Unit 2

Quantum Mechanical Model of Atom

Choose the best answer

1. Electronic configuration of species M^{2+} is $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6$ and its atomic weight is 56. The number of neutrons in the nucleus of species M is

   a) 26 b) 22 c) 30 d) 24

2. The energy of light of wavelength 45 nm is

   a) 6.67×10^{15}J b) 6.67×10^{11}J

   c) 4.42×10^{-18}J d) 4.42×10^{-15}J

3. The energies E_1 and E_2 of two radiations are 25 eV and 50 eV respectively. The relation between their wavelengths ie λ_1 and λ_2 will be

   a) $\frac{\lambda_1}{\lambda_2} = 1$ b) $\lambda_1 = 2\lambda_2$ c) $\lambda_1 = \sqrt{25 \times 50}\ \lambda_2$ d) $2\lambda_1 = \lambda_2$

4. Splitting of spectral lines in an electric field is called

   a) Zeeman effect b) Shielding effect

   c) Compton effect d) Stark effect

5. Based on equation $E = -2.178 \times 10^{-18}\ J \left(\frac{z^4}{n^2}\right)$, certain conclusions are written. Which of them is not correct ? (NEET)

   a) Equation can be used to calculate the change in energy when the electron changes orbit

   b) For n = 1, the electron has a more negative energy than it does for n = 6 which means that the electron is more loosely bound in the smallest allowed orbit

   c) The negative sign in equation simply means that the energy of electron bound to the nucleus is lower than it would be if the electrons were at the infinite distance from the nucleus.

   d) Larger the value of n, the larger is the orbit radius.

6. According to the Bohr Theory, which of the following transitions in the hydrogen atom will give rise to the least energetic photon ?

a) n = 6 to n = 1 b) n = 5 to n = 4

c) n = 5 to n = 3 d) n = 6 to n = 5

7. Assertion : The spectrum of He^+ is expected to be similar to that of hydrogen

Reason : He^+ is also one electron system.

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

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

(c) If assertion is true but reason is false

(d) If both assertion and reason are false

8. Which of the following pairs of d-orbitals will have electron density along the axes ? (NEET Phase - II)

a) d_{z2}, d_{xz} b) d_{xz}, d_{yz} c) d_{z2}, $d_{x^2-y^2}$ d) d_{xy}, $d_{x^2-y^2}$

9. Two electrons occupying the same orbital are distinguished by

a) azimuthal quantum number b) spin quantum number

c) magnetic quantum number d) orbital quantum number

10. The electronic configuration of Eu (Atomic no. 63) Gd (Atomic no. 64) and Tb (Atomic no. 65) are (NEET - Phase II)

a) [Xe] $4f^6\ 5d^1\ 6s^2$, [Xe] $4f^7\ 5d^1\ 6s^2$ and [Xe] $4f^8\ 5d^1\ 6s^2$

b) [Xe] $4f^7$, $6s^2$, [Xe] $4f^7\ 5d^1\ 6s^2$ and [Xe] $4f^9\ 6s^2$

c) [Xe] $4f^7$, $6s^2$, [Xe] $4f^8\ 6s^2$ and [Xe] $4f^8\ 5d^1\ 6s^2$

d) [Xe] $4f^6\ 5d^1\ 6s^2$, [Xe] $4f^7\ 5d^1\ 6s^2$ and [Xe] $4f^9\ 6s^2$

11. The maximum number of electrons in a sub shell is given by the expression

a) $2n^2$ b) $2l + 1$ c) $4l + 2$ d) none of these

12. For d-electron, the orbital angular momentum is

a) $\frac{\sqrt{2}h}{2\pi}$ b) $\frac{\sqrt{2h}}{2\pi}$ c) $\frac{\sqrt{2\times4}\,h}{2\pi}$ d) $\frac{\sqrt{6}\,h}{2\pi}$

13. What is the maximum numbers of electrons that can be associated with the following set of quantum numbers ? n = 3, l = 1 and m = –1

a) 4 b) 6 c) 2 d) = 10

14. Assertion : Number of radial and angular nodes for 3p orbital are 1, 1 respectively.

Reason : Number of radial and angular nodes depends only on principal quantum number.

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

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

(c) assertion is true but reason is false

(d) both assertion and reason are false

15. The total number of orbitals associated with the principal quantum number n = 3 is

a) 9 b) 8 c) 5 d) 7

16. If n = 6, the correct sequence for filling of electrons will be,

a) ns → (n – 2) f → (n – 1)d → np b) ns → (n – 1) d → (n – 2) f → np

c) ns → (n – 2) f → np → (n – 1) d d) none of these are correct

17. Consider the following sets of quantum numbers :

	n	l	m	s
(i)	3	0	0	$+\frac{1}{2}$
(ii)	2	2	1	$-\frac{1}{2}$
(iii)	4	3	–2	$+\frac{1}{2}$
(iv)	1	0	–1	$+\frac{1}{2}$
(v)	3	4	3	$-\frac{1}{2}$

Which of the following sets of quantum number is not possible ?

a) (i), (ii), (iii) and (iv) b) (ii), (iv) and (v)

c) (i) and (iii) d) (ii), (iii) and (iv)

18. How many electrons in an atom with atomic number 105 can have (n + l) = 8 ?

a) 30 b) 17 c) 15 d) unpredictable

19. Electron density in the yz plane of $3d_{xy}$ orbital is

a) zero b) 0.50 c) 0.75 d) 0.90

20. If uncertainty in position and momentum are equal, then minimum uncertainty in velocity is

a) $\frac{1}{m}\sqrt{\frac{h}{\pi}}$ d) $\sqrt{\frac{h}{\pi}}$ c) $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$ d) $\frac{h}{4\pi}$

21. A macroscopic particle of mass 100 g and moving at a velocity of 100 cm s^{-1} will have a de Broglie wavelength of

a) 6.6×10^{-29} cm b) 6.6×10^{-30} cm c) 6.6×10^{-31} cm d) 6.6×10^{-32} cm

22. The ratio of de Broglie wavelengths of a deuterium atom to that of an α - particle, when the velocity of the former is five times greater than that of later, is

a) 4 b) 0.2 c) 2.5 d) 0.4

23. The energy of an electron in the 3rd orbit of hydrogen atom is –E. The energy of an electron in the first orbit will be

a) –3E b) $-E/3$ c) $-E/9$ d) –9E

24. Time independent Schnodinger wave equation is

a) $\hat{H}\psi = E\psi$ b) $\nabla^2\psi + \frac{8\pi^2 m}{h^2}(E+V)\psi = 0$

c) $\frac{\partial^2\psi}{\partial x^2} + \frac{\partial^2\psi}{\partial y^2} + \frac{\partial^2\psi}{\partial z^2} + \frac{2m}{h^2}(E-V)\psi = 0$ d) all of these

25. Which of the following does not represent the mathematical expression for the Heisenberg uncertainty principle ?

a) $\Delta x \,.\, \Delta p \geq h/4\pi$ b) $\Delta x \,.\, \Delta v \geq h/4\pi m$

c) $\Delta E \,.\, \Delta t \geq h/4\pi$ d) $\Delta E \,.\, \Delta x \geq h/4\pi$