Atomic structure Assignment - II

1. In an X-ray experiment, different metals are used as the target. In each case, the frequency (ν) of the radiation produced is measured. If Z= atomic number, which of the following plots will be a straight line

(a) ν against *Z* (b) $\frac{1}{\nu}$ against *Z* (c) $\sqrt{\nu}$ against *Z* (d) ν against $\sqrt{Z}$

2. In Moseley's equation [$\sqrt{\nu} = a(Z-b)$], which was derived from the observations made during the bombardment of metal targets with X-rays,

(a) *a* is independent but *b* depends on the metal (b) Both *a* and *b* depend on the metal
(c) Both *a* and *b* are independent of the metal and are constant (d) *b* is independent but *a* depends on the metal

3. If molecular mass and atomic mass of sulphur are 256 and 32 respectively, its atomicity is

(a) 2 (b) 8 (c) 4 (d) 16

4. ***Assertion (A) :*** The atoms of different elements having same mass number but different atomic number are known as isobars

Reason (R) : The sum of protons and neutrons, in the isobars is always different

(a) Both *A* and *R* are true and *R* is a correct explanation of *A*
(b) Both *A* and *R* are true but *R* is not a correct explanation of *A*
(c) *A* is true but the *R* is false
(d) *A* is false but *R* is true

5. The mass number of an anion, X^{3-}, is 14. If there are ten electrons in the anion, the number of neutrons in the nucleus of atom, X_2 of the element will be

(a) 10 (b) 14 (c) 7 (d) 5

6. Atoms consists of protons, neutrons and electrons. If the mass of neutrons and electrons were made half and two times respectively to their actual masses, then the atomic mass of ${}_6C^{12}$

(a) Will remain approximately the same (b) Will become approximately two times
(c) Will remain approximately half (d) Will be reduced by 25%

7. A neutral atom (Atomic no. > 1) consists of

(a) Only protons (b) Neutrons + protons
(c) Neutrons + electrons (d) Neutrons +proton + electron

8. Compared with an atom of atomic weight 12 and atomic number 6, the atom of atomic weight 13 and atomic number 6

(a)Contains more neutrons (b) Contains more electrons
(c)Contains more protons (d) Is a different element

9. ***Assertion (A) :*** Nuclide ${}^{30}Al_{13}$ is less stable than ${}^{40}Ca_{20}$

Reason (R): Nuclides having odd number of protons and neutrons are generally unstable

(a) Both *A* and *R* are correct and *R* is the correct explanation of *A*
(b) Both *A* and *R* are correct but *R* is not the correct explanation of *A*
(c) *A* is correct but *R* is incorrect
(d) *A* is incorrect but *R* is correct

10. Which of the following are iso-electronic species $\text{I}-CH_3^+$, $\text{II}-NH_2^-$, $\text{III}-NH_4^+$, $\text{IV}-NH_3$

(a) I, II, III (b) II, III, IV (c) I, II, IV (d) I and II

11. The charge on the atom containing 17 protons, 18 neutrons and 18 electrons is

(a) + 1 (b) – 2 (c) –1 (d) Zero

12. Which of the following is true for Thomson's model of the atom

(a) The radius of an electron can be calculated using Thomson's model.
(b) In an undisturbed atom, the electrons will be at their equilibrium positions, where the attraction between the cloud of positive charge and the electrons balances their mutual repulsion
(c) When the electrons are disturbed by collision, they will vibrate around their equilibrium positions and emit electromagnetic radiation whose frequency is of the order of magnitude of the frequency of electromagnetic radiation of a vibrating electron.
(d) It can explain the existence of protons.

13. When a gold sheet is bombarded by a beam of α–particles, only a few of them get deflected whereas most go straight, undeflected. This is because

(a) The force of attraction exerted on the α–particles by the oppositely charged electrons is not sufficient.
(b) A nucleus has a much smaller volume than that of an atom.
(c) The force of repulsion acting on the fast moving α–particles is very small.
(d) The neutrons in the nucleus do not have any effect on the α–particles.

14. From the α–particle scattering experiment, Rutherford concluded that
(a) α–particles can come within a distance of the order of $10^{-14} m$ of the nucleus
(b) The radius of the nucleus is less than $10^{-14} m$
(c) Scattering follows Coulomb's law
(d) The positively charged parts of the atom move with extremely high velocities.

15. Rutherford's scattering formula fails for very small scattering angles because
(a) The full nuclear charge of the target atom is partially screened by its electron
(b) The impact parameter between the α–particle source and the nucleus of the target is very large compared to the size of the nucleus
(c) The kinetic energy of the α–particles is large
(d) The gold foil is very thin

16. The radius of $^{27}_{13}Al$ will be
(a) $1.2\times10^{-15} m$ (b) $27\times10^{-15} m$ (c) $10.8\times10^{-15} m$ (d) $3.6\times10^{-15} m$

17. The nucleus of an atom can be assumed to be spherical. The radius of the nucleus of mass number *A* is given by $1.25\times10^{-13}\times A^{1/3} cm$. Radius of atom is one Å. If the mass number is 64, then the fraction of the atomic volume that is occupied by the nucleus is
(a) 1.0×10^{-3} (b) 5.0×10^{-5} (c) 2.5×10^{-2} (d) 1.25×10^{-13}

18. In a Bohr's model of atom when an electron jumps from *n* = 1 to *n* = 3, how much energy will be emitted or absorbed
(a) $2.15\times10^{-11} ergs$ (b) $0.1911\times10^{-10} ergs$ (c) $2.389\times10^{-12} ergs$ (d) $0.239\times10^{-10} ergs$

19. The radius of first Bohr's orbit for hydrogen is 0.53 Å. The radius of third Bohr's orbit would be
(a) 0.79 Å (b) 1.59 Å (c) 3.18 Å (d) 4.77 Å

20. The energy of an electron in the first Bohr orbit of H atom is —13.6 *eV*. The possible energy value (s) of the excited state (s) for electrons in Bohr orbits to hydrogen is (are)
(a) – 3.4 *eV* (b) – 4.2 *eV* (c) – 6.8 *eV* (d) + 6.8 *eV*

21. Energy of electron of hydrogen atom in second Bohr orbit is
(a) $-5.44\times10^{-19} J$ (b) $-5.44\times10^{-19} kJ$ (c) $-5.44\times10^{-19} cal$ (d) $-5.44\times10^{-19} eV$

22. The Bohr orbit radius for the hydrogen atom (*n* = 1) is approximately 0.530 Å. The radius for the first excited state (*n* = 2) orbit is
(a) 0.13 Å (b) 1.06 Å (c) 4.77 Å (d) 2.12 Å

23. The energy of an electron in nth orbit of hydrogen atom is
(a) $\frac{13.6}{n^4} eV$ (b) $\frac{13.6}{n^3} eV$ (c) $\frac{13.6}{n^2} eV$ (d) $\frac{13.6}{n} eV$

24. As electron moves away from the nucleus, its potential energy
(a) Increases (b) Decreases (c) Remains constant (d) None of these

25. Uncertainty principle gave the concept of
(a) Probability (b) An orbital
(c) Physical meaning of ψ, the ψ^2 (d) All the above

26. The uncertainty in momentum of an electron is $1\times10^{-5} kg-m/s$. The uncertainty in its position will be ($h = 6.62\times10^{-34} kg-m^2/s$)
(a) $1.05\times10^{-28} m$ (b) $1.05\times10^{-26} m$ (c) $5.27\times10^{-30} m$ (d) $5.25\times10^{-28} m$

27. Uncertainty in position of a 0.25 *g* particle is $10^{-5} m$. Uncertainty of velocity is ($h = 6.6\times10^{-34} J-s$)
(a) 1.2×10^{34} (b) 2.1×10^{-32} (c) 1.6×10^{-20} (d) 1.7×10^{-9}

28. If uncertainty in the position of an electron is zero, the uncertainty in its momentum would be
(a) Zero (b) < *h* / 2λ (c) > *h* / 2λ (d) Infinite

29. The position of both an electron and a helium atom is known within 1.0 *nm* and the momentum of the electron is known within $50\times10^{-26} kg\ ms^{-1}$. The minimum uncertainty in the measurement of the momentum of the helium atom is
(a) $50 kg\ ms^{-1}$ (b) $60 kg\ ms^{-1}$ (c) $80\times10^{-26} kg\ ms^{-1}$ (d) $50\times10^{-26} kg\ ms^{-1}$

30. **Assertion (*A*):** The position of an electron can be determined exactly with the help of an electron microscope.
Reason (*R*): The product of uncertainty in the measurement of its momentum and the uncertainty in the measurement of the position cannot be less than a finite limit.
(a) Both *A* and *R* are true and *R* is the correct explanation of *A*

(b) Both *A* and *R* are true but *R* is not the correct explanation of *A*
(c) *A* is true but *R* is false
(d) *A* is false but *R* is true

31. The uncertainty in the position of an electron (mass = 9.1×10^{-28} g) moving with a velocity of $3.0 \times 10^{4}\ cm\ s^{-1}$ accurate upto 0.001% will be (Use $\frac{h}{4\pi}$ in the uncertainty expression, where $h = 6.626 \times 10^{-27}\ erg - s$)

(a) 1.92×10^{-5} *cm* (b) 7.68 *cm* (c) 5.76 *cm* (d) 3.84 *cm*

32. The uncertainty in the position of a moving bullet of mass 10 *gm* is $10^{-5}\ m$. Calculate the uncertainty in its velocity

(a) $5.2 \times 10^{-28}\ m/\sec$ (b) $3.0 \times 10^{-28}\ m/\sec$ (c) $5.2 \times 10^{-22}\ m/\sec$ (d) $3 \times 10^{-22}\ m/\sec$

33. The electron density between 1*s* and 2*s* orbital is
(a) High (b) Low (c) Zero (d) None of these

34. *p*-orbitals of an atom in presence of magnetic field are
(a) Two fold degenerate (b) Non degenerate (c) Three fold degenerate (d) None of these

35. The energy of an electron of $2p_y$ orbital is
(a) Greater than of $2p_x$ orbital (b) Less than that of $2p_x$ orbital (c) Equal to that of 2*s* orbital (d) Same as that of $2p_z$ orbital

36. **Assertion (*A*):** A special line will be seen for a $2p_x - 2p_y$ transition

Reason (*R*): Energy is released in the form of wave of light when the electron drops from $2p_x$ to $2p_y$ orbital

(a) Both *A* and *R* are true statements and *R* is the correct explanation of *A*
(b) Both *A* and *R* are true statements and *R* is not the correct explanation of *A*
(c) *A* is true but *R* is a false statement
(d) Both *A* and *R* are false statements

37. For *n* = 3 energy level, the number of possible orbitals (all kinds) are
(a) 1 (b) 3 (c) 4 (d) 9

38. The number of electrons that can be accommodated in dz^2 orbital is
(a) 10 (b) 1 (c) 4 (d) 2

39. The quantum number '*m*' of a free gaseous atom is associated with
(a) The effective volume of the orbital
(b) The shape of the orbital
(c) The spatial orientation of the orbital
(d) The energy of the orbital in the absence of a magnetic field

40. When the azimuthal quantum number has a value of *l* = 1, the shape of the orbital is
(a) Unsymmetrical (b) Spherically symmetrical (c) Dumb-bell (d) Complicated

41. For a given value of quantum number *l*, the number of allowed values of *m* is given by
(a) *l* + 2 (b) 2*l* + 2 (c) 2*l* + 1 (d) *l* + 1

42. The set of quantum numbers not applicable for an electron in an atom is

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

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

43. Which of the following statements is not correct for an electron that has the quantum numbers *n* = 4 and *m* = 2

(a) The electron may have the quantum number $s = +\frac{1}{2}$ (b) The electron may have the quantum number *l* = 2
(c) The electron may have the quantum number *l* = 3 (d) The electron may have the quantum number *l* = 0, 1, 2, 3

44. The electrons identified by quantum numbers *n* and *l* (i) *n* = 4, *l* = 1 (ii) *n* = 4, *l* = 0 (iii) *n* = 3, *l* = 2 (iv) *n* = 3, *l* = 1 can be placed in order of increasing energy from the lowest to highest, as
(a) (iv) < (ii) < (iii) < (i) (b) (ii) < (iv) < (i) < (iii) (c) (i) < (iii) < (ii) < (iv) (d) (iii) < (i) < (iv) < (ii)

45. Which of the following sets of quantum numbers is not allowed
(a) *n* = 1, *l* = 0, *m* = 0, *s* = + 1/2 (b) *n* = 1, *l* = 1, *m* = 0, *s* = – 1/2

(c) $n = 2, l = 1, m = 1, s = +1/2$ (d) $n = 2, l = 0, m = 0, s = -½$

46. 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) $0, 0, \sqrt{20}\hbar, \sqrt{6}\hbar$

47. In an excited state, a calcium atom has the electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^6 4s 4d$. What is the angular momentum of this state.

(a) $\sqrt{4}\hbar$ (b) $\sqrt{16}\hbar$ (c) $\sqrt{20}\hbar$ (d) $\sqrt{10}\hbar$

48. The four quantum number for the valence shell electron or last electron of sodium ($Z = 11$) is

(a) $n = 2, l = 1, m = -1, s = -1/2$ (b) $n = 3, l = 0, m = 0, s = +1/2$

(c) $n = 3, l = 2, m = -2, s = -1/2$ (d) $n = 3, l = 2, m = 2, s = +1/2$

49. For which of the following sets four quantum numbers, an electron will have the highest energy

	n	l	m	s
(a)	3	2	1	+ 1/ 2
(b)	4	2	– 1	+ 1/2
(c)	4	1	0	– 1/ 2
(d)	5	0	0	– 1/ 2

50. If $m =$ magnetic quantum number and l= azimuthal quantum number then

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