IIT – JEE **TW TEST –(NAPJC-8)** **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. A d_{yz} orbital has
   (a) no nodal plane
   (b) one nodal plane in the yz plane
   (c) two nodal planes in the xy and xz planes
   (d) Three nodal planes in the xy, xz and yz planes.

2. The electron in a hydrogen atom makes a transition from an excited state to the ground state. Which of the following statements is correct?
   (a) Its kinetic energy increases and its potential and total energies decreases
   (b) Its kinetic energy decreases, potential energy increases and its total energy remains constant
   (c) Its kinetic and total energie decreases and its potential energy increases
   (d) Its kinetic potential and total energies decreases

3. Which of the following statements is correct?
   (a) $(n-1)d$ subshell has lower energy than ns subshell
   (b) $(n-1)d$ subshell has higher energy than ns subshell
   (c) $(n+1)d$ subshell has lower energy that nf subshell
   (d) nf subshell has lower energy than $(n+2)s$ subshell

4. The energy of a 700 nm photon is
   (a) 1.77 eV (b) 2.47 eV (c) 700 eV (d) 3.57 eV

5. Assume that the potential energy of a hydrogen atom in its ground state is zero. Then its energy in the first excited state will be
   (a) 13.6 eV (b) 27.2 eV (c) 23.8 eV (d) 10.2 eV

6. The ionization energy of a hydrogen atom is 13.6 eV. The energy of the lowest electronic level in doubly ionized lithium $(Z=3)$ is
   (a) –28.7eV (b) –54.4eV (c) –122.4eV (d) –13.6eV

7. In which of the following transitions will the wavelength be minimum?
   (a) $n=6 \text{ to } n=4$ (b) $n=4 \text{ to } n=2$ (c) $n=3 \text{ to } n=1$ (d) $n=2 \text{ to } n=1$

8. The maximum number of electrons in a subshell is given is given by the expression

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

9. The four quantum numbers of the valence electron of potassium are

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

10. If $m =$ magnetic quantum number and $\ell =$ azimuthal quantum number, then

(a) $m = \ell + 2$ (b) $m = 2\ell^2 + 1$ (c) $\ell = \frac{m-1}{2}$ (d) $\ell = 2m + 1$

11. In which of the following orbitals, there is zero probability of finding the electron in the xy plane?

(a) p_x (b) d_{yz} (c) $d_{x^2-y^2}$ (d) p_z

12. Photoelectric emission is observed from a surface for frequencies υ_1 and υ_2 of the incident radiation $(\upsilon_1 > \upsilon_2)$. If the maximum kinetic energies of the photoelectrons in the two cases are in the ratio $1 : k$ then the threshold frequency υ_0 is given by:

(a) $\frac{v_2 - v_1}{k-1}$ (b) $\frac{kv_1 - v_2}{k-1}$ (c) $\frac{kv_2 - v_1}{k-1}$ (d) $\frac{v_2 - v_1}{k}$

13. Magnetic moment of $Fe^{a+}(Z = 26)$ is $\sqrt{24}$ BM. Hence number of unpaired electrons and value of a respectively are:

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

14. How fast is an electron moving if it has a wavelength equal to the distance travelled in one second:

(a) $\sqrt{\frac{m}{h}}$ (b) $\sqrt{\frac{h}{m}}$ (c) $\sqrt{\frac{h}{p}}$ (d) $\sqrt{\frac{h}{2KE}}$

15. A photosensitive metallic surface has work function hv_0. If photons of $2hv_0$ fall on the surface, the electrons come out with a maximum velocity of 4×10^6 m/s. If photon energy is increased to $5hv_0$, the maximum velocity of photo-electrons will be:

(a) 2×10^7 m/s (b) 8×10^6 m/s (c) 2×10^6 m/s (d) 8×10^5 m/s

16. Which set is correct for an electron in $4f-$orbital:

(a) $n = 3 \quad \ell = 2 \quad m_\ell = -2 \quad m_s = \pm 1/2$

(b) $n = 4 \quad \ell = 4 \quad m_\ell = -4 \quad m_s = -1/2$

(c) $n = 4 \quad \ell = 3 \quad m_\ell = +1 \quad m_s = +1/2$

(d) $n = 4 \quad \ell = 3 \quad m_\ell = +4 \quad m_s = +1/2$

17. Which of the following ions has the highest magnetic moment:

(a) Mn^{3+} (b) Zn^{2+} (c) Sc^{3+} (d) Ti^{3+}

18. If λ_v, λ_x and λ_m represent the wavelength of visible light, X-ray and microwave respectively, then:

(a) $\lambda_m > \lambda_v > \lambda_x$ (b) $\lambda_m > \lambda_x > \lambda_v$ (c) $\lambda_v > \lambda_m > \lambda_x$ (d) $\lambda_v > \lambda_x > \lambda_m$

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. Choose the correct statements

(a) Energy in the bohr modal is quantized

(b) The quantum energy of a wave is proportional to its frequency.

(c) Photons are quanta of light.

(d) The value of the Plank constant depends on energy.

20. Choose the correct relations on the basis of Bohr's theory

(a) Velocity of electron $\propto \frac{1}{n}$ (b) Frequency of revolution $\propto \frac{1}{n^3}$

(c) Radius of orbit $\propto n^2 Z$ (d) Force on electron $\propto \frac{1}{n^4}$

21. An electron jumps from n^{th} level to $n = 1$ level. The fact which is correct for H-atom are:

(a) Number of spectral lines $= \frac{n(n-1)}{2}$ (b) Number of spectral lines $= \sum(n-1)$

(c) Number of spectral lines $= n(n-1)$ (d) If $n = 4$, the no. of spectral lines $=$ six

22. The magnitude of spin angular momentum of an electron is given by:

(a) $s = \sqrt{s(s+1)}\frac{h}{2\pi}$ (b) $s = s\frac{h}{2\pi}$ (c) $s = \pm\frac{1}{2}.\frac{h}{2\pi}$ (d) $s = \frac{\sqrt{3}}{2}.\frac{h}{2\pi}$

23. A photon of wavelength is 4.0×10^{-7} m strikes on a metal surface, the work function of metal being 3.4×10^{-19} J. Select the correct statements:

(a) The energy of photon is 4.97×10^{-19} J

(b) The kinetic energy of the emission is 1.57×10^{-19} J

(c) The kinetic energy of the emission is 0.98 eV

(d) The velocity of photoelectron is $5.87\times10^{5}\,ms^{-1}$

(ANSWER KEY)

1.	**[c]**	**2.**	**[a]**	**3.**	**[b]**	**4.**	**[a]**	**5.**	**[c]**	**6.**	**[c]**	**7.**	**[c]**
8.	**[b]**	**9.**	**[b]**	**10.**	**[c]**	**11.**	**[d]**	**12.**	**[b]**	**13.**	**[a]**	**14.**	**[b]**
15.	**[b]**	**16.**	**[c]**	**17.**	**[a]**	**18.**	**[a]**	**19.**	**[bc]**	**20.**	**[abd]**	**21.**	**[abd]**
22.	**[ad]**	**23.**	**[abcd]**										