ATOMIC STRUCTURE

Set 2

1. The word 'atom' is derived from the Greek word 'a-tomio', which means:
a) Smallest
b) Fundamental
c) Uncut-able
d) Invisible
2. The particles that constitute cathode rays are:
a) Protons
b) Neutrons
c) Electrons
d) Photons
3. The value of the charge-to-mass ratio (e/m_e) for an electron is:
a) 1.7588×10^{11} C kg^{-1}
b) 9.1094×10^{-31} C kg^{-1}
c) 1.602×10^{-19} C kg^{-1}
d) 1.672×10^{-27} C kg^{-1}
4. The present accepted value of the charge on an electron is:
a) -1.6×10^{-19} C
b) $-1.602176 \times 10^{-19}$ C
c) $+1.6 \times 10^{-19}$ C
d) $+1.602176 \times 10^{-19}$ C
5. The mass of an electron is approximately:
a) 1.67×10^{-27} kg
b) 9.1×10^{-31} kg
c) 1.67×10^{-24} kg
d) 9.1×10^{-28} kg
6. The smallest and lightest positive ion is obtained from hydrogen and is called a:
a) Deuteron
b) Triton

c) Proton
d) Positron
7. In Thomson's model, the positive charge in the atom is:
a) Concentrated in the nucleus
b) Uniformly distributed
c) Located in the electrons
d) Non-existent
8. In Rutherford's experiment, a very few alpha particles were deflected by nearly 180°, which indicated:
a) The atom is mostly empty space
b) The nucleus is positively charged
c) The nucleus is very small and dense
d) Electrons revolve around the nucleus
9. If the nucleus is represented by a cricket ball, the radius of the atom would be about:
a) 10 meters
b) 100 meters
c) 1 kilometer
d) 5 kilometers
10. In a neutral atom:
a) Number of protons = Number of electrons
b) Number of protons = Number of neutrons
c) Number of electrons = Number of neutrons
d) Mass number = Atomic number
11. The total number of nucleons in an atom is its:
a) Atomic number
b) Mass number
c) Neutron number
d) Proton number
12. Atoms with the same mass number but different atomic numbers are called:
a) Isotopes
b) Isobars
c) Isotones

d) Isomers
13. The chemical properties of an element are primarily determined by its:
a) Mass number
b) Number of neutrons
c) Atomic number
d) Atomic mass
14. Which of the following are isotopes?
a) $^{14}_{6}C$ and $^{14}_{7}N$
b) ^{1}H and ^{2}H
c) $^{23}_{92}U$ and $^{23}_{592}U$
d) $^{16}_{8}O$ and $^{18}_{8}O$
15. The failure of Rutherford's model was that it could not explain why the electron:
a) Is negatively charged
b) Does not fall into the nucleus
c) Revolves around the nucleus
d) Has a small mass
16. According to classical electromagnetic theory, an electron moving in a circular path will:
a) Gain energy
b) Lose energy and spiral into the nucleus
c) Remain stable
d) Change its charge
17. In the photoelectric effect, the kinetic energy of the ejected electrons:
a) Depends on the intensity of light
b) Depends on the frequency of light
c) Is constant for all metals
d) Decreases with increasing frequency
18. The work function (W_0) of a metal is:
a) The maximum energy needed to eject an electron
b) The minimum energy needed to eject an electron
c) The kinetic energy of the ejected electron
d) The energy of the incident photon
19. Einstein's photoelectric equation is:

a) $E = hv$
b) K.E. = $hv - W_0$
c) $W_0 = hv_0$
d) Both b and c
20. The dual behaviour of electromagnetic radiation refers to:
a) Electric and magnetic fields
b) Wave and particle nature
c) Absorption and emission
d) Reflection and refraction
21. Planck's quantum theory states that energy is:
a) Continuous
b) Radiated
c) Quantized
d) Wave-like
22. The spectrum produced when radiation is passed through a sample and certain wavelengths are absorbed is called a/an:
a) Emission spectrum
b) Continuous spectrum
c) Absorption spectrum
d) Band spectrum
23. The Lyman series of the hydrogen spectrum lies in the _____ region.
a) Visible
b) Infrared
c) Ultraviolet
d) Microwave
24. The Rydberg constant for hydrogen is approximately:
a) $1.09677 \times 10^{7}\ m^{-1}$
b) 3.29×10^{15} Hz
c) 2.18×10^{-18} J
d) 6.626×10^{-34} J s
25. Bohr's model could not explain the spectra of:
a) Hydrogen
b) Hydrogen-like ions (He^{+})

c) Multi-electron atoms
d) Isotopes of hydrogen
26. Bohr's frequency rule states that the frequency of radiation absorbed or emitted is proportional to:
a) The change in angular momentum
b) The energy difference between orbits
c) The radius of the orbit
d) The velocity of the electron
27. The energy of an electron in the ground state of a hydrogen atom is:
a) -2.18×10^{-18} J
b) -1.09×10^{-18} J
c) -5.45×10^{-19} J
d) 0 J
28. For a hydrogen-like ion, the energy of an electron:
a) Is independent of Z
b) Becomes more negative as Z increases
c) Becomes more positive as Z increases
d) Is the same as for hydrogen
29. The de Broglie hypothesis proposed that:
a) Light has particle nature
b) Matter has wave nature
c) Energy is quantized
d) Electrons have spin
30. The wavelength of a matter wave is:
a) Inversely proportional to its momentum
b) Directly proportional to its momentum
c) Inversely proportional to its energy
d) Directly proportional to its mass
31. Heisenberg's Uncertainty Principle is significant for:
a) Macroscopic objects only
b) Microscopic objects only
c) Both macroscopic and microscopic objects
d) Charged particles only
32. The quantum mechanical model of the atom is based on the:

a) Bohr model
b) Rutherford model
c) Schrödinger equation
d) de Broglie relation only
33. The probability of finding an electron at a point is proportional to:
a) ψ
b) ψ^2
c) ψ^3
d) $1/\psi$
34. The principal quantum number 'n' can have values:
a) 0, 1, 2, 3...
b) 1, 2, 3, 4...
c) 0, ±1, ±2...
d) ...-2, -1, 0, 1, 2...
35. For n=2, the possible values of the azimuthal quantum number 'l' are:
a) 0
b) 0, 1
c) 0, 1, 2
d) 1, 2
36. The subshell with l=2 is denoted by the letter:
a) s
b) p
c) d
d) f
37. For the d subshell (l=2), the number of possible orbitals is:
a) 1
b) 3
c) 5
d) 7
38. The spin quantum number (m_s) was introduced to explain:
a) The shape of orbitals
b) The fine structure of spectral lines
c) The energy of orbitals
d) The orientation of orbitals

39. The number of electrons that can fit in the n=2 shell is:
a) 2
b) 8
c) 18
d) 32
40. The Aufbau principle states that electrons fill orbitals in order of:
a) Increasing energy
b) Decreasing energy
c) Increasing n
d) Increasing l
41. Pauli's Exclusion Principle states that:
a) No two electrons can have the same spin
b) An orbital can hold a maximum of two electrons with opposite spins
c) Electrons will fill degenerate orbitals singly first
d) Electrons repel each other
42. Hund's rule of maximum multiplicity applies to:
a) Filling orbitals of different shells
b) Filling orbitals of the same subshell
c) The order of filling different subshells
d) The spin of electrons in different orbitals
43. The electronic configuration of Nitrogen (Z=7) is:
a) $1s^2\ 2s^2\ 2p^3$
b) $1s^2\ 2s^2\ 2p^4$
c) $1s^2\ 2s^2\ 2p^5$
d) $1s^2\ 2s^2\ 2p^6$
44. Which element has the electronic configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$?
a) Neon (Ne)
b) Argon (Ar)
c) Sodium (Na)
d) Magnesium (Mg)
45. Chromium (Z=24) has an exceptional configuration. What is it?
a) [Ar] $4s^2\ 3d^4$
b) [Ar] $4s^1\ 3d^5$
c) [Ar] $4s^2\ 3d^5$

d) [Ar] $4s^1\ 3d^4$

46. Copper (Z=29) has an exceptional configuration. What is it?

a) [Ar] $4s^2\ 3d^9$

b) [Ar] $4s^1\ 3d^{10}$

c) [Ar] $4s^2\ 3d^{10}$

d) [Ar] $4s^1\ 3d^9$

47. The extra stability of half-filled and fully-filled subshells is due to:

a) Higher exchange energy

b) Lower nuclear charge

c) Smaller atomic size

d) Greater shielding

48. The number of unpaired electrons in an oxygen atom (Z=8) is:

a) 0

b) 1

c) 2

d) 3

49. The region of space where the probability of finding an electron is zero is called a:

a) Node

b) Orbital

c) Shell

d) Subshell

50. Which quantum number defines the orientation of an orbital in space?

a) n

b) l

c) m_l

d) m_s

Answer Key: Set 2

1. c) Uncut-able
2. c) Electrons
3. a) 1.7588×10^{11} C kg^{-1}
4. b) $-1.602176 \times 10^{-19}$ C

5. b) 9.1×10^{-31} kg
6. c) Proton
7. b) Uniformly distributed
8. c) The nucleus is very small and dense
9. d) 5 kilometers
10. a) Number of protons = Number of electrons
11. b) Mass number
12. b) Isobars
13. c) Atomic number
14. b) ^{1}H and ^{2}H (and d) ^{16}O and ^{18}O are also isotopes, but b is the best single answer)
15. b) Does not fall into the nucleus
16. b) Lose energy and spiral into the nucleus
17. b) Depends on the frequency of light
18. b) The minimum energy needed to eject an electron
19. d) Both b and c (K.E. = hv - W_o and $W_o = hv_o$)
20. b) Wave and particle nature
21. c) Quantized
22. c) Absorption spectrum
23. c) Ultraviolet
24. a) 1.09677×10^{7} m^{-1}
25. c) Multi-electron atoms
26. b) The energy difference between orbits
27. a) -2.18×10^{-18} J
28. b) Becomes more negative as Z increases
29. b) Matter has wave nature
30. a) Inversely proportional to its momentum
31. b) Microscopic objects only
32. c) Schrödinger equation
33. b) ψ^2
34. b) 1, 2, 3, 4...
35. b) 0, 1
36. c) d
37. c) 5
38. b) The fine structure of spectral lines
39. b) 8
40. a) Increasing energy
41. b) An orbital can hold a maximum of two electrons with opposite spins
42. b) Filling orbitals of the same subshell

43. a) $1s^2\ 2s^2\ 2p^3$
44. b) Argon (Ar)
45. b) [Ar] $4s^1\ 3d^5$
46. b) [Ar] $4s^1\ 3d^{10}$
47. a) Higher exchange energy
48. c) 2
49. a) Node
50. c) m_l