CHEMISTRY

BOOKS - SURA CHEMISTRY (TAMIL ENGLISH)

QUANTUM MECHANICAL MODEL OF ATOM

Evaluation

1. Electronic configuration of species M^{2+} is $1s^2 2s^2 2p^6 3s^6 3d^6$ and its atomic weight is 56. The number of neutrons in the nucleus of species M is

A. 26

B. 22

C. 30

D. 24

Answer: C

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2. The energy of light of wavelength 45 nm is

A. $6.67 \times 10^{15} J$

B. $6.67 \times 10^{11} J$

C. 4.42×10^{-18}

D. 4.42×10^{-15}

Answer: C

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3. The energies E_1 and E_2 of two radiations between their wavelenghts ieλ_1 and λ_2 will be

A. $\frac{\lambda_1}{\lambda_2} = 1$

B. $\lambda_1 = 2\lambda_2$

C. $\lambda_1 = \sqrt{25 \times 50}\lambda_2$

D. $2\lambda_1 = \lambda_2$

Answer: B

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4. Splitting of spectral lines in an electric field is called

A. Zeeman effect

B. Shielding effect

C. Compton effect

D. Stark effect

Answer: D

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5. Based on equation $E = -2.178 \times 10^{-18} J\left(\frac{Z^2}{n^2}\right)$, certain conclusions are written. Which of them is not correct ?

A. Equations can be used to calculate the change in energy when the electron changes orbit

B. For n = 1,the electron has a more negative energy than it does for n = 6 which means that the electron is more

loosely bound i the smallest allowed orbit

C. The negative sign in equation simply means that the energy of electron bound to the nucleus is lower than it would be if the electrons were at the infinite distance from the nucleus.

D. Larger the value of n the larger is the orbit radius.

Answer: B

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6. According to the Bohr Theory, which of the following transitions in the hydrogen atom will give rise to the least energetic photon?

A. n = 6 to n = 1

B. n = 5 to n = 4

C. n = 5 to n = 3

D. n = 6 to n = 5

Answer: D

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7. Assertion : the spectrum of He^+ is expected to be similar to that of hydrogen

Reason : `He^(+) is also one electron system

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is no the correct explantion of assertion.

C. If assertion is true but reason are flase

D. If both assertion and reason are false

Answer: A

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8. Which of the following pairs of d-orbitals will have electron along the axes?

A. d_{z^2}, d_{xz}

B. d_{xz}, d_{yz}

C. $d_{z^2}, d_{x^2-y^2}$

D. $d_{xy}, d_{x^2} - y^2$

Answer: C

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9. Two electrons occupying the same orbital are distinguished by

A. azimuthal quantum number

B. spin quantum number

C. magnetic quantum number

D. orbital quantum number

Answer: B

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10. The electronic configuration of Eu (Atomic no. 63) Gd (Atomic no. 64) and Tb (Atomic no. 65) are

A. $[Xe]4f^{6}5d^{1}6s^{2}$, $[Xe]4f^{7}5d^{1}6s^{2}$ and $[Xe]4f^{8}5d^{1}6s^{2}$

B. $[Xe]4f^{7}6s^{2}$, $[Xe]4f^{7}5d^{1}6s^{2}$ and $[Xe]4f^{9}6s^{2}$

C. $[Xe]4f^{7}6s^{2}$, $[Xe]4f^{8}6s^{2}$ and $[Xe]4f^{8}5d^{1}6s^{2}$

D. $[Xe]4f^{6}5d^{1}6s^{2}$, $[Xe]4f^{7}5d^{1}6s^{2}$ and $[Xe]4f^{8}6s^{2}$

Answer: B

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11. The maximum numbers of electrons in a sub shell is given by the expression

A. $2n^2$

B. $21 + 1$

C. $41 + 2$

D. none of these

Answer: C

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12. For d-electron,the orbital angular momentum is

A. $\frac{\sqrt{2}h}{2\pi}$

B. $\frac{\sqrt{2h}}{2\pi}$

C. $\frac{\sqrt{2 \times 4h}}{2\pi}$

D. $\frac{\sqrt{6}h}{2\pi}$

Answer: D

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13. What is the maximum numbers of electrons that can be associated with the following set of quantum numbers ? $n = 3, I = 1$ and $m = -1$

A. 4

B. 6

C. 2

D. 10

Answer: C

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14. Assertion : Number of radial and angular nodes for 3p orbital are 1, 1 respectively.

Reason: Number of radial and angular nodes depends only on principal quantum number.

A. both assertion and reason are true and reason is the correct explanation of assertion

B. both assertion and reason are true but reason is not the correct explanation of assertion.

C. assertion is true but reason is false

D. both assertion and reason are false

Answer: C

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15. The total number of orbitals associated with the principle quantum number n=3 is

A. 9

B. 8

C. 5

D. 7

Answer: A

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16. If n=6, the correct sequence for filling of electrons will be,

A. $ns \rightarrow (n-2)f \rightarrow (n-1)d \rightarrow np$

B. $ns \rightarrow (n-1)d \rightarrow (n-2)f \rightarrow np$

C. $ns \rightarrow (n-2)f \rightarrow np \rightarrow (n-1)d$

D. none of these are correct

Answer: A

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17. How many electrons in an atom with atomic number 105 can have (n+1)=8 ?

A. 30

B. 17

C. 15

D. unpredictable

Answer: B

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18. Electron density in the yz plane of $3d_{x^2-y^2}$ orbtial is

A. Zero

B. 0.50

C. 0.75

D. 0.90

Answer: A

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19. If uncertainty in position and momentum are qual, that minimum uncertainty in velocity is

A. $\frac{1}{m}\sqrt{\frac{h}{\pi}}$

B. $\sqrt{\frac{h}{\pi}}$

C. $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$

D. $\frac{h}{4\pi}$

Answer: C

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20. A macroscopic particle of mass 100 g and moving at a velocity of $100 cm s^{-1}$ will have a de Broglie wavelenght of

A. 6.6×10^{-29} cm

B. 6.6×10^{-30}cm

C. 6.6×10^{-31}cm

D. 6.6×10^{-32}cm

Answer: C

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21. The ratio of de Broglic wavelengths of a deuterium atom to that of an a-particle, when the velocity of the former is five times greater than that of later, is

A. 4

B. 0.2

C. 2.5

D. 0.4

Answer: D

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22. The energy of an electron in the 3rd orbit of hydrogen atom is-E. The energy of an electron in the first orbit will be

A. $-3E$

B. $-\frac{E}{3}$

C. $\frac{-E}{9}$

D. $-9E$

Answer: D

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23. Time independent schrodinger wave equation is

A. $\widehat{H}\Psi = E\Psi$

B. $\nabla^2\Psi + \frac{8\pi^2 m}{h^2}(E+V)\Psi = 0$

C. $\frac{\partial^2 \Psi}{\partial x^2} + \frac{\partial^2 \Psi}{\partial y^2} + \frac{\partial^2 \Psi}{\partial z^2} + \frac{2m}{h^2}(E - V)\Psi = 0$

D. all of these

Answer: A

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24. Which of the following does not represent the mathematical expression for the Heisenberg uncertainty principle?

A. $\Delta x . \Delta p \geq \frac{h}{4\pi}$

B. $\Delta x . \Delta v \geq \frac{h}{4\pi m}$

C. $\Delta E . \Delta t \geq \frac{h}{4\pi}$

D. $\Delta E . \Delta x \geq \frac{h}{4\pi}$

Answer: D

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25. Which quantum number reveal information about the shape, energy, orientation and size of orbitals?

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26. How many orbitals are possible for n=4?

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27. How many radial nodes for$2_s, 4_p, 5_d$ and $4f$ orbitals exhibit? How many angular nodes?

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28. The stabilisation of a half filled d-orbital is more prounced than that of the p-orbital why?

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29. consider the following electronic arrangements for the d^5 configuration.

Which of these represents the ground state

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30. consider the following electronic arrangements for the d^5 configuration.

Which configuration has the maximum exchange energy.

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31. State and explain pauli's exclusion principal.

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32. Define orbital? What are the n and I values for $3p_x$ and $4d_{x^2-y^2}$ electron?

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33. Explain briefly the time independent schrodinger wave equation?

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34. Calculate the uncertainty in position of an electron, if $\Delta v = 0.1\,\%$ and $v = 2.2 \times 10^6 ms^{-1}$.

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35. Determine the values of all the four quantum numbers of the 8^{th} electron in O-atom and 15^{th} electron in CI atom .

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36. The quantun mechanical treatment of the hydrogen atom gives the enrgy value:

$E_n = \frac{-13.6}{n^2} eV \text{atom}^{-1}$.

Use the expression to find ΔE between n = 3 and n = 4.

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37. The quantun mechanical treatment of the hydrogen atom gives the enrgy value:

$E_n = \frac{-13.6}{n^2} eV \text{atom}^{-1}$.

Calculate the wavelength corresponding to the above transition.

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38. How fast must a 54g tennis ball travel in order to have a de Broglie wavelength that is qual to that of a photon of green light 54000Å ?

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39. For each of the following, give the sub level designation, the allowable m values and the number of orbitals

(i) $n = 4, l = 2.$

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40. For each of the following, give the sub level designation, the allowable m values and the number of orbitals

(ii) $n = 5, l = 3.$

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41. For each of the following, give the sub level designation, the allowable m values and the number of orbitals

(iii) $n = 7, l = 0$

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42. Give the electronic confiuration of Mn^{2+} and Cr^{3+}.

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43. Describe the Aufbau principal .

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44. An atom of an element contains 35 electrons and 45 neutrons. Deduce.

(i) the number of protons

(ii) the electronic configuration for the element

(iii) All the four quantum numbers for the last electron.

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45. Show that the circumference of the Bohr orbital for the hydrogen atom is an integral multiple of the de Broglie wave lenght associated with the electron revolving arround the nucleus.

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46. Calculate the energy required for the process.

$He_g^+ \rightarrow He_{(g)}^{2+} + e^-$

The ionisation energy for the H atom in its ground state is $-13.6eVa \rightarrow m^{-1}$.

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47. An ion with mass number 37 prossesses unit negative charg. If contains $11.1\,\%$ more neutrons than electrons. Find the symbol of the ion.

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48. The Li^{2+} ion is a hydrogen like ion that can be described by the Bohr model. Calculate the Bohr radius of the thired orbital

and calculate the energy of an electron in 4^{th} orbital.

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49. Protons can be acceleration in particle accelerators. Calculate the wavelength (in Å) of such accelerated proton moving at $2.85 \times 10^{8} ms^{-1}$ (the mass of proton is $1.673 \times 10^{-27} Kg$).

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50. What is the de Broglie wavelength (in cm) of a 160g cricket ball travelling at $140 Kmhr^{-1}$.

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51. Suppose that the uncertainty in determining the position of an electron in an orbital is 0.6 Å. What is the uncertainty in its momentum?

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52. Show that if the measurement of the uncertainty in the location of the particle is equal to its de Broglie wavelength, the minimum uncertainty in the its velocity (ΔV) Is equal to $1/4\pi$ of its velocity (V).

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53. What is the de Broglie wave lenght of an electron, which is accelerated from the rest, through a potential difference of 100

V?

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54. Identify the missing quantum numbers and the sub energy level

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Additional Questions Choose The Correct Answer

1. Consider the following sets of quantum numbers

	n	l	m	s
(i)	2	1	-1	$3/2$
(ii)	1	1	1	$+1/2$
(iii)	1	0	$+1$	$-1/2$
(iv)	1	0	0	$-1/2$

Which of the following sets of quantum numbers is not possible ?

A. (i) and (ii)

B. (ii) and (iv)

C. (i), (ii) and (iii)

D. (i), (ii) and (iii) and (iv)

Answer: A

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2. How many neutrons and protons respectively are present in the $._6C^{13}$ nuclei ?

A. $6, 13$

B. $6, 7$

C. $13, 6$

D. $7, 6$

Answer: D

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3. Maximum number of electrons in a subshell with l = 3 and n = 4 is

A. 10

B. 12

C. 14

D. 16

Answer: C

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4. The number of neutorn(s) present in deuterium is

A. 0

B. 1

C. 2

D. 3

Answer: B

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5. Neutrons was dicovered by

A. Rutherford

B. Chadwich

C. Bohr

D. Thomson

Answer: B

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6. Based on equation $E = -2.178 \times 10^{-18}\left(\frac{Z^2}{n^2}\right)J$ certain conclusion are written. Which of them is not correct?

A. Equation can be used to calculate the energy change when the electron changes orbit.

B. For n = 3, the electron has more negative energy than it does for n = 5 which means that the electron is more tightly bound in the smallest allowed orbit.

C. The negative sign in the equation simply means that the energy of electron bound to the nucleus is lower it would be if the electrons were at the infinite distance from nucleus.

D. Smaller the value of n, the larger is the orbit radius.

Answer: D

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7. J.J Thomson's cathode ray experiment revealed that atoms consists of

A. electrons

B. protons

C. neutrons

D. photons

Answer: A

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8. In Rutherford's gold foil experiment, a thin gold foil was bombarded with a stream of fast moving

A. B particles

B. α- particles

C. γ - particles

D. δ particles

Answer: B

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9. Consider the following statements

1. $\lambda = h/mv$ is valid only when the particle travels at speed much less than the speed of light.

2. Einstein's mass-energy relationship is $E = mc^2$

The angular momentum (mvr) of the electron must be equal to an integral multiple of $h/4\pi$.

Which of the following statement(s) given above is/are correct?

A. 1 & 3

B. only 1

C. 1 & 2

D. 1, 2 & 3

Answer: C

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10. Almost the entire mass of an atom is concentrated in the _____.

A. proton

B. electrons

C. neutrons

D. nucleus

Answer: D

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11. The fixed cicular paths around the nucleus are called _____.

A. orbits

B. orbitals

C. nucleous

D. mesons

Answer: A

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12. Using s, p, d, d notations, describe the orbitals with the following quantum numbers n = 2, l =1.

A. 2s

B. 1s

C. 2p

D. 1p

Answer: C

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13. The nucles of an atom contains:

A. Electrons and protons

B. Neutrons and protons

C. Electrons, protons and neutrons

D. Neutrons and electrons

Answer: B

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14. Which is the lightest among the following?

A. An atom of hydrogen

B. An electron

C. A neutron

D. A proton

Answer: B

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15. The atomic number of an element is 17 and its mass number is 37.

The number of protons, electrons and neutrons present in the neutral atom are :

A. 17,37,20

B. 20,17,37

C. 17,17,20

D. 17,20,17

Answer: C

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16. Mass number is equal to the _____.

A. Number of protons + number of electrons

B. Number of neutrons + number of electrons

C. Number of neutrons + number of electrons

D. Number of electrons

Answer: B

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17. The radius of nucleus is approximately times smaller than the radius of atom.

A. 1,00,000

B. 5000

C. 10000

D. 200

Answer: A

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18. Name the element whose isotope has mass number 14 and 8 neutrons.

A. Carbon

B. Nitrogen

C. Oxygen

D. Fluorine

Answer: A

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19. The charge to mass ratio of electron was found to be

A. $1.6022 \times 10^{-19} Ckg^{-1}$

B. $1.925 \times 10^{12} Ckg^{-1}$

C. $1.758 \times 10^{11} Ckg^{-1}$

D. $1.869 \times 10^{13} Ckg^{-1}$

Answer: C

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20. When α- rays strike a thin gold foil then,

A. most of the α - rays do not pass through the gold foil.

B. most of the α- rays get deflected back.

C. most of the α-rays get deflected through small angles

D. most of the α- rays pass through without any deviation.

Answer: D

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21. Isotopes have

A. same number of protons

B. same number of neturons

C. different number of electrons

D. different atomic number

Answer: A

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22. ${}_6C^{14}$ and ${}_7N^{14}$ are

A. isotones

B. isoelectronic

C. isobars

D. isotopes

Answer: C

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23. Which of the following conclusions could not be derived from Rutherford's $\propto$ - particle scattering experiment?

A. Most of the space in the atom is empty.

B. The radius of the atom is about 10^{10} m while that of the nucleus is 10^{-15} m

C. Electrons moves in a circular path of fixed energy called orbits

D. Nucleus and the electrons are held, together by electrostatic force at attraction.

Answer: C

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24. If $E_n = -313.6/n_2$, if the value of $E_1 = -34.84$ to which value 'n' corresponds

A. 4

B. 3

C. 2

D. 1

Answer: B

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25. Which of the following about the electron is incorrect?

A. It is negatively charged particle.

B. The mass of electron is euqal to the mass of neuton.

C. It is a basic constituent of all the atoms

D. electron mass = $9.10938356 \times 10^{-31}$ kilograms

Answer: B

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26. Which of the following properties of atom could be explained correctly by Thomson model of an atom?

A. Overall neutrality of atom.

B. Spectra of hydrogen atom

C. Position of protons, electrons and neutrons in atom

D. Stability of atom

Answer: A

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27. In which of the following pairs, the ions are isoelectronic?

Na^+, Mg^{2+} $(ii) Al^{3+}, O^-$

(iii) Na^+, O^{2-} N^{3-}, Cl^-

A. Only (i)

B. Both (i) & (iii)

C. Both (iii) & (iv)

D. Only (ii)

Answer: B

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28. Assertion (A) : Isotopes of a given element show the same type of chemical behavior.

Reason (R) : The chemical properties of an atom are governed by the number of electrons in the atom.

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not the correct explanation of A

C. A is true but R is false

D. Both A and R are false

Answer: A

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29. 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 the order if increasing energy as

A. (iv) lt (ii) lt (iii) lt (i)

B. (ii) lt (iv) lt (i) lt (iii)

C. (i) lt (iii) lt (ii) lt (iv)

D. (iii) lt (i) lt (iv) lt (ii)

Answer: A

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30. Dual character of an electron was explained by

A. Bohr

B. Heiseberg

C. de-Broglie

D. Pauli

Answer: C

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31. de-Broglie equation is

A. $\lambda = mv/h$

B. $\lambda = hmv$

C. $\lambda = hv/m$

D. $\lambda = h/mv$

Answer: D

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32. The value of Bohr radius for hydrogen atom is

A. $0.529 \times 10^{-8} cm$

B. $0.529 \times 10^{-10} cm$

C. $0.529 \times 10^{-12} cm$

D. `0.529 xx 10^(-12)

Answer: A

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33. Which of the following particle having same kinetic energy, would have the maximum de-Broglie wave length

A. α - particle

B. proton

C. β- particle

D. Neutron

Answer: C

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34. If the energy of an electron in the second Bohr orbit of H-atom is -E , what is the energy of the electrons in the Bohr's first orbit?

A. 2E

B. $-4E$

C. $-2E$

D. $4E$

Answer: B

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35. The energy of electron in an atom is given by E_n =

A. $\frac{4\pi^2 me^4}{n^2h^2}$

B. $\frac{4\pi^2 me^4}{n^2h^2}$

C. $\frac{2\pi^2 me^4}{n^2h^2}$

D. $\frac{2\pi me^4}{n^2h^2}$

Answer: C

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36. The energy of the second Bohr orbit of the hydrogen atom is $-3.41eV$. The energy of the second Bohr orbit of the He^+ ion will be _____.

A. $-6.82eV$

B. $-13.62eV$

C. $-1.70eV$

D. $-0.85eV$

Answer: B

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37. Schrodinger wave equation is applied to determine _____.

A. Probability of finding electron at a given point in space

B. Wave motion of the electron

C. Probability density of electron in a given region

D. All of the above

Answer: D

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38. Bohr's equation for energy of an electron in a hydrogen atom is given as _____.

A. $E = \frac{-1312}{n^2} KJmol^{-1}$

B. $E = \frac{-1312}{n^2 h^2} KJmol^{-1}$

C. $E = hv$

D. $E = \frac{4\pi^2 me^4}{n^2 h^2} KJmol^{-1}$

Answer: A

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39. The effect which represents the splitting of spacral lines by external electric field is _____.

A. Stark effect

B. Zeeman effect

C. Raman effect

D. None of these

Answer: A

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40. Accroding to Bohr's theory angular momentum of an electron in 6^{th} orbit is

A. $2.5\frac{h}{\pi}$

B. $6\frac{h}{\pi}$

C. $3\frac{h}{\pi}$

D. $\frac{2.5h}{2\pi}$

Answer: C

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41. When an electron jumps from lower orbit to heigher orbit,

A. energy is released

B. energy is absorbed

C. no change in energy

D. it rediates energy

Answer: B

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42. Which of the following set of quantum number is possible?

A. $n = 4 \quad l = 2 \quad m = -2 \quad s = -2$

B. $n = 4 \quad l = 4 \quad m = 0 \quad s = 1/2$

C. $n = 4 \quad l = 3 \quad m = -3 \quad s = 1/2$

D. $n = 4 \quad l = 0 \quad m = 0 \quad s = 0$

Answer: C

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43. What is the maximum number of orbitals that can be identified with the following quantum numbers ? $n = 3, l = 1, m_1 = 0$

A. 1

B. 2

C. 3

D. 4

Answer: A

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44. Maximum number of electrons in a subshell of an atom is determined by the following

A. $2l + 1$

B. $4l - 2$

C. $2n^2$

D. $4l + 2$

Answer: D

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45. Who modified Bohr's theory by introducing elliptical orbits for electrons path?

A. Rutherford

B. Thomson

C. Hund

D. Sommerfeld

Answer: D

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46. The de-Broglie wavelength of a particle with mass 1 g and velocity $100 m / s$ is

A. $6.63 \times 10^{-35} m$

B. $6.63 \times 10^{-34} m$

C. $6.63 \times 10^{-33} m$

D. $6.65 \times 10^{-35} m$

Answer: C

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47. The number of nodes in s orbital of any energy level is equal to

A. n

B. $2n^2$

C. $n-1$

D. $n-2$

Answer: C

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48. Which of the following is not among short comings of Bohr's model?

A. Bohr theory could not account for the fine lines in the atomic spectrum

B. Bohr theory was unable to account for the splitting of the spectral lines in the presence of magnetic field.

C. No explanation for using the principle of quantisation of angular momentum

D. It did not give information about energy level.

Answer: D

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49. Assertion (A) : Energy of an electron is taken negative.

Reason (R) : Energy of electron at infinity is zero.

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not the correct explanation of A

C. A is true but R is false

D. Both A and R are false

Answer: A

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50. What will be the wavelength of a ball of mass 0.1 kg moving with a velocity of $10ms^{-1}$?

A. $6.62 \times 10^{-34}m$

B. $6.626 \times 10^{34} m$

C. $6.626 \times 10^{-32} m$

D. $6.626 \times 10^{34} m$

Answer: A

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51. Assertion (A) : Bohr's orbits are also called stationary states.

Reason (R) : Electrons are stationary is an orbit.

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not the correct explanation of A

C. A is true but R is false

D. Both A and R are false

Answer: C

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52. The wavelengrh associated with an electron moving with velocity $10^{10} ms^{-1}$ is

A. $6.62 \times 10^{-10} m$

B. $7.28 \times 10^{-14} m$

C. $3.69 \times 10^{12} m$

D. $4.92 \times 10^{11} m$

Answer: B

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53. Assertion (A) : Angular momentum of an electron in an atom is quantized .

Reason (R) : In an atom only those orbits are permitted in which angular momentum of the electron is natural number multiple of $\frac{h}{2\pi}$.

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not the correct explanation of A

C. A is true but R is false

D. Both A and R are false

Answer: A

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54. Assertion (A) : The orbitals having equal energy are known as degenerate orbitals.

Reason (R) : The three 2p orbitals are degenerate is the presence of external magnetic field.

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not the correct explanation of A

C. A is true but R is false

D. Both A and R are false

Answer: C

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55. The de-Broglie wavelength associated with a matter particle is

A. Directly proportional to the momentum of the particle

B. Directly proportional to the velocity of the particle

C. Inversely proportional to the momentum of the particle

D. Inversely proportinal to Plank's constant.

Answer: C

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56. The electronic configuration of copper is _____.

A. $[Ar]4s^2 3d^9$

B. $[Ar]4s^1 3d^{10}$

C. $[Ar]4s^0 3d^{10}$

D. All

Answer: B

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57. How many nodes are possible for 2z orbtial?

A. 1

B. 2

C. 3

D. zero

Answer: A

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58. The subsidiary quantum number decides _____.

A. the shape of the orbital

B. the orientation of the orbital

C. energ level of the orbital

D. the spin of the electron

Answer: A

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59. Consider the following statements and pick the incorrect statement(s).

1. Schrodinger wave equation is used to determine the probability of finding a electron at a given point in space.

2 The energy of a electron at infinity is positive.

3. Angular momentum quantum number gives information regarding subshells.

A. 1 & 3

B. only 1

C. only 2

D. 1,2 & 3

Answer: C

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60. As per Aufbau principle, arrange the orbitals in increasing order of energy.

A. $4p > 4d > 5s > 5p$

B. $4p < 4d < 5s < 5p$

C. $4d < 4p < 5s < 5p$

D. $4p < 5s < 4d < 5p$

Answer: D

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61. In multi-electron atom, 4s - orbital is lower in energy than

A. 3d -orbital

B. 3p - orbital

C. 2s - orbital

D. 2p - orbital

Answer: A

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62. Shape of an orbital is given by

A. Principal quantum number

B. Spin quantum number

C. Azimuthal quantum number

D. Magnetic quantum number

Answer: A

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63. Orientation of orbitals is given by

A. Principal quantum number

B. Spin quantum number

C. Azimuthal quantum number

D. Magnetic quantum number

Answer: A

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64. Which one of the following orbitals is spherical in shape?

A. 4s

B. 3p

C. 3d

D. 4f

Answer: A

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65. Which of the following configuration is correct for iron?

A. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^7$

B. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$

C. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$

D. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$

Answer: D

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66. Which of the following has maximum number of unpaired d - electrons?

A. N^{3+}

B. Fe^{2+}

C. Zn^{+}

D. Cu^{+}

Answer: B

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67. Assertion (A) : In a multi-electron atom, the electrons in different subshell have different energies.

Reason (R) : Energy of an orbital depends upon n + l value.

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not the correct explanation of A

C. A is true but R is false

D. Both A and R are false

Answer: A

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68. Which of the following electronic configuration represent the element in ground state?

A. $1s^2 2s^1 2p^1$

B. $1s^2 2s^2 2p^1$

C. $1s^2 2s^1 2p_x^1 2p_y^1 2p_z^1$

D. $1s^2 2s^2 2p^6 3s^2 3p_x^1 3p_z^1 3d^1$

Answer: B

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69. In an atom _____ charged nucleus there.

A. large positively

B. tiny positively

C. larger negatively

D. tiny negatively

Answer: B

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70. De Broglie and Bohr's concepts are in _____with each other.

A. Oppose

B. Agreement

C. Neglect

D. a & c

Answer: B

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71. The dual nature of matter imposes a limitation on the simultaneous determination of _____ and _____ of a microscopic particle.

A. position , velocity

B. energy , effect

C. orientation, level

D. wavelength, velocity

Answer: A

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72. Which of the following is incorrect?

A. Heisenberg arrived at his uncertainty principle

B. The uncertianty principle signficant

C. The uncertainty principle determining effect for macroscopic objects

D. All the above are correct

Answer: C

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73. What leads to the development of electron microscope?

A. The finding of velocity of electron

B. The finding of particle nature of electron

C. The finding of wave nature of electron

D. None of these above

Answer: C

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74. The solutions of Schrodinger wave equation gives the allowed _____.

A. Energy levels

B. Eiger values

C. equation

D. a & b

Answer: A

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75. What is the integral values can take azimuthal quantum number ?

A. Zero to n

B. Zero to n - 1

C. Zero to n +1

D. zero to n^2

Answer: B

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76. Which effect provides the experimental justification for magnetic quantum number?

A. Altutude effect

B. Latitude effect

C. Stoke effect

D. Zeeman effect

Answer: D

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77. Different values of 'm' for a given 'l' value represent different _____ of orbitals in space.

A. orientation

B. energy levels

C. displacement

D. b & c

Answer: A

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78. During exchange process the energy is _____.

A. Released

B. Gained

C. Returned

D. refuse

Answer: A

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Additional Short Answer

1. Consider the following electronic arrangement for p^3 configuration.

Which of these represents the ground state? Substantiate your answer with a proper reason.

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2. Calculate the De-Broglie wavelength of a particle whose momentum is $66.26 \times 10^{-28} kgms^{-1}$.

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3. Write a note on Thomson's plum pudding model of an atom.

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4. What are the defects of Rutherford's model?

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5. What is the difference between atomic mass and mass number?

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6. How many neutorns and protons are there in the following nuclei?

$._{6}^{13}C, ._{8}^{16}C, ._{12}^{24}Mg, ._{26}^{56}Fe, ._{38}^{88}Sr$

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7. After the execution of the $\alpha - ray$ scattering experiment what were the observatoins made by Rutherford? What did he conclude from his observation?

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8. Which of the following are isoelectronic species?

$Na^+, K^+, Mg^{2+}, S^{2-}, Ar.$

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9. In a chemical reaction, chlorine atom undergoes reduction and aluminium atom undergoes oxidation. Will this redox

reaction affect their initial number of protons, neutrons and electrons?

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10. Symbols $._{35}^{79}Br$ and $.^{79}Br$ can be written, where as symbols $._{79}^{35}Br$ and $.^{35}Br$ are not acceptable. Answer briefly.

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11. In Rutherford's experiment, generally thin foil of heavy atoms, like gold, platinum etc. have been used to bombard the α-particles.

If the thin foil of light atoms like aluminium is used, what difference would be observed from the above results?

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12. Calculate the number of electrons, protons and neutrons in

(i) Phosphorous atom.

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13. Calculate the number of electrons, protons and neutrons in

(ii) Phosphate ion.

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14. Match table - 1 using the options given in table - 2.

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15. What is Zeeman effect?

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16. Orbits are also called as stationary states. Say whether the above statement is true or false. Justify you answer.

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17. If the velocity of the electron in Bohr's first orbit is $2.19 \times 10^{6} ms^{-1}$. Calculate the de-Broglie wavelength with it.

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18. Calculate the uncertainty in the position of a cricket ball of mass 150 g if the uncertainty in velocity is $3.52 \times 10^{-24} ms^{-1}$.

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19. Write the Schrodinger wave equation.

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20. State Heisenberg's uncertainty principle and give its mathematical expression.

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21. What are the significance of Ψ and Ψ^2 ?

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22. How does the Bohr theory of the hydrogen atom differ from that of Schrodinger?

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23. Bring out the main points of difference between orbital and orbital.

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24. The effect of uncertainty principle is significant only for motion of microscopic particles and is negligible for the

macroscopic particles. Justify the statement with the help of a suitable example.

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25. Can we apply Heisenberg's uncertainty principle to a stationary electron? Why ?

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26. An electron or a proton which one will have a higher velocity to produce matter waves of the same wavelength? Explain it.

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27. Calculate the total number of angular and radial nodes present in 3d and 4f orbitals.

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28. Explain why the uncertainty principle is significant only for the motion of sub-atomic particles but is negligible for the macroscopic objects?

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29. what is the maximum number of electrons that can be accommodated in a shell ?

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30. what is meant by nodal surface or node?

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31. What is shape of the orbital with (i) n = 2 and I = 0.

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32. What is shape of the orbital with (ii) n = 2 and I = 1?

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33. Writr note on the necessity for Hund's rule.

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34. Discuss the filling of electron in a carbon atom.

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35. Explain the shape of p orbitals.

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36. What is common between d_{xy} and $d_{x^2-y^2}$ orbitals?

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37. What is the difference between them?

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38. What is the angle between the lobes of the above two orbitals?

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39. Discuss the shapes of d orbitals.

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Additional Long Answer

1. Define the following terms with examples.

Isotopes.

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2. Define the following terms with examples.

Isotones.

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3. Define the following terms with examples.

Isobars.

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4. Define the following terms with examples.

Isoelectronic species.

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5. Define the following terms with examples.

Nucleon.

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6. Enlist the postulates of Bohr's atom model.

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7. By applying Bohr's postulates, arrive at the radius of n^{th} orbit for hydrogen like atom.

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8. Write a note on limitations of Bohr's atom model.

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9. Derive de-Broglie equation.

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10. The quantum numbers of six electrons are given below. Arrange them in order of increasing energies. If any of these combination(s) has/have the same energy lists.

(i) $n = 4, l = 2, m_l = -2, m_s = -\frac{1}{2}$

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

(iii) $n = 4, l = 1, m_l = 0, m_s = +\frac{1}{2}$

(iv) $n = 3, l = 2, m_l = -2, m_s = -\frac{1}{2}$

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

(vi) $n = 4, l = 1, m_l = 0, m_s = +\frac{1}{2}$.

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11. A neutral atom of an element has 2 K, 8L and 5M electrons.

Find out the following.

(i) Atomic number of the element.

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12. A neutral atom of an element has 2 K, 8L and 5M electrons.

Find out the following.

(ii) Total number of s-eelctrons.

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13. A neutral atom of an element has 2 K, 8L and 5M electrons.

Find out the following.

(iii) Total number of p-electrons.

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14. A neutral atom of an element has 2 K, 8L and 5M electrons.

Find out the following.

(iv) Number of protons in the nucleus.

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15. A neutral atom of an element has 2 K, 8L and 5M electrons.

Find out the following.

(v) Valency of the element.

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16. Determine the following for the fourth shell of an atom.

(a) The number of subshells.

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17. Determine the following for the fourth shell of an atom.

(b) The designation for each subshell.

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18. Determine the following for the fourth shell of an atom.

(c) The number of orbitals in each subshell.

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19. Determine the following for the fourth shell of an atom.

(d) The maximum number of electrons that can be contaied in each subshell.

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20. Complete the table given below.

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Numerical

1. Calculate the uncertainty in the velocity of a wagon of mass 3000 kg whose position is known to an accuracy of ± 10 pm.

(Planck's contant = $6.626 \times 10^{-34} kgm^2 s^{-1}$)

Given : $m = 3000kg$, $\Delta x = 10pm$

$= 10 \times 10^{-12} m = 10^{-11} m$

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2. The uncertainty in the position and velocity of a particle are $10^{-2} m$ and $5.27 \times 10^{-24} ms^{-1}$ respectively. Calculate the mass of the particle.

Given : $h = 6.626 \times 10^{-34} kgm^2 s^{-1}$

$\Delta v = 5.27 \times 10^{-24} ms^{-1}$, $\Delta x = 10^{-2} m$

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3. Calculate the product of the uncertainties of displacement and velocity of a moving electron having a mass of

$9.1 \times 10^{-28} g.$

Given : $h = 6.626 \times 10^{-34} kgm^2 s^{-1}$

$m = 9.1 \times 10^{-28} g = 9.1 \times 10^{-31} kg$

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4. A beam of helium atoms moves with a velocity of $2.0 \times 10^3 ms^{-1}$. Find the wavelength of the particles constituting the beam. $\left(h = 6.626 \times 10^{-34} Js\right)$.

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