\frac{1}{2}$
   (B) $n = 4,\ \ell = 4,\ m = -4,\ s = -\frac{1}{2}$
   (C) $n = 4,\ \ell = 1,\ m = +3,\ s = +\frac{1}{2}$
   (D) $n = 4,\ \ell = 3,\ m = +1,\ s = +\frac{1}{2}$

6. **Which set of quantum numbers is correct for the 19th electron of chromium?**
   (A) $n = 3,\ \ell = 0,\ m = 0,\ s = \frac{1}{2}$
   (B) $n = 3,\ \ell = 2,\ m = -2,\ s = \frac{1}{2}$
   (C) $n = 4,\ \ell = 0,\ m = 0,\ s = \frac{1}{2}$
   (D) $n = 4,\ \ell = 1,\ m = -1,\ s = \frac{1}{2}$

7. **In which of the following electronic arrangement *all three* rules—Aufbau, Pauli and Hund—are invalid?**

1) 
2) 
3) 
4) 

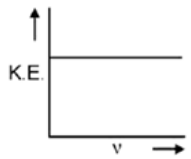
8. **The energies of orbitals of H-atom are in the order:**
   (A) $3s < 3p < 4s < 3d < 4p$
   (B) $3s < 3p < 3d < 4s < 4p$
   (C) $3s = 3p = 3d < 4s = 4p$
   (D) $3s = 3p = 3d < 4s < 4p$

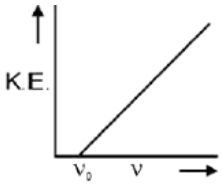
9. **When atoms are bombarded with α-particles, only a few in million suffer deflection, others pass out undeflected. This is because:**
   (A) The force of repulsion on the moving α-particle is small
   (B) The force of attraction on the α-particle to electrons is very small
   (C) There is only one nucleus and a large number of electrons
   (D) The nucleus occupies much smaller volume compared to the volume of the atom

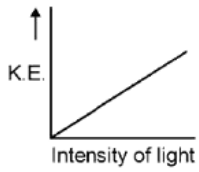
10. **A metal in its dipositive state has the electronic configuration $2, 8, 14$ and atomic weight $= 56$. Number of neutrons in its nucleus would be:**
   (A) 30
   (B) 32
   (C) 34
   (D) 28

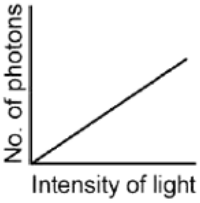
11. **The wavelength of an electromagnetic radiation is 400 nm. The wavenumber is:**
   (A) 2.5×10^4 cm^{-1}
   (B) 2.5×10^3 cm^{-1}
   (C) 2.5×10^5 cm^{-1}
   (D) 2.5×10^2 cm^{-1}

12. **Which is the correct graphical representation based on photoelectric effect?**

I. 

II. 

III. 

IV. 

   (A) I & II
   (B) II & III
   (C) III & IV
   (D) II & IV

13. **Which of the following is *not* among shortcomings of Bohr's model?**
    1) Bohr theory could not account for the fine lines in the atomic spectrum.
    2) Bohr theory was unable to account for splitting of spectral lines in a magnetic field.
    3) Bohr theory failed for He atom.
    4) It did not give information about energy level.

14. **The value of n_1 for Paschen series of hydrogen spectrum is (n_1 = orbit number in which electron falls):**
    (A) 1
    (B) 2
    (C) 3
    (D) 4

15. **Given below are two-statements :**

    Statement I: Azimuthal quantum number ℓ identifies the subshell and determines the shape of orbital.

    Statement II: There are $(2\ell + 1)$ orbitals of each type in a subshell.

    Choose the most appropriate answer:
    (A) Both I and II are correct.
    (B) I is correct but II is incorrect.
    (C) I is incorrect but II is correct.
    (D) Both I and II are incorrect.

16. **Match the Column–I and Column–II (see figure), then choose the correct matching:**

Column - I		Column - II	
(a)	Diffraction and interference of light can be explained by	(p)	discontinous line spectrum
(b)	Spectrum of visible light is called	(q)	$\nu = \frac{E_2 - E_1}{h}$
(c)	Bohr's frequency rule is	(r)	wave nature of electromagnetic radiations
(d)	Emission spectra of atoms in gas phase is called	(s)	continuous spectrum

    (A) (a)–(r), (b)–(s), (c)–(q), (d)–(p)
    (B) (a)–(p), (b)–(r), (c)–(s), (d)–(q)
    (C) (a)–(q), (b)–(p), (c)–(s), (d)–(r)
    (D) (a)–(p), (b)–(q), (c)–(r), (d)–(s)

17. **Assertion–Reason**

Assertion (A): In hydrogen atom, energy of $4s$ is more than $3d$.
Reason (R): An orbital with lower value of $(n+\ell)$ has smaller energy than one with higher $(n+\ell)$.

(A) Both (A) and (R) are correct but (R) is not the correct explanation of (A).
(B) (A) is correct but (R) is not correct.
(C) (A) is not correct but (R) is correct.
(D) Both (A) and (R) are correct and (R) is the correct explanation of (A).

18. **Match the Column–I and Column–II (see figure), then choose the correct matching:**

Column - I		Column - II	
(a)	The orbital wave function for an electron in an atom has	(p)	no physical meaning
(b)	Total number of nodes	(q)	(n – 1)
(c)	for 1s orbital probability density is	(r)	maximum near to nucleus and deceases sharply as we move away from it
(d)	nodal surfaces are	(s)	region where probability density function reduces to zero.

(A) (a)–(s), (b)–(p), (c)–(q), (d)–(r)
(B) (a)–(p), (b)–(r), (c)–(s), (d)–(q)
(C) (a)–(q), (b)–(p), (c)–(s), (d)–(r)
(D) (a)–(p), (b)–(q), (c)–(r), (d)–(s)

19. **If the binding energy of the electron in a hydrogen atom is $13.6\,\text{eV}$, the energy required to remove the electron from the first excited state of Li^{2+} is:**

(A) 13.6 eV
(B) 30.6 eV
(C) 122.4 eV
(D) 3.4 eV

20. **In Bohr series of lines of hydrogen spectrum, the third line from the red end corresponds to which inter-orbit jump?**

(A) $3 \rightarrow 1$
(B) $5 \rightarrow 2$
(C) $2 \rightarrow 5$
(D) $3 \rightarrow 2$

21. **A golf ball has a mass of $40\,\mathrm{g}$ and a speed of $45\,\mathrm{m\,s^{-1}}$. If the speed can be measured within 2% accuracy, calculate the uncertainty in position.**
    (A) 1.46×10^{-33} m
    (B) 1.46×10^{-40} m
    (C) 1.46×10^{-20} m
    (D) 1.46×10^{-10} m

22. **Ionization energy of gaseous Na atoms is $495.5\,\mathrm{kJ\,mol^{-1}}$. The lowest possible frequency of light that ionizes a sodium atom is**
    ($h = 6.626 \times 10^{-34}\,\mathrm{J\,s},\ N_A = 6.022 \times 10^{23}\,\mathrm{mol^{-1}}$):
    (A) 3.15×10^{15} $\mathrm{s^{-1}}$
    (B) 4.76×10^{14} $\mathrm{s^{-1}}$
    (C) 1.24×10^{15} $\mathrm{s^{-1}}$
    (D) 7.50×10^{4} $\mathrm{s^{-1}}$