**IIT – JEE 2017** **TW TEST (NAPJC – 7)** **MARKS: 74**
**TIME: 1 ½ HR** **TOPIC: ATOMIC STRUCTURE** **DATE:30/5/15**

## SECTION-I

This section contains **18 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D) for its answer, out which **ONLY ONE** is correct. **(+3, - 1)**

1. The wavelength of radiation required to remove the electron of hydrogen atom (ionization energy $21.7\times10^{-12}$ erg ) from $n=2$ orbit to $n=\infty$ is
(a) $3.664\times10^{-4}$ cm (b) $3.664\times10^{-5}$ cm (c) $3.664\times10^{-6}$ cm (d) $3.664\times10^{-7}$ cm

2. In Bohr theory, the ratio of kinetic energy and potential energy of an electron in any of orbit of hydrogen atom is
(a) 1/2 (b) $-1/2$ (c) $1/4$ (d) $-1/4$

3. The expression of speed of electron in Bohr radii is given by
(a) $\upsilon=\dfrac{n(h/2\pi)}{Ze^2/(4\pi\varepsilon_0)}$ (b) $\upsilon=\dfrac{2\pi(Ze^2/4\pi\varepsilon_0)}{nh}$ (c) $\upsilon=\dfrac{n^2(h/2\pi)}{Ze^2/(4\pi\varepsilon_0)}$ (d) $\upsilon=\dfrac{4\pi^2(Ze^2/42\pi\varepsilon_0)}{n^2h^2}$

4. Which of the following orbitals will have zero probability of finding the electron in yz plane?
(a) $p_x$ (b) $p_y$ (c) $p_z$ (d) $d_{yz}$

5. If an electron is to be located within 0.1 nm, the approximate uncertainty in its speed will be about
(a) $10^{-5}\,ms^{-1}$ (b) $6\times10^{5}\,ms^{-1}$ (c) $10^{-2}\,ms^{-1}$ (d) $10^{2}\,ms^{-1}$

6. Which of the following statements regarding Bohr theory of hydrogen atom is not correct?
(a) Kinetic energy of an electron in an orbit is equal to half of magnitude of its potential energy
(b) Kinetic energy of an electron in an orbit is equal to the magnitude of its potential energy
(c) Total energy of an electron is equal to negative of its kinetic energy
(d) Potential energy of an electron in an orbit is equal to $-m\upsilon^2$

7. The kinetic energy of an electron in $He^+$ is maximum when it is present in the orbit having
(a) $n=1$ (b) $n=2$ (c) $n=3$ (d) $n=\infty$

8. The correct statement on the aufbau principle is that
(a) $(n-1)$d subshell is always lower in energy than ns orbital
(b) $(n-1)$f subshell always has energy more than np orbital
(c) 5d is lower in energy than 4f
(d) 6p is lower in energy than 5d

9. The outer electronic configuration of cerium $(Z = 58)$ is

(a) $(4d)^{10}(5s)^2(5p)^6(4f)^3(6s)^1$ (b) $(4d)^{10}(5s)^2(5p)^6(5d)^1(6s)^2$

(c) $(4d)^{10}(5s)^2(5p)^6(5d)^3(6s)^2$ (d) $(4d)^{10}(5s)^2(5p)^6(4f)^2(6s)^2$

10. Let $m_p$ be the mass of a proton, $m_n$ that of a neutron, $M_1$ that of a $^{20}_{10}Ne$ nucleus and $M_2$ that of a $^{40}_{20}Ca$ nucleus. Then

(a) $M_2 = 2M_1$ (b) $M_1 < 10(m_p + m_n)$

(c) $M_2 > 2M_1$ (d) $M_1 = M_2$

11. What are the values of the orbital angular momentum of an electron in the orbitals 1s, 3s, 3d and 2p

(a) $0, 0, \sqrt{6}\hbar, \sqrt{2}\hbar$ (b) $1, 1, \sqrt{4}\hbar, \sqrt{2}\hbar$ (c) $0, 1, \sqrt{6}\hbar, \sqrt{3}\hbar$ (d) $0, 0, \sqrt{20}\hbar, \sqrt{6}\hbar$

12. If the value of the principal quantum number is 3, the maximum number of values the magnetic quantum number can have is

(a) one (b) four (c) nine (d) twelve

13. Four sets of values of quantum numbers $(n, \ell, m \text{ and } s)$ are given below. Which of these does not provide a permissible solution of the wave equation?

(a) $3, 2, -2, \frac{1}{2}$ (b) $3, 3, 1, -\frac{1}{2}$ (c) $3, 2, 1, \frac{1}{2}$ (d) $3, 1, 1, -\frac{1}{2}$

14. Which of the following sets of quantum numbers represents the 19th electron of chromium $(Z = 24)$?

(a) $4, 0, 0, +\frac{1}{2}$ (b) $4, 1, -1, +\frac{1}{2}$ (c) $3, 2, 2, +\frac{1}{2}$ (d) $3, 2, -2, +\frac{1}{2}$

15. The value of the magnetic moment of a particular ion is 2.83 Bohr magneton. The ion is

(a) $Fe^{2+}$ (b) $Ni^{2+}$ (c) $Mn^{2+}$ (d) $Co^{3+}$

16. The angular velocity of first exited state of electron of $He^+$ is $\omega$ what is angular velocity of the electron in 3rd exited state of $Be^{3+}$

(a) $\frac{\omega}{2}$ (b) $2\omega$ (c) $\frac{\omega}{4}$ (d) $4\omega$

17. The potential energy of the electron present in the ground state of $Li^{2+}$ ion is represented by: (k coulomb constents)

(a) $\frac{3ke^2}{r}$ (b) $-\frac{3ke}{r}$ (c) $\frac{3ke^2}{r^2}$ (d) $-\frac{3ke^2}{r}$

18. Magnetic moments of $V(Z = 23), Cr(= 24), Mn(Z = 25)$ are $x, y, z$ respectively. Hence:

(a) $x = y = z$ (b) $x < y < z$ (c) $x < z < y$ (d) $z < y < x$

## SECTION-II

This section contains **5 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D) for its answer, out which **ONE OR MORE** is/are correct. **(+4, -1)**

19. Which of the following statements are **not** correct?
(a) Dipositive zinc exhibits paramagnetism due to lost of two electrons from a 3d-orbital of neutral atom.
(b) The magnetic moment of an atom is related to the number of unpaired electrons in its electronic configuration
(c) Bohr theory can be successfully modified to explain the electronic spectrum of multielectron atom.
(d) The orbit angular momentum of an electron in a atom is given as $n\left(h/2\pi\right)$

20. Which of the following statements are **not** correct?
(a) The ionization energy of a hydrogen like species in its ground state is equal to the magnitude of energy of the orbit having $n=1$
(b) The ionization energy of a hydrogen like species in its ground state increases in proportion to the positive charge in its nucleus
(c) Accrording to the uncertainty principle, $\Delta p\Delta x \le h/4\pi$
(d) The energy of an electron in a orbital of a multielectron atom depends only on the principal quantum number n.

21. Which of the following statements are **not** correct?
(a) The angular momentum of an electron in Bohr orbits is given as $\sqrt{\ell\left(\ell+1\right)}\,\dfrac{h}{2\pi}$
(b) The uncertaintly principle states that $\Delta x.\Delta p \ge \dfrac{h}{y\pi}$
(c) The de Broglie expression is $p=h/m$
(d) The filling of degenerate orbitals by electrons is governed by Hund's rule.

22. In which of these options do both constituents of the pair have the same magnetic moment?
(a) $Zn^{2+}$ and $Cu^{+}$ (b) $Co^{2+}$ and $Ni^{2+}$ (c) $Mn^{4+}$ and $Co^{2+}$ (d) $Mg^{2+}$ and $Sc^{+}$

23. A metal surface having $v_0$ as threshold frequency is incident by light of frequency v, then select the correct:
(a) $u=\sqrt{2h.c\left(\lambda_0-\lambda\right)}$ (b) $u=\sqrt{2h\left(v-v_0\right)}$
(c) $u=\sqrt{\dfrac{2h\left(\lambda_0-\lambda\right)}{m}}$ (d) $u=\sqrt{\dfrac{2\left(hv-w\right)}{m}}$

## (ANSWER KEY)

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | **[b]** | **2.** | **[b]** | **3.** | **[b]** | **4.** | **[a]** | **5.** | **[b]** | **6.** | **[b]** | **7.** | **[a]** |
| **8.** | **[b]** | **9.** | **[d]** | **10.** | **[a]** | **11.** | **[a]** | **12.** | **[c]** | **13.** | **[b]** | **14.** | **[a]** |
| **15.** | **[b]** | **16.** | **[a]** | **17.** | **[d]** | **18.** | **[c]** | **19.** | **[acd]** | **20.** | **[bcd]** | **21.** | **[ac]** |
| **22.** | **[ac]** | **23.** | **[bd]** | | | | | | | | | | |