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Chapter End Test

(2019-20)

Date : ___/__/2019 Duration : ___ min. Max. Marks : ___	Chemistry Topic : Structure of Atom	CLASS XI

General Instructions:

- All questions are compulsory.
- Do not write anything in the question paper.
- Use of calculators is not allowed.

[Topic : de Broglie Equation]

1. A body of mass x kg is moving with a velocity of 100 ms^{-1}. its de-Broglie wavelength is 6.62 × 10^{-35}m. Hence, x is (h = 6.62×10^{-34} Js)

(a) 0.25 kg (b) 0.15 kg (c) 0.2 kg (d) 0.1 kg

2. If the radius of the first Bohr orbit is x, then de-Broglie wavelength of electron in 3rd orbit is nearly

(a) 3x (b) 9x (c) 3πx (d) 5πx

3. Which expression represents de Broglie relationship?

(a) $\frac{h}{mv} = p$ (b) $\lambda = \frac{h}{mv}$ (c) $\lambda = \frac{h}{mp}$ (d) $\lambda m = \frac{v}{p}$

4. What is the wavelength of light. Given energy = 3.03 × 10^{-19} J, h = 6.6 × 10^{-34} Js, c = 3.0 × 10^{8} m/s?

(a) 6.54 nm (b) 654 nm (c) 0.654 nm (d) 65.4 nm

[Topic : Planck's Quantum Theory]

5. Which one of the following statements is wrong about photon?

(a) Photon's energy is hv (b) Photon's rest mass is zero

(c) Momentum of photon is $\frac{hv}{c}$ (d) Photon exerts no pressure

6. The energies E_1 and E_2 of two radiations are 25 eV and 50 eV respectively. The relation between their wavelengths, i.e., λ_1 and λ_2 will be

(a) $\lambda_1 = \frac{1}{2}\lambda_2$ (b) $\lambda_1 = \lambda_2$ (c) $\lambda_1 = 2\lambda_2$ (d) $\lambda_1 = 4\lambda_2$

[Topic : Uncertainty principle]

7. In an atom, an electron is moving with a speed of 600 m/s with an accuracy of 0.005% Certainty with which the position of the electron can be located is (h = 6.6 × 10^{34} kg m^2 s^{-1}, mass of electron, m_e = 9.1 × 10^{-31} kg)

(a) 1.52 × 10^{-4}m (b) 5.10 × 10^{-3} m (c) 1.92 × 10^{-3} m (d) 3.84 × 10^{-3} m

8. The measurement of the electron position is associated with an uncertainty in momentum which is equal to 1 × 10^{-18} g cm s^{-1}. The uncertainty in electron velocity is (mass of electron is 9 × 10^{-28} g)

(a) 1 × 10^{8} cm s^{-1} (b) 1 × 10^{11} cm s^{-1} (c) 1 × 10^{9} cm s^{-1} (d) 1 × 10^{6} cm s^{-1}

[Topic : Atomic Spectrum]

9. Amplification of electromagnetic waves by stimulated emission of radiation produces

(a) X-rays (b) Y-rays (c) Radiowaves (d) Laser

[Topic : Quantum Mechanical Model]

10. Which of the following statements is incorrect? An atomic orbital

(a) is a single electron wave function

(b) describes trajectory of electron in an atom

(c) defines distribution of electron density in space

(d) can be represented by boundary surface

11. The total number of atomic orbitals in fourth energy level of an atom is

(a) 4 (b) 8 (c) 16 (d) 32

12. Maximum number of electrons in a subsbell of an atom is determined by the following

(a) $2l + 1$ (b) $4l - 2$ (c) $2n^2$ (d) $4l + 2$

13. Which of the following is not permissible arrangement of electrons in an atom?

(a) $n = 5 l = 3, m = 0, s = +\frac{1}{2}$ (b) $n = 3, l = 2, m = -3, s = -\frac{1}{2}$

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

14. For principal quantum number n = 4, the total number of orbitals having l = 3 is

(a) 3 (b) 7 (c) 5 (d) 9

15. Which of the following element outermost orbit's last magnetic quantum number m = 0?

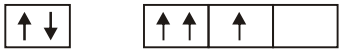
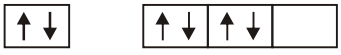
(a) Na (b) O (c) Cl (d) N

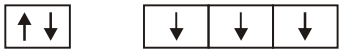
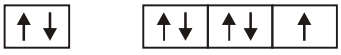
[Topic : Electronic Configuration]

16. Isoelectronic species are :

(a) F^-, O^{2-} (b) F^-, O (c) F^{-1}, O^+ (d) F^-, O^{2+}

17. The orbital diagram in which both the Paull's exclusion principle and Hund's rule are violated is

(a)  (b) 

(c)  (d) 

[Topic : Quantum Numbers]

18. If n = 3, l = 0, m = 0, then atomic number is

(a) 12, 13 (b) 13, 14 (c) 10, 11 (d) 11, 12

19. The set of quantum numbers for the outermost electron for copper in its ground state is .....

(a) 4, 1, 1, + 1/2 (b) 3, 2, 2, + 1/2 (c) 4, 0, 0, + 1/2 (d) 4, 2, 2, + 1/2

[Topic : Bohr Model]

20. The radius of which of the following orbit is same as that of the first Bohr's orbit of hydrogen atom?

(a) He^+ (n = 2) (b) Li^{2+} (n = 2) (c) Li^{2+} (n = 3) (d) Be^{3+} (n = 2)

21. The energy of the second Bohr orbit of the hydrogen atom is –328 kJ mol^{-1}; hence the energy of fourth Bohr orbit would be

(a) –1312 kJ mol^{-1} (b) –82 kJ mol^{-1} (c) –41 kJ mol^{-1} (d) –164 kJ mol^{-1}

22. The line spectrum of He^+ ion will resemble that of :

(a) Hydrogen atom (b) Li^+ ion (c) Helium atom (d) Lithium atom

23. As electron moves away from the nucleus, its

(a) K.E. decreases but P.E. increase (b) Both K.E. and P.E. decrease

(c) Both K.E. and P.E. increase (d) K.E. increases but P.E. decreases

24. In Bohr's model of hydrogen atom, the period of evolution of an electron in the 1st orbit to that in the 2nd orbit are in the ratio

(a) 1 : 2 (b) 2 : 1 (c) 1 : 4 (d) 1 : 8

25. Ionisation energy of He^+ is 19.6×10^{-18} J $atom^{-1}$. The energy of the first stationary state (n = 1) of Li^{2+} is

(a) -2.2×10^{-15} J $atom^{-1}$ (b) 8.82×10^{-17} J $atom^{-1}$

(c) 4.41×10^{-16} J $atom^{-1}$ (d) -4.41×10^{-17} J $atom^{-1}$

[Topic : Structure of Atom]

26. (i) Which of the following orbitals are not possible?

1p, 2s, 3f and 4d.

(ii) Write the E.C. of Cr^{3+} and Cu^{2+}? **[1+2=3]**

[Topic : de Broglie Equation]

27. The mass of an electron is 9×10^{-31} kg. If its K.E. is 3.0×10^{-25} J, calculate its wavelength. [h = 6.6×10^{-34} kg m^2 s^{-1}] **[3]**

[Topic : Bohr's model]

28. The electron energy in hydrogen atom is given by $E_n = (-2.18 \times 10^{-18})/n^2$ J. Calculate the energy required to remove the electron completely from n = 2 orbit. What is the longest wavelength of light that can be used to cause this transition? **[3]**

[Topic : Quantum Numbers]

29. Explain, giving reasons, which of the following sets of quantum number are not possible. **[3]**

(a) n = 1, l = 1, m_l = – 0, $m_s = +\frac{1}{2}$ (b) n = 2, l = 1, m_l = 0, $m_s = -\frac{1}{2}$

(c) n = 3, l = 1, m_l = 0, $m_s = +\frac{1}{2}$

30. (i) Using s, p, d, f notations, describe the orbital with the following quantum numbers:

(a) n = 2, l = 1 (b) n = 4, l = 0

(ii) An electron is in one of the 4f orbital. What possible values for the quantum numbers, n, l and m can it have?

(iii) Calculate ionization potential in volts of He^+. **[1+1+1=3]**

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Solutions to Chapter End Test

(2019-20)

Date : ___/__/2019 Duration : ___ min. Max. Marks : ___	Chemistry Topic : Some Basic Concept of Chemistry	CLASS XI

1.	(d)	2.	(d)	3.	(b)	4.	(b)	5.	(d)
6.	(c)	7.	(c)	8.	(c)	9.	(d)	10.	(b)
11.	(c)	12.	(a)	13.	(b)	14.	(b)	15.	(a)
16.	(a)	17.	(a,b)	18.	(d)	19.	(c)	20.	(d)
21.	(b)	22.	(a)	23.	(a)	24.	(d)	25.	(d)

26. [1p] and [3f] orbital are not possible.

(i) $_{24}Cr = 3d^5\ 4s^1$

So $Cr^{3+} = 3d^3\ 4s^0$

(ii) $_{29}Cu = 1s^2\ 2s^2 2p^6 3s^2 3p^6 4s^2 3d^9$

Due to extra stability

$Cu = 3d^{10}\ 4s^1$

So, $Cu^{2+} = 3d^9\ 4s^0$

27. Mass of an $e^- = 9.1 \times 10^{-31}$ kg

K.E. $= 3 \times 10^{-25}$ J

$h = 6.6 \times 10^{-34}$ kg $m^2\ s^{-1}$

λ = ?

As, [K.e = $\frac{1}{2} mv^2$]

$$\therefore \quad v = \sqrt{\frac{2 \times K.E}{m}} = \sqrt{\frac{2 \times 3 \times 10^{-25} J}{9.1 \times 10^{-31}\ kg}}$$

$= (812\ ms^{-1})$

By de-broglie equation,

$[\lambda = h/mv]$

$$\text{or,} \quad \lambda = \frac{6.62 \times 10^{-34} Js}{(9.1 \times 10^{-31} kg)(812 ms^{-1})}$$

$= [8.967 \times 10^{-7}\ m]$

$= [8967\ Å]$

28. $$E_n = \left[\frac{-2.18 \times 10^{-18}}{n^2}\right] J$$

Energy required to remove an electron from (n = 2)

So, (n_1 = 2)

($n_2 = \infty$) .....

$\therefore$ (Complete ionisation)

$\therefore$ ($\Delta E = E_2 - E_1$)

$$\text{or,} \quad \Delta E = -2.17 \times 10^{-18}\left(\frac{1}{n_2^2} - \frac{1}{n_1^2}\right)$$

$$\left(\frac{2.18 \times 10^{-18}}{(2)^2}\right) = (5.45 \times 10^{-19}\ J\,atom^{-1})$$

$\Delta E = h\nu = (h.\ c/\lambda)$

$$\lambda = \frac{hc}{\Delta E} = \frac{(6.626\times10-34\,Js)(3\times10^{8}\ ms^{-1})}{5.45\times10^{-19}\,J}$$

$= (3.647 \times 10^{-7}\ m)$

$= (3.647 \times 10^{-5}\ cm)$

29. (a) When $n = 1$ then $l = 0$ to $(n - 1)$

But given $(l = 1)$ hence not possible.

(b) $n = 2$,

$l = 0$ to $(2 - 1) \Rightarrow l = 0, 1$

$(m_2 = -1, 0, +1)$ possible

(c) $n = 3$,

$l = 0$ to $(3 - 1)$

$l = 0, 1, 2$

$m_l = -2, -1, 0, 1, 2$

$\therefore$ possible.

30. (i) (a) n = 2, $l = 1$ [2p] orbital

(b) n = 4, $l = 0$ [4s] orbital

(ii) For [4f] = orbital

n = 4

$l = 3$ [m = – 3 to + 3]

(iii) I.E. = $13.6\ Z^2/n^2$

= $13.6 \times Z^2\backslash 1^2$ [Z =2 for He^+]

= 13.6 × 4 = 54.4 eV

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