doubtnut
India's Number 1 Education App

CHEMISTRY

BOOKS - NAGEEN CHEMISTRY (ENGLISH)

STRUCTURE OF ATOM

Example

1. The atomic number of an element is 4 while its mass under is 9. Find the number of electrons, protons and neutrons present in an atom of it. How should the element be represented?

Watch Video Solution

2. how many neutrons and protons are there in the following nuclei ?

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

Watch Video Solution

3. A neutral atom possesses 92 protons and 146 neutrons. Find its atomic number, mass under and number of electrons present in it.

Watch Video Solution

4. A sample of neon is found to consist of ${}_{10}^{20}Ne$, ${}_{10}^{21}Ne$ and ${}_{10}^{22}Ne$ in the percentage 90.92, 0.26 and 8.82 respectively. Find the average atomic mass of neon.

Watch Video Solution

5. A radiation has wavelength 4650Å. Calculate its wave number and frequency.

Watch Video Solution

6. The frequency of a radiation belonging to radio waves is $3 \times 10^7 Hz$. Find the wave number and wavelength of the radiation.

Watch Video Solution

7. One of the spectral lines of caesium has a wavelength of 456nm. Calculate the frequency of this line.

Watch Video Solution

8. Calculate the energy associated with one photon of the radian of wavelength 4000Å.

Watch Video Solution

9. A photon of wavelength 400nm strikes a metal surface. The electrons are ejected with a velocity $5.85 \times 10^5 ms^{-1}$. Calculate the minimum

energy required to remove an electron from the metal surface. The mass of an electron is $9.109 \times 10^{-31} kg$.

Watch Video Solution

10. Calculate the wavelength of the spectral line in the spectrum of hydrogen when n=3 in Balmer formula.

Watch Video Solution

11. Calculate the short and long wavelength limits of Lyman series in the spectrum of hydrogen.

Watch Video Solution

12. A spectral line in the Balmer series of hydrogen spectrum corresponds to wavelength 6561Å. Find the energy levels involved in the transition responsible for the origin of this line $\left(R = 109679 cm^{-1}\right)$.

Watch Video Solution

13. Find the energy difference between n=4 and n=3 levels of hydrogen and calculate the frequency of the radiaiton emitted when an electron transits between these levels. (Plank's constant $h = 6.626 \times 10^{-34} Js$).

Watch Video Solution

14. An electron is moving with a kinetic energy of $4.55 \times 10^{-25} J$. Calculate its de-Broglie wavelength.

Watch Video Solution

15. A ball of mass 175g moves with an uniform velocity. The ball can be located with an error equal to 5500Å. If an effort is made to determine the velocity of the ball, what will be the uncertainity in this measurement?

Watch Video Solution

Watch Video Solution

16. Calculate the uncertainity in momentum of an electron if uncertainty in its position is 1Å $\left(10^{-10}m\right)$.

Watch Video Solution

17. (a) An atomic orbital has n=3. What are the possible values of l?

(b) An atomic orbital has l=3. What are the possible values of m?

(c) An atomic orbital has n=2. What are the possible values of l and m?

Watch Video Solution

18. Using the s,p,d,f notations, describe the orbitals with the following quantum numbers,

(a) n=1, l=0 (b) n=2, l=1

(c) n=3, l=0 (d) n=4, l=3

(e) n=5, l=2

Watch Video Solution

19. Designate the electrons having the following sets of quantum numbers,

(a) $n = 2, l = 0, m = 0, s = +\frac{1}{2}$

(b) $n = 3, l = 1, m = +1, s = +\frac{1}{2}$

(c) $n = l, l = 0, m = 0, s = -\frac{1}{2}$

Watch Video Solution

20. Among the following sets of quantum number, state which are possible. Explain why the other are not permitted?

(a) n=1, l=0, m=-1, $s = +\frac{1}{2}$

(b) n=, l=0, m=0, $s = -\frac{1}{2}$

(c) $n = 2, l = 3, m = 0, s = -\frac{1}{2}$

(c) $n = 2, l = 3, m = 0, s = +\frac{1}{2}$

(d) $n = 3, l = 1, m = 1, s = -\frac{1}{2}$

(e) $n = 0, l = 0, m = 0, s = +\frac{1}{2}$

(f) $n = 2, l = 0, m = 0, s = -\frac{1}{2}$

Watch Video Solution

21. Menstion the values of n and l corresponding to the following orbitals.

(a) 2s (b) 2p (c) 3d (d) 4f (e) 3s

Watch Video Solution

Review Exercises

1. How many protons and neutrons are present in the following nuclei?

$_{2}^{4}He, _{6}^{12}C, _{18}^{40}Ar, _{10}^{22}Ne, _{92}^{235}U$

Watch Video Solution

2. Choose isotopes and isobars from the following:

$_{6}^{12}C, _{5}^{12}B, _{7}^{14}N, _{8}^{14}O, _{8}^{16}O, _{6}^{14}C, _{7}^{13}N$

Watch Video Solution

3. The nucleus of Iron atom contains 26 protons and 30 neutrons. Find its atomic number, mass number and number of electrons present in it. How the atom should be represented?

Watch Video Solution

4. (i) Explain how anode rays are produced in a discharge tube?

(ii) Why is the effect of β-particles on a photographic plate more than that of α - particles?

Watch Video Solution

5. Which of the following particles is not present in all atoms : electron, proton, neutron ?

Watch Video Solution

6. The natural uranium consists of three isotopes $^{238}_{92}U$, $^{235}_{92}U$ and $^{234}_{92}U$ in the ratio 99.274 : 0.720, 0.006. Find the average atomic mass of uranium.

Watch Video Solution

7. calculate the number of electrons which will together weigh one gram.

(ii) calculate the mass and charge of one mole of electrons .

Watch Video Solution

8. Give experimental evidences to show that

(i) cathode rays travel in straight lines

(ii) cathode rays possess kinetic energy

(iii) most part of the atom is hollow

(iv) the space occupied by the nucleus is much smaller than that by an atom.

Watch Video Solution

9. calculate the number of electrons which will together weigh one gram.

(ii) calculate the mass and charge of one mole of electrons .

Watch Video Solution

10. Write the complete symbols for the nuclei with

(i) atomic number 17 and mass number 35

(ii) atomic number 8 and mass number 16

(iii) atomic number 26 and mass number 55

(iv) atomic number 2 and mass number 4.

Watch Video Solution

11. A yellow line of sodium corresponds to a frequency $5.09 \times 10^{14} s^{-1}$. Calculate the wavelength and the wave number of this line.

Watch Video Solution

12. Mention the main points of difference between the emission and absorption spectra of an atom.

Watch Video Solution

13. Calculate the wave number and energy of the spectral line emitted by an excited hydrogen atom corresponding to $n_1 = 3$ and $n_2 = 5$.

Watch Video Solution

14. In a hydrogen atom, an electron undergoes transition from an energy level with n= 4 to an energy level with n= 2. Calculate the wavelength of

the spectral line thus obtained. In which region of electromagnetic spectrum this line would be observed and what would be its colour?

Watch Video Solution

15. Calculate

(i) the frequency of radiation when $\lambda = 2.5\mu$,

(ii) the wavelength of radiation when v =1368 k Hz,

(iii) the wave number of radiation when $\lambda = 460nm$,

(iv) the energy of radiation when $\bar{v} = 4.0 \times 10^5 m^{-1}$.

Watch Video Solution

16. Explain what is meant by quantisation of energy.

Watch Video Solution

17. Which of the following are quantised?

A. Going upstairs on a ladder.

B. Slippiing down a slope.

C. The movement of a second's hand in a watch.

D. The movement of fare meter in a taxi.

Answer: A::D

Watch Video Solution

18. A hydrogen atom in the ground state. To which level will it get excited on absorbing a photon of energy 12.75eV $\left(1eV = 1.6 \times 10^{-19}\right)$

Watch Video Solution

19. Calculate the wavelength of the spectral line when an electron jumps from n=7 to n=4 level in an atom of hydrogen.

Watch Video Solution

20. Calculate the ionisation energy of He^+ if that of H atom is 13.6eV.

Watch Video Solution

21. What nature of electron is indicated by each of the following properties shown by electrons ?

(i) Electron has mass.

(ii) Electron possesses kinetic energy.

(iii) Electrons can be polarised.

(iv) Electrons can be diftracted.

Watch Video Solution

22. Using Heisenberg's uncertainty principle, calculate the uncertainty in velocity of an electron if uncertainty in its position is $10^{-11}m$ Given, $h = 6.6 \times 10^{-14}kgm^2s^{-1}, m = 9.1 \times 10^{-31}kg$

Watch Video Solution

23. A body of mass 70 kg travels with a speed of 15 km/hour. Calculate the de-Broglie wavelength of the body.

Watch Video Solution

24. Using s, p, d, f notations describe the orbitals with the following quantum numbers:

(a) n=1, l=0, m=0

(b) n=3, l=0, m=0

(c) n=2, l=1, m=+1

Watch Video Solution

25. Designate the electrons with the following sets of quantum numbers :

(a) $n = 3, l = 0, m = 0, s = -\frac{1}{2}$

(b) $n = 2, l = 1, m = +1, s = +\frac{1}{2}$

(c) $n = 5, l = 0, m = 0, s = +\frac{1}{2}$

Watch Video Solution

Watch Video Solution

26. STATEMENT-1: An orbital cannot have more then two electrons and they must have opposite spins.

STATEMENT-2: No two electrojns in an atom can have same set of all the four quantum numbers as per Pauli's exclusion principle.

Watch Video Solution

27. Explain why can more than 8 electrons not be accommodated in L shell?

Watch Video Solution

28. Which of the following sets of quantum numbers do not belong to 2p subshell?

(i) $n = 2, l = 1, m = +1, s = +\frac{1}{2}$

(ii) $n = 2, l = 0, m = 0, s = -\frac{1}{2}$

(iii) $n = 1, l = 1, m = 0, s = +\frac{1}{2}$

Watch Video Solution

29. Show the arrangement of electrons by block diagrams in the following subshells: $2s^2, 2p^2, 2p^5, 3d^7, 4f^7$

Watch Video Solution

30. How many electrons possess anticlockwise spin in an atom of oxygen?

Watch Video Solution

31. How many electrons are unpaired in

(i) He ? (ii) C?

(iii) N? (iv) K?

Watch Video Solution

32. Why is 4s orbital filled before the filling of 3d orbital?

Watch Video Solution

33. Write the names and electronic configurations of the elements in which electrons enter into 3d subshell.

Watch Video Solution

34. Why does chromium have configuration of type $3d^5 4s^1$ instead of $3d^4 4s^2$?

Watch Video Solution

35. Does the filling of an orbital by electrons mean that orbitals are some sort of containers? If not so, mention the correct situation.

Watch Video Solution

Very Short Answer Type Questions

1. Name the scientist who indicated that the matter is electrical in nature?

Watch Video Solution

2. Why is a cathode ray tube evacuated to a low pressure ?

Watch Video Solution

3. What is the behaviour of cathode rays in the presence of an electric field?

Watch Video Solution

4. What happens when cathode rays are passed through a gas?

Watch Video Solution

5. Mention the charge, mass and e/m ratio for an electron.

Watch Video Solution

6. What is the nature of charge on (i) cathode rays (ii) anode rays?

Watch Video Solution

7. Among α, β and γ-rays, which is the most penetrating?

Watch Video Solution

8. Who proposed the first model of atom?

Watch Video Solution

9. Give a rough estimate of number of a particles which suffer a deflection of 180° when made to fall on a gold foil.

Watch Video Solution

10. If the nucleus of an atom is magnified to the size of a football, how big the atom would look like?

Watch Video Solution

11. Give the equation which had been instrumental in the discovery of neutron.

Watch Video Solution

12. How are the atomic number (Z) and mass number (A) related to each other?

Watch Video Solution

13. Do isobars possess similar chemical properties?

Watch Video Solution

14. Why are the waves associated with light called electromagnetic waves?

Watch Video Solution

15. Define wavelength and frequency of a wave.

Watch Video Solution

16. Among X-rays and microwaves, which does possess a higher wavelength range?

Watch Video Solution

17. Give the wavelengths of D_1 and D_2 lines of sodium.

Watch Video Solution

18. Which transitions are responsible for the occurrence of Brackett series in the spectrum of hydrogen?

Watch Video Solution

19. The Bohr model for the spectra of a H-atom

Watch Video Solution

20. Should earth be regarded as a wave in the light of de-Broglie equation?

Watch Video Solution

21. What does Ψ^2 indicate?

Watch Video Solution

22. How many nodal points are present in a 3s orbital?

Watch Video Solution

23. Which quantum number does not depend upon the value of n?

Watch Video Solution

24. For a given value of l, how many values of m are permissible?

Watch Video Solution

25. Which subshell is filled after the filling of 4p subshell?

Watch Video Solution

26. If two sushells have the same value of n + 1, which shell will be filled first?

Watch Video Solution

27. (a) An atomic orbital has n = 3. What are the possible values of l?

(b) What is the maximum number of electrons that can be accommodated in a shell with principal quantum number n ?

Watch Video Solution

28. Which orbital does possess the lowest energy in an atom?

Watch Video Solution

29. How many electrons are present in the atom whose electronic configuration is $1s^2, 2s^2, 2p_x^1$?

Watch Video Solution

30. Which atom does contain $3d^1$ subshell?

Watch Video Solution

Short Answer Type Questions

1. Mention the Faraday's laws of electrolysis.

Watch Video Solution

2. Give the experimental evidences which show that cathode rays travel in straight lines.

Watch Video Solution

3. Determine the mass of an electron if for an electron $\frac{e}{m} = 1.759 \times 10^{8} Cg^{-1}$ and $e = 1.6021 \times 10^{-19} C$

Watch Video Solution

4. What changes in a discharge tube used for producing cathode rays are required to obtain anode rays?

Watch Video Solution

5. Why proton is regarded as a subatomic particle?

Watch Video Solution

6. What happens when the radiations obtained from a radio active substance are passed through an electric field, marks are found at three places on the photographic plate placed in its path. Give reason.?

Watch Video Solution

7. Discuss the effect of $\alpha -$, $\beta -$ and γ-rays on a photographic plate.

Watch Video Solution

8. What is the plum pudding model of the atom?

Watch Video Solution

9. Which particles are mainly responsible for the mass of an atom?

Watch Video Solution

10. Define atomic number and mass number of an atom.

Watch Video Solution

11. Define isotopes and isobars.

Watch Video Solution

12. Define wave number. How is it related to frequency and wavelength?

Watch Video Solution

13. Which of the following are not electromagnetic waves?

(i) α-rays

(ii) Radio waves

(iii) β-rays

(iv) Sound waves

(v) Micro waves

(vi) Cosmic rays

Watch Video Solution

14. What is photoelectric effect? Mention the Einstein's photoelectric equation.

Watch Video Solution

15. Why light is sald to possess a dual nature?

Watch Video Solution

16. What do you understand by the term spectrum ?

Watch Video Solution

17. Mention the main points of difference between the emission and absorption spectra of an atom.

Watch Video Solution

18. How many series are found in the spectrum of atomic hydrogen? Mention their names and the regions in which they appear.

Watch Video Solution

19. State one major drawback of Rutherford's model.

Watch Video Solution

20. Explain what is meant by quantisation of energy.

Watch Video Solution

21. Electronic energy is negative because:

Watch Video Solution

22. State the expression for Heisenberg.s uncertainty principle.

Watch Video Solution

23. What do you understand by an orbital? How is it different from an orbit?

Watch Video Solution

24. How many and which quantum numbers are required to completely define :

(i) an orbital and

(ii) an electron in an atom?

Watch Video Solution

25. Draw the shapes of 1s, 2s, $2p_x$, $2p_y$, and $2p_z$, orbitals.

Watch Video Solution

26. Give a brief account of Hund's rule of maximum multiplicity.

Watch Video Solution

27. What is Aufbau principle? How is it helpful in the filling up of electrons in various orbitals in an atom?

Watch Video Solution

28. Name a process which can remove both temporary and permanent hardness of the water.

Watch Video Solution

29. Why is 4s shell filled before 3d shell? Explain in the light of n+I rule

Watch Video Solution

30. Write the electronic configurations of following elements

Li, N, Ne, P, Cl, Ca, Sc, Cr, Fe, Cu, Zn, Ag

Watch Video Solution

Essay Long Answer Type Questions

1. What are cathode rays? How are these rays formed?

Watch Video Solution

2. How was neutron discovered? Describe the important properties of neutron.

Watch Video Solution

3. What is the nature of charge on (i) cathode rays (ii) anode rays?

Watch Video Solution

4. What is a proton and how was it discovered?

Watch Video Solution

5. What is radio activity? Compare the properties of α, β and γ-rays. What is the contribution of radio activity in the development of atomic structure?

Watch Video Solution

6. Permutit is technical name given to

Watch Video Solution

7. Describe Rutherford's nuclear model of the atom.

Watch Video Solution

8. Explain why isobars are placed at different places in periodic table?

Watch Video Solution

9. A sample of hard water is found to contain 50mg of $CaSO_4$ in 12kg of sample.Calculate the hardness of the sample in terms of ppm of $CaSO_4$.

Watch Video Solution

10. Describe in brief the principles which led to the failure of Bohr's model.

Watch Video Solution

11. What is the significance of Ψ and Ψ^2 in the quantum mechanical model of atom?

Watch Video Solution

12. What are quantum numbers and what information is provided by them? Specify the electrons with following sets of quantum numbers :

(i) $n = 4, l = 1, m = +1, s = +\frac{1}{2}$

(ii) $n = 3, l = 0, m = 0, s = -\frac{1}{2}$

Watch Video Solution

13. Write short notes on

(i) Pauli's exclusion principle

(ii) Aufbau principle.

Watch Video Solution

14. Explain the following terms in relation to orbitals :

(i) Node (ii) Nodal point

Watch Video Solution

15. Explain why

(i) the three electrons present in 2p subshell nitrogen remain unpaired.

(ii) in potassium, the 19th electron enters into 4s subshell instead of 3d subshell,

(iii) chromium has configuration $3d^5 4s^1$ instead of $3d^4$, $4s^2$,

(iv) the electronic configuration of zinc can be represented as $[Ar]3d^{10}4s^2$?

Watch Video Solution

Objective Mcq Type Questions

1. The discovery of neutron became very late because

A. neutrons are present in nucleus

B. neutrons are chargeless

C. neutrons are fundamental particles

D. all of the above.

Answer: B

Watch Video Solution

2. Which is the correct statement about proton?

A. Proton is nucleus of deuterium

B. Proton is a particle

C. Proton is ionised hydrogen molecule

D. Proton is ionised hydrogen atom.

Answer: D

Watch Video Solution

3. The number of neutrons in the radioactive isotope of hydrogen is

A. 2

B. 0

C. 1

D. 3

Answer: A::C

Watch Video Solution

4. If the nucleus of an atom is enlarged to the size of a ball of 10 cm diameter, the atom would look like a sphere of diameter roughly equal to

A. 10m

B. 10km

C. 100km

D. 1000km

Answer: B

Watch Video Solution

5. In a given atom no two electrons can have the same values of all the four quantum numbers. This is called

A. same principal quantum number

B. same azimuthal quantum number

C. identical sets of quantum numbers

D. same magnetic quantum number.

Answer: C

Watch Video Solution

6. The number of unpaired electrons in chromium (atomic number 24) is

A. 2

B. 3

C. 5

D. 6

Answer: D

Watch Video Solution

7. Atomic number of an element indicates

A. the number of electrons in the nucleus

B. the number of neutrons in the nucleus

C. the number of protons in the nucleus

D. valency of an element.

Answer: C

Watch Video Solution

8. If the mass number of an element is W and its atomic number is N, then

A. number of ${}^{0}_{-1}e = W - N$

B. number of ${}^{1}_{1}H = W - N$

C. number of ${}^{1}_{0}e = W - N$

D. number of ${}^{1}_{0}n = N$

Answer: C

Watch Video Solution

9. Electronic configuration of H^- is

A. $1s^0$

B. $1s^1$

C. $1s^2$

D. $1s^1 2s^1$

Answer: C

Watch Video Solution

10. Magnetic quantum number specifies

A. size of orbitals

B. shape of orbitals

C. orientation of orbitals in space

D. nuclear stability.

Answer: C

Watch Video Solution

11. When the value of n = 2, m can have

A. 1 value

B. 3 values

C. 4 values

D. 7 values.

Answer: C

Watch Video Solution

12. The correct set of quantum numbers for the unpaired electron of chlorine atom is

A. n-2, l-1, m-0

B. n-2, l-1, m-1

C. n-3, l-1, m-1

D. n-3, l-0, m-0

Answer: C

Watch Video Solution

13. From the given sets of quantum numbers, that one that is inconsistent with the theory is

A. $n = 3, l = 2, m = -3, s = +\frac{1}{2}$

B. $n = 4, l = 3, m = 3, s = +\frac{1}{2}$

C. $n = 2, l = 1, m = 0, s = -\frac{1}{2}$

D. $n = 4, l = 3, m = 2, s = +\frac{1}{2}$

Answer: A

Watch Video Solution

14. Which of the following are isoelectronic with one another?

A. Na^+ and Ne

B. K^+ and O

C. Ne and O

D. Ne and O

Answer: A

Watch Video Solution

15. The total number of neutrons in dipositive zinc ions with mass number 70 is

A. 34

B. 40

C. 36

D. 38

Answer: A::B

Watch Video Solution

16. A p-orbital can accommodate

A. 4 electrons

B. 6 electrons

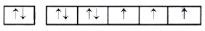
C. 2 electrons with parallel spins

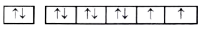
D. 2 electrons with opposite spins.

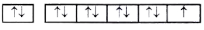
Answer: D

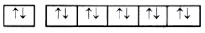
Watch Video Solution

17. Which of the following is not correct for electronic distribution in the ground state?

A. Co [Ar] 

B. Ni [Ar] 

C. Cu [Ar] 

D. Zn [Ar] 

Answer: C

Watch Video Solution

18. Which of the following electron transitions will require the largest amount of energy in a hydrogen atom?

A. From n= 1 to n = 2

B. From n = 2 to n = 3

C. From $n = \infty$ to n =1

D. From n =3 to n = 5.

Answer: A

Watch Video Solution

19. A 200 g cricket ball is thrown with a speed of 3×10^3 cm/sec, what will be its de-Broglie wavelength?

A. $1.1 \times 10^{-32} cm$

B. $2.2 \times 10^{-32} cm$

C. $0.55 \times 10^{-32} cm$

D. $11.0 \times 10^{-32} cm$

Answer: A::B::D

Watch Video Solution

20. For the energy levels in an atom which one of the following statements is correct?

A. There are seven principal electron energy levels

B. The second principal energy level can have four sub energy levels and contains a maximum of eight electrons

C. The Menergy level can have a maximum of 32 electrons

D. The 4s subenergy level is at a higher energy than the 3d subenergy level.

Answer: B

Watch Video Solution

21. Which electronic level would allow the hydrogen atom to absorb a photon but not to emit a photon?

A. 3s

B. 2p

C. 1s

D. 3d

Answer: A::B::C

Watch Video Solution

22. Spectrum produced due to transition of an electron from M to L shell is

A. absorption

B. emission

C. X-rays

D. continuous

Answer: B

Watch Video Solution

23. Energy of the third orbit of Bohr's atom is

A. $-13.6eV$

B. $-3.6eV$

C. $-1.5eV$

D. None of these

Answer: A::B::C

Watch Video Solution

24. If the speed of the electron in the Bohr's first orbit is x, then speed of the electron in the 3rd orbit would be

A. x/9

B. x/3

C. 3x

D. 9x

Answer: A::B::D

Watch Video Solution

25. An ion has 18 electrons in the outermost shell , it is

A. Cu^+

B. Th^{4+}

C. Cs^+

D. K^+

Answer: A

Watch Video Solution

26. Which of the following statement(s) is not correct?

A. The electronic configuration of Cr is [Ar] $3d^5 4s^1$ (At. No. of Cr= 24).

B. The magnetic quantum number may have a negative, value.

C. In silver atom, 23 electrons have a spin of one type and 24 of the opposite type. (At. no. of Ag =47).

D. The oxidation state of nitrogen in N_3H is -3.

Answer: D

Watch Video Solution

27. 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) lt (ii) lt (iii) lt (i)

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

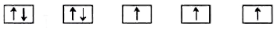
C. (i) lt (iii) lt (ii) lt (iv)

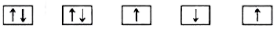
D. (iii) lt (i) lt (iv) lt (ii)

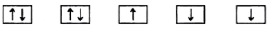
Answer: A

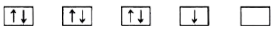
Watch Video Solution

28. Ground state electronic configuration of nitrogen atom can be represented by

A. 

B. 

C. 

D. 

Answer: A

Watch Video Solution

29. The number of nodal planes in a p_x orbital is

A. one

B. two

C. three

D. zero.

Answer: A

Watch Video Solution

30. The electronic configuration of an element is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$.

This represents its

A. excited state

B. ground state

C. cationic form

D. anionic form.

Answer: B

Watch Video Solution

31. Which of the following statements regarding the electron spin $+\frac{1}{2}$ and $-\frac{1}{2}$ is correct? These two numbers

A. represent the rotation of electron in clockwise and anticlockwise directions respectively

B. represent the rotation of electron in anticlockwise and clockwise directions respectively

C. represent the upward and downward directions of magnetic moment.

D. represent two quantum mechanical states which have no classical mechanical analogues.

Answer: A

Watch Video Solution

32. The speed of a 200 g golf ball is 5.0 metre per hour. The wavelength of this ball will be of the order of

A. $10^{-10}m$

B. $10^{-20}m$

C. $10^{-30}m$

D. $10^{-4}m$

Answer: D

Watch Video Solution

33. Energy of H-atom in the ground state is -13.6 eV, hence energy in the second excited state is

A. $-6.8eV$

B. $-3.4eV$

C. $-1.51eV$

D. $-4.53eV$

Answer: A::B::C::D

Watch Video Solution

34. Uncertainty in position of a particle of 25 g in space is 10^{-5} m. Hence, uncertainty in velocity $\left(ms^{-1}\right)$ is (Planck's constant $h = 6.6 \times 10^{-34} Js$)

A. 2.1×10^{-28}

B. 2.1×10^{-34}

C. 0.5×10^{-34}

D. 5.0×10^{-24}

Answer: A

Watch Video Solution

35. In Balmer series of lines of hydrogen spectrum, the third line from the red end corresponds to which one of the following inner-orbit jumps of the electron for Bohr orbits in an atom of hydrogen?

A. $3 \rightarrow 2$

B. $5 \rightarrow 2$

C. $4 \rightarrow 1$

D. $2 \rightarrow 5$

Answer: A::B::C::D

Watch Video Solution

36. The de-Broglie wavelength of a tennis ball of mass 60 g moving with a velocity of 10 m/s is approximately (Plank's constant $h = 6.63 \times 10^{-34} Js$)

A. $10^{-33} m$

B. $10^{-31} m$

C. $10^{-16} m$

D. $10^{-25} m$

Answer: A

Watch Video Solution

37. The orbital angular momentum for an electron revolving in an orbit is given by $\sqrt{l(l+1)}\frac{h}{2\pi}$. The momentum for an s-electron will be given by

A. $+\frac{1}{2}.\frac{h}{2\pi}$

B. zero

C. $\frac{h}{2\pi}$

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

Answer: A::B::C

Watch Video Solution

38. Which of the following sets of quantum numbers is correct for an electron in 4f orbital?

A. $n=4, l=3, m=+4, s=+\frac{1}{2}$

B. $n=4, l=4, m=-4, s=-\frac{1}{2}$

C. $n=4, l=3, m=+1, s=+\frac{1}{2}$

D. $n=3, l=2, m=-2, s=+\frac{1}{2}$

Answer: A::B::C::D

Watch Video Solution

39. Consider the ground state of Cr atom (Z =24). The numbers of electrons with the azimuthal quantum numbers, l= 1 and 2 are respectively

A. 12 and 4

B. 12 and 5

C. 16 and 4

D. 16 and 5.

Answer: B

Watch Video Solution

40. Calculate the wavelength and energy of radiation emitted for the electronic transition from infinity (∞) to stationary state one of the hydrogen atom $\left(\mathrm{R}=1.09678 \quad \times 10^{7} m^{-1}\right)$

A. 91 nm

B. 192 nm

C. 406 nm

D. $9.1 \times 10^{-8} m$

Answer: A

Watch Video Solution

41. In a multi-electron atom, which of the following orbitals described by the three quantum numbers will have the same energy in the absence of magnetic and electric fields ?

(A) n=1, l=0 m=0, (B) n=2, l=0, m=0

(c) n=2, l=1, m=1 (d) n=3, l=2, m=1

(e) n=3, l=2, m=0

A. D and E

B. C and D

C. B and C

D. A and B

Answer: A

Watch Video Solution

42. Uncertainty in the position of an electron $(\text{mass} = 9.1 \times 10^{-31} kg)$ moving with a velocity $300 ms^{-1}$ accurate upto 0.001% will be

A. $19.2 \times 10^{-2} m$

B. $5.76 \times 10^{-2} m$

C. $1.92 \times 10^{-2} m$

D. $3.84 \times 10^{-2} m$

Answer: C

Watch Video Solution

43. Which of the following sets of quantum numbers represents the highest energy of an atom?

A. $n = 4, l = 3, m = +4, s = +\frac{1}{2}$

B. $n = 3, l = 2, m = 1, s = +\frac{1}{2}$

C. $n = 4, l = 0, m = 0, s = +\frac{1}{2}$

D. $n = 3, l = 0, m = 0, s = +\frac{1}{2}$

Answer: B

Watch Video Solution

44. Which one of the following constitutes a group of the isoelectronic species?

A. C_2^{2-}, O_2^-, CO, NO

B. $NO^+, C_2^{2-}, CN^-, N_2$

C. $CN^-, N_2, O_2^{2-}, C_2^{2-}$

D. N_2, O_2^-, NO^+, CO

Answer: A::B::C::D

Watch Video Solution

45. The ionisation enthalpy of hydrogen atom is $1.312 \times 10^6 \text{ J mol}^{-1}$. The energy required to excite the electron in the atom from n = 1 to n = 2 is

A. $8.51 \times 10^5 \text{J mol}^{-1}$

B. $6.56 \times 10^5 \text{J mol}^{-1}$

C. $7.56 \times 10^5 \text{J mol}^{-1}$

D. $9.84 \times 10^5 \text{J mol}^{-1}$

Answer: D

Watch Video Solution

46. The total number of atomic orbitals in fourth energy level of an atom is

A. 16

B. 32

C. 4

D. 8

Answer: A

Watch Video Solution

47. The energies E_1 and E_2 of two radiations are 25 eV and 50 eV respectively. The relation between their wavelengths, i.e., λ_1 and λ_2 will be

A. $\lambda_1 = 2\lambda_2$

B. $\lambda_1 = 4\lambda_2$

C. $\lambda_1 = \frac{1}{2}$

D. $\lambda_1 = \lambda_2$

Answer: A

Watch Video Solution

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

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

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

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

D. $ns \to (n-2)f \to (n-1)d \to np$

Answer: D

Watch Video Solution

49. The correct set of four quantum numbers for the valence elections of rubidium atom (Z= 37) is:

A. $5, 1, 1 + \frac{1}{2}$

B. $6, 0, 0, + \frac{1}{2}$

C. $5, 0, 0, + \frac{1}{2}$

D. $5, 1, 0, + \frac{1}{2}$

Answer: C

Watch Video Solution

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

A. 1

B. 2

C. 3

D. 4

Answer: A

Watch Video Solution

51. Calculate the energy in joule corresponding to light of wavelength 45 nm :

$\left(\text{Planck's constant } h = 6.63 \times 10^{-34} \text{ Js: speed of light } : c = 3 \times 10^{8} \text{ms}^{-1}\right.$

.

A. 6.67×10^{15}

B. 6.67×10^{11}

C. 4.42×10^{-15}

D. 4.42×10^{-18}

Answer: D

Watch Video Solution

52. Energy of an electron is given by

$E = -2.178'10^{-18}J$

Wavelength of light required to excite an electron in an hydrogen atom from level n = 1 to n = 2 will be $\left(h = 6.62 \times 10^{-34}Js \text{ and } c = 3.0 \times 10^{8}ms^{-1}\right)$

A. $1.214 \times 10^{-7}m$

B. $2.816 \times 10^{-7}m$

C. $6.500 \times 10^{-7}m$

D. $8.500 \times 10^{-7}m$

Answer: A

Watch Video Solution

53. 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. $3 < 4 < 2 < 1$

B. $4 < 2 < 3 < 1$

C. $2 < 4 < 1 < 3$

D. $1 < 3 < 2 < 4$

Answer: B

Watch Video Solution

54. A gas absorbs photon of 355 nm and emits at two wavelengths. If one of the emission is at 680 nm, the other is at

A. 1035m

B. 325m

C. 743m

D. 518m

Answer: C

Watch Video Solution

55. The frequency of light emitted for the transition n =4 to n =2 of He^+ is equal to the transition in H atom corresponding to which of the following?

A. n=3 to n=1

B. n=2 to n=1

C. n=3 to n=2

D. n=4 to n=3

Answer: B

Watch Video Solution

56. The energy required to break one mole of Cl-Cl bonds in Cl_2 is 242 kJ mol^{-1}. The longest wavelength of light capable of breaking a single Cl-Cl bond is

A. 594nm

B. 640nm

C. 700nm

D. 494nm

Answer: D

Watch Video Solution

57. Which one is the wrong statement ?

A. de-Broglie's wavelength is given by $\lambda = \frac{h}{mv}$ where m= mass of the particle, v = group velocity of the particle

B. The uncertainty principle is at $\triangle E \times \triangle t \geq \frac{h}{4\pi}$

C. Half-filled and fully filled orbitals have greater stability due to greater exchange energy, greater symmetry and more balanced arrangement

D. The energy of 2s orbital is less than the energy of 2p orbital in case of hydrogen like atoms

Answer: D

Watch Video Solution

58. The radius of the second Bohr orbit for hydrogen atom is [Planck's constant $(h) = 6.6262 \times 10^{-34} \cdot Js$, mass of electron=$9.1091 \times 10^{-31} kg$, charge of electron $= 1.60210 \times 10^{-19} C$, permittivity of vacuum $(\in_0) = 8.854185 \times 10^{-12} kg^{-1} \cdot m^{-3} \cdot A^2$]-

A. 0.526Å

B. 2.12Å

C. 1.65Å

D. 4.76Å

Answer: B

Watch Video Solution

59. The most abundant elements by mass in the body of a healthy human adult are Oxygen (61.4%), Carbon (22.9%). Hydrogen $(10.0)\%$, and Nitrogen (2.6%). The weight which a $75kg$ person would gain if all $._1^1 H$ atoms are replaced by $._1^2 H$ atoms is

A. 7.5kg

B. 10kg

C. 15kg

D. 37.5kg

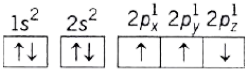
Answer: A

Watch Video Solution

60. Which one is wrong statement?

A. Total orbital angular momentum of electron in 's' orbital is equal to zero

B. An orbital is designated by three quantum numbers while an electron in an atom is designated by four quntum numbers

C. The electronic configuration of N atoms is 

D. The value of m for d_Z^2 is zero

Answer: C

Watch Video Solution

61. 4d, 5p, 5f and 6p orbitals are arranged in the order of decreasing energy. The correct option is :

A. $6p > 5f > 4d > 5p$

B. $5f > 6p > 4d > 5p$

C. $5f > 6p > 5p > 4d$

D. $6p > 5f > 5p > 4d$

Answer: C

Watch Video Solution

62. Which of the following series of transitions in the spectrum of hydrogen atom fall in visible region?

A. Paschen series

B. Brackett series

C. Lyman series

D. Balmer series.

Answer: D

Watch Video Solution

63. In which of the following, energy of 2s orbital is minimum

A. Li

B. H

C. Na

D. K

Answer: D

Watch Video Solution

64. Which one of the following about an electron occupying the 1s orbital in a hydrogen atom is incorrect ? (The Bohr radius is represented by a_0).

A. The magnitude of the potential energy is double that of its kinetic energy on an average.

B. The probability density of finding the electron is maximum at the nucleus.

C. The total energy of the electron is maximum when it is at a distance ao from the nucleus.

D. The electron can be found at a distance $2a_0$ from the nucleus.

Answer: C

Watch Video Solution

65. The size of the iso-electronic species Cl^-, Ar and Ca^{2+} is affected by:

A. nuclear charge

B. azimuthal quantum number of valence shell

C. electron-electron interaction in the outer orbitals

D. principal quantum number of valence shell.

Answer: A

Watch Video Solution

66. The quantum number of four electrons are given below:

$n = 4, l = 2, m_l = -2, m_s = -1/2$

$n = 3, l = 2, m_l, m_s = +1/2$

$n = 4, l = 1, m_l = 0, m_s = +1/2$

$n = 3, l = 1, m_l = 1, m_s = -1/2$

The correct order of their increasing energies will be:

A. $I < III < II < IV$

B. $IV < II < III < I$

C. $I < II < III < IV$

D. $IV < III < II < I$

Answer: B

Watch Video Solution

67. If p is the momentum of the fastest electron ejected from a metal surface after the irradiation of light having wavelength i, then for 1.5 p momentum of the photoelectron, the wavelength of the light should be (assume kinetic energy of ejected photoelectron to be very high in comparison to work function):

A. $\frac{4}{9}\lambda$

B. $\frac{2}{3}\lambda$

C. $\frac{3}{4}\lambda$

D. $\frac{1}{2}\lambda$

Answer: A

Watch Video Solution

True Or False Type Questions

1. The gas taken in a discharge tube glows when a high voltage is passed into it at 10^{-1} atm.

Watch Video Solution

2. Cathode rays produce .....when they strike metals.

Watch Video Solution

3. The e/m value for cathode rays depends upon the nature of the gas taken in the discharge tube.

Watch Video Solution

4. Canal rays travel in a straight line.

Watch Video Solution

5. The ionising power of α -rays is maximum.

Watch Video Solution

6. Calculate the wavelength of a photon in Angstroms having an energy of 1 electron-volt.

Watch Video Solution

7. Atomic number of an ion is the same as the number of electrons present in it.

Watch Video Solution

8. The symbol ${}_{1}^{3}H$ indicates that the given hydrogen atom has a mass number equal to ..... and atomic number equal to .....

Watch Video Solution

9. Do isobars possess similar chemical properties?

Watch Video Solution

10. All types of waves are electromagnetic in nature.

Watch Video Solution

11. The frequency of an electromagnetic radiation is 2×10^6 Hz. What is its wavelength in metres (Velocity of light $=3 \times 10^8$ ms -1)

Watch Video Solution

12. The radiant energy is emitted or absorbed continuously in the form of photons.

Watch Video Solution

13. Atomic spectra contain well defined discrete lines.

Watch Video Solution

14. According to Bohr, .Angular momentum of an orbiting electron is quantised.. What is meant by this statement ?

Watch Video Solution

15. Bohr's model is unable to explain the stability of an atom.Discuss

Watch Video Solution

16. The transitions corresponding to Lyman series involve very long wavelengths.

Watch Video Solution

17. The kinetic energy of an electron is 4.55×10^{-25} J. Calculate the wavelength, (h=6.6×10^{-34} Jsec,mass of electron=9.1×10^{-31} kg).

Watch Video Solution

18. The position and velocity of earth can be determined simultaneously with a fair degree of accuracy.Comment.

Watch Video Solution

19. A 600 W mercury lamp emits monochromatic radiation of wavelength 331.3 nm. How many photons are emitted from the lamp per second?

Watch Video Solution

Fill In The Blanks Type Questions

1. Calculate the wavelength associated with an electron moving with a velocity of 10^{10} cm per sec.

Watch Video Solution

2. Cathode rays produce .....when they strike metals.

Watch Video Solution

3. The charge on an electron was first determined by .....in by his famous .....experiment.

Watch Video Solution

4. The actual mass of a proton is .....g.

Watch Video Solution

5. The entire mass and positive charge of an atom is concentrated into its.....

Watch Video Solution

6. The light radiations with discrete quantities of energies are called.....

Watch Video Solution

7. How many moles of photon would contain sufficient energy to raise the temperature of 225g of water 21 to 96? Specific heat of water is $4.18 Jg^{-1}K^{-1}$ and frequency of light radiation used is$2.45 \times 10^{9} s^{-1}$.

Watch Video Solution

8. The $2p_x$ and $2p_y, 2p_z,$ orbitals of an atom have identical shapes but differ in their.....

Watch Video Solution

9. An orbital consists a maximum of .....electrons.

Watch Video Solution

10. In Bohr's model, an electron should follow a .....path due to loss of energy.

Watch Video Solution

11. The uncertainty principle and the concept of wave nature of matter were proposed by .....and .....respectively.

Watch Video Solution

12. Which has a higher energy, a photon of violet light with wavelength 4000 A ° or a photon of red light with wavelength 7000 A ° ?

Watch Video Solution

13. The splitting of spectral lines under the influence of magnetic field is called and can be explained with the help of .....quantum number.

Watch Video Solution

14. Wave functions of electrons in atoms and molecules are called.....

Watch Video Solution

15. An acceptable value of wave function should be .....,.....,..... and should be .....at infinite distance.

Watch Video Solution

16. The principal quantum number tells the .....to which electron belongs.

Watch Video Solution

17. The values of l are governed by the value of.....

Watch Video Solution

18. An electron has principal quantum number 3. The number of its (i) sub-shell and (ii) orbitals would be respectively.

Watch Video Solution

19. An f subshell contains .....orbitals.

Watch Video Solution

20. The energy of 6s subshell is .....than that of 4f subshell.

Watch Video Solution

Assertion Reason Type Questions

1. Assertion : 1. In the presence of an electric field, the canal rays are deflected towards the negative electrode.

Reason : Canal rays are composed of electrons which are negatively charged.

A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct and Reason is not the correct explanation of Assertion.

C. If Assertion is correct but Reason is incorrect.

D. If Assertion is incorrect but Reason is correct.

Answer: C

Watch Video Solution

2. Assertion : During α -particles scattering experiment, 99% of the α-particles get deflected through very large angles.

Reason : The nuclei of atoms are positively charged and repel α-particles which are also positively charged.

A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct and Reason is not the correct explanation of Assertion.

C. If Assertion is correct but Reason is incorrect.

D. If Assertion is incorrect but Reason is correct.

Answer: D

Watch Video Solution

3. Assertion : All types of electromagnetic radiation travel with the same E velocity.

Reason : Electromagnetic radiations possess a dual nature, i.e., they behave both as particle andzas wave.

A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct and Reason is not the correct explanation of Assertion.

C. If Assertion is correct but Reason is incorrect.

D. If Assertion is incorrect but Reason is correct.

Answer: B

Watch Video Solution

4. Assertion : An electron always absorbs or emits radiation of definite frequencies during excitation or de-excitation.

Reason : The energy is quantised.

A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct and Reason is not the correct explanation of Assertion.

C. If Assertion is correct but Reason is incorrect.

D. If Assertion is incorrect but Reason is correct.

Answer: A

Watch Video Solution

5. Assertion : The M shell of an atom cannot accommodate more than 18 electrons.

Reason : The maximum possible sets of four quantum numbers for this shell are 18.

A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct and Reason is not the correct explanation of Assertion.

C. If Assertion is correct but Reason is incorrect.

D. If Assertion is incorrect but Reason is correct.

Answer: A

Watch Video Solution

6. Assertion : While filling different subshells in an atom, electrons enter into 3d subshell before filling 4p subshell.

Reason : Electrons prefer to remain unpaired as far as possible.

A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct and Reason is not the correct explanation of Assertion.

C. If Assertion is correct but Reason is incorrect.

D. If Assertion is incorrect but Reason is correct.

Answer: B

Watch Video Solution

Numerical Problems

1. calculate the total number of electrons present in one mole of methane.

(ii) find (a) the total number and (b) the total mass of neutrons is $7mgof^{14}C.$

(Assume that mass of neutron = $1.675 \times 10^{-27} kg$).

(iii) find (a) the total number and (b) the total mas of protons in 34 mg of NH_3 at STP .

will the answer change if the temperature and pressure are changed ?

Watch Video Solution

2. The density of mercury is 13.6 g/mL. The diameter of an atom of mercury assuming that each atom is occupying a cube of edge length equal to the diameter of the mercury atom is approximately

Watch Video Solution

3. Calculate the wavelength of radio waves associated with frequency of $1 \times 10^5 MHz$.

Watch Video Solution

4. A photon of wavelength 4×10^{-7} m strikes on metal surface. The work funcation of the metal being 2.13eV. Calculate (i) the energy of the photon (eV) . (ii) the kinetic energy of the emission, and (ii) the velcoity of the photoelectron $\left(1eV = 1.6020 \times 10^{-19} J\right)$

Watch Video Solution

5. In a hydrogen atom, an electron jumps from the third orbit to the first orbit. Find out the frequency and wavelength of the spectral line.

Watch Video Solution

6. Calculate the wavelength and energy of radiation emitted for the electronic transition from infinity (∞) to stationary state one of the hydrogen atom $\left(\mathrm{R} = 1.09678 \quad \times 10^{7} m^{-1}\right)$

Watch Video Solution

7. The electron energy in hydrogen atom is given by $E = \left(-21.7 \times 10^{-12} \right) \ln^2$ ergs. Calculate the energy required to remove an electron completely from the n=2 orbit. What is the longest wavelength in cm of light that can be used to cause this transition?

Watch Video Solution

8. the mass of an electron is 9.1×10^{-31} kg . If its K.E. is $3.0 \times 10^{-25} J$. Calculate its wavelength .

Watch Video Solution

9. Calculate the uncertainty in position of an electron whose velocity is $3.0 \times 10^4 cms^{-1}$ accurate up to 0.001%. Mass of an electron $= 9.1 \times 10^{-28} g$.

Watch Video Solution

10. The uncertainty in the position and velocity of a particle are 10^{-10} m and 5.27×10^{-24} m s^{-1} respectively. Calculate the mass of the particle $\left(h = 6.625 \times 10^{-34} \text{ Js}\right)$.

Watch Video Solution

11. What is the energy in joules of a single photon of wavelength $250 \times 10^{-9} m$?

Watch Video Solution

12. What transition in the hydrogen spectrum would have the same wavelength as the Balmer transition $n = 4 \rightarrow n = 2 of He^{+}$ spectrum?

Watch Video Solution

13. Calculate the ionisation energy of H atom.

Watch Video Solution

14. The ionisation energy of He^+ is 19.6×10^{-12} J/atom. Calculate the energy of the first stationary state of Li^{2+}.

Watch Video Solution

15. Estimate the difference in energy between 1st and 2nd Bohr orbits for hydrogen atom. At what minimum atomic number, a transition from n = 2 to n=1 energy level would result in the emission of X-rays with $\lambda = 3 \times 10^{-8} m$? Which hydrogen atom like species does this atomic number correspond to?

Watch Video Solution

Ncert Textbook Exercises

1. calculate the number of electrons which will together weigh one gram.

(ii) calculate the mass and charge of one mole of electrons .

Watch Video Solution

2. calculate the total number of electrons present in one mole of methane.

(ii) find (a) the total number and (b) the total mass of neutrons is $7mgof^{14}C.$

(Assume that mass of neutron = $1.675 \times 10^{-27}kg$).

(iii) find (a) the total number and (b) the total mas of protons in 34 mg of NH_3 at STP .

will the answer change if the temperature and pressure are changed ?

Watch Video Solution

3. how many neutrons and protons are there in the following nuclei ?

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

Watch Video Solution

4. write the complete symbol for the atom with the given atomic number (Z) and atomic mass (A).

(i) Z=17 , A=35.

(ii) Z= 92 , A = 233.

(iii) Z= 4 , A= 9.

Watch Video Solution

5. Yellow ligth emitted from a sodium lamp has a wavelength (λ) of 580 nm. Calculate the frequency (v) and wavenumber $(\bar{v})$ of the yellow light .

Watch Video Solution

6. find energy of each of the photons which

(i) correspond to light of frequency $3 \times 10^{15} Hz$.

(ii) have wavelength of 0.50 A.

Watch Video Solution

7. calculate the wavelength frequency and wavenumber of a light wave whose period is $2.0 \times 10^{-10} s$.

Watch Video Solution

8. what is the number of photons of light with a wavelength of 4000 pm that provide 1 J of energy ?

Watch Video Solution

9. A photon of wavelength 4×10^{-7} m strikes on metal surface. The work funcation of the metal being 2.13eV. Calculate (i) the energy of the photon

(eV) . (ii) the kinetic energy of the emission, and (ii) the velcoity of the photoelectron $\left(1eV = 1.6020 \times 10^{-19} J\right)$

Watch Video Solution

10. Electromagnetic radiation of wavelength 242 nm is just sufficient to ionise the sodium atom. What is the ionisation energy of sodium per atom?

Watch Video Solution

11. A 25 watt bulb emits monochromatic yellow light of wavelength of $0.57 \mu m$ calculate the rate of emission o0f quanta per second.

Watch Video Solution

12. electrons are emitted with zero velocity from a metal surface when it is exposed to radiation of wavelength 6800 A . Calculate thrshold

frequency (v_0) and work funcation (W_0) of the metal.

Watch Video Solution

13. what is the wavelength of light emitted when the electron in a hydrogen atom undergoes transition from an energy level with n=4 to and energy level with n=2 ?

(e) $n = 3$ $l = 3$ $m_1 = -3$ $m_s = +1/2$

(f) $n = 3$ $l = 1$ $m_1 = 0$ $m_s = +1/2$

Watch Video Solution

14. how much energy is required to ionise a H atom if the electron occupies n=5 orbitl? Compare answer with the ionization enthalpy of H atom (energy required to remove the electron from n=1 orbit)

Watch Video Solution

15. what is the maximum number of emission lines when the exectied electron of a H atom in n= 6 drops to the ground state ?

Watch Video Solution

16. the energy associated with the first orbit in the hydrogen atom is $-2.18 \times 10^{-18} J \ \text{atom}^{-1}$. What is the energy associated with the fifth orbit ?

(ii) calculate the radius of Bohr's fifth orbit for hydrogen atom .

Watch Video Solution

17. calculate the wavenumber for the longest wavelength transition in the balmer series of atomic hydrogen .

Watch Video Solution

18. what is the energy in joules, required to shift the electron of the hydrogen atom from the first bohr orbit to the fifth bohr orbit and what is the wavelenght of the light emitted when the electron returns to the ground state? The ground state electron energy is -2.18×10^{-11} ergs.

Watch Video Solution

19. The electron energy in hydrogen atom is given by $E_n = -\frac{2.18 \times 10^{-18}}{n^2} J$. Calculate the energy required to remove an electron completely from the n=2 orbit. What is the longest wavelength of light in cm that can be used to cause this transition?

Watch Video Solution

20. Calculate the wavelength of an electron moving with a velocity of $2.05 \times 10^7 ms^{-1}$.

Watch Video Solution

21. the mass of an electron is 9.1×10^{-31} kg . If its K.E. is $3.0 \times 10^{-25} J$. Calculate its wavelength .

Watch Video Solution

22. Which of the following are isoelectronic species i.e, those having the same number of electrons?

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

Watch Video Solution

23. (i) Write the electronic configurations of the following ions:

(a) H^{-} (b) Na^+ (c) O^{2-} (d) F^-

(ii) What are the atomic numbers of elements whose outermost electrons are represented by

$(a) 3s^1 (b) 2p^3$ and $(c) 3p^5$?

(iii) Which atoms are indicated by the following configurations?

$(a) [He] 2s^1 (b) [Ne] 3s^2 3p^3 (c) [Ar] 4s^2 3d^1$.

Watch Video Solution

24. What is the lowest value of n that allows g orbital to exist?

Watch Video Solution

25. An electron is in one of the 3d-orbitals. What are the possible values of n, l and m for this electron?

Watch Video Solution

26. an atom of an element contains 29 electrons and 35 neutrons . Dedue (i) the number of protons and (ii) the electronic configuration of the element.

Watch Video Solution

27. Give the number of electrons in the species H_2^+. H_2, and O_2^+.

Watch Video Solution

28. An tomic obital has n=3 , what are the possible values of l and m_l ?

(ii) List the quantum numbers $(m_l$ and $l)$ of electrons for 3d orbital .

(iii) which of the following orbitals are possible ?

Watch Video Solution

29. Using s,p,d notations, describe the orbital with the following quantum numbers.

(a) n=1, l=0 (b) n=3, l=1

(c) n=4, l=2 (d) n=4, l=3

Watch Video Solution

30. Explain giving reasons, which of the following sets of quantum numbers are not possible?

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

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

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

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

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

(f) $n = 3, l = 1, m_l = 0, m_s = +\frac{1}{2}$

Watch Video Solution

31. How many electrons in an atom may have the following quantum numbers?

(a) $n = 4, m_s = -1/2$ (b) n=3 , l=0

Watch Video Solution

32. Show that the circumference of the Bohr orbit for the hydrogen atom is an integral multiple of the de Broglie wavelength associated with the electron revolving around the orbit

Watch Video Solution

33. What transition in the hydrogen spectrum would have the same wavelength as the Balmer transition $n = 4 \rightarrow n = 2 of He^+$ spectrum?

Watch Video Solution

34. Calculate the energy required for the process

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

The ionization energy for the H atom in the ground state is $2.18 \times 10^{-18} J \text{atom}^{-1}$

Watch Video Solution

35. If the diameter of a carbon atom is 0.15 nm, calculate the number of carbon atoms which can be placed side by side in a straight line across length of scale of length 20 cm long.

Watch Video Solution

36. 2×10^8 atoms of carbon are arranged side by side. Calculate the radius of carbon atom if the length of this arrangement is 2.4 cm.

Watch Video Solution

37. The diameter of zinc atom is 2.6 A .Calculate (a) radius of zinc atom in pm and (b) number of atoms present in a length of 1.6 cm if the zinc atoms are arranged side by side lengthwise.

Watch Video Solution

38. A certain particle carries $2.5 \times 10^{-16} C$ of static electric charge. Calculate the number of electrons present in it.

Watch Video Solution

39. In Millikan's experiment, static electric charge on the medias has been obtained by shining X-rays. if the static electric charge on the oil drop is $-1.282 \times 10^{-18} C$. Calculate the number of electrons present in it.

Watch Video Solution

40. In Rutherford's experiment, generally the thin foil of heavy atoms, like gold, platinum etc. have been used to be bombarded by the α-particles. If the thin foil of light atoms like aluminium etc. is used, what difference would be observed from the above results?

Watch Video Solution

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

Watch Video Solution

42. An element with mass number 81 contains 31.7% more neutrons as compared to protons. Find the symbol of the atom.

Watch Video Solution

43. An ion with mass number 37 possesses one unit of negative charge. If the ion contains 11.1% more neutrons than the electrons, find the symbol of the ion

Watch Video Solution

44. An ion with mass number 56 contains 3 units of positive charge and 30.4% more neutrons than electrons. What would be the symbol of this

ion?

Watch Video Solution

45. Arrange the following type of radiations in increasing order of frequency: (a) radiation from microwave oven (b) amber light from traffic signal (c). radiation from FM radio (d) cosmic rays from outer space and (e) X-rays

Watch Video Solution

46. Nitrogen laser produces a radiation at a wavelength of 337.1 nm. If the number of photons emitted is 5.6×10^{24}. Calculate the power of this laser.

Watch Video Solution

47. Neon gas is generally used in the sign boards. If it emits strongly at 616 nm, calculate (a) the frequency of emission, (b) distance traveled by this radiation in 30 s (c). energy of quantum and (d) number of quanta present if it produces 2 J of energy

Watch Video Solution

48. In astronomical observations, signals observed from the distant stars are generally weak If the photon detector receives a total of $3.15 \times 10^{-18} J$ from the radiations of 600 nm, calculate the number of photons received by the detector.

Watch Video Solution

49. Lifetimes of the molecules in the excited states are often measured by using pulsed radiation source of duration nearly in the nano second range of the radiation source has the duration of a 2ns and the Der of

photons emitted during the pulse source is 2.5×10^{15}, calculate the energy of the source.

Watch Video Solution

50. The longest wavelenght doublet absorption transition is observed at 589 and 589.6 nm. Energy difference between two excited states is

Watch Video Solution

51. The work function for caesium atom is 1.9 eV. Calculate (a) the threshold wavelength and (b) the threshold frequency of the radiation. If the caesium element is irradiated with a wavelength 500 nm, calculate the kinetic energy and the velocity of the ejected photoelectron

Watch Video Solution

52. Following results are observed when sodium metal is irradiated with different wavelength. Calculate (a) threshold wavelength and (b) Planck's constant

$\lambda(nm)$	500	450	400
$v \times 10^{-5}\left(cms^{-1}\right)$	2.55	4.35	5.35

Watch Video Solution

53. The ejection of the photoelectron from the silver metal in the photoelectric effect experiment can be stopped by applying the voltage of 0.35 V when the radiation 256.7 nm is used, Calculate the work function for silver metal.

Watch Video Solution

54. If the photon of wavelength 150pm strikes an atom and one of its inner bound electrons is ejected out with a velocity of 1.5*10^7 m/s. Calculate the energy with which it is bound to the nucleus.

Watch Video Solution

55. Emission transition in the Paschen series end at orbit n=3 and start from orbit n and can be represented as $v = 3.29 \times 10^{15}(Hz)\left[1/3^2 - 1/n^2\right]$

Calculate the value of n if the transition is observed at 1285nm Find the region of the spectrum.

Watch Video Solution

56. Calculate the wavelength for the emission transition if it starts from the orbit having radius 1.3225 nm and ends at 211.6 pm. Name the series to which this transition belongs and the region of the spectrum.

Watch Video Solution

57. Dual behaviour of matter proposed by de-Broglie led to the discovery of electron microscope often used for the highly magnified images of

biological molecules and other type of material. If the velocity of electron in this microscope is $1.6 \times 10^6 ms^{-1}$. calculate de-Broglie wavelength associated with this electron.

Watch Video Solution

58. Similar to electron diffraction, neutron diffraction microscope is also used for the determination of the structure of molecules. If the wavelength used here is 800 pm, calculate the characteristic velocity associated with the neutron

Watch Video Solution

59. If the velocity of an electron in Bohr's first orbit is $2.19 \times 10^6 ms^{-1}$, what will be the de Broglie wavelength associated with it?

Watch Video Solution

60. The velocily associated wiih a proton moving in a potential difference of 1000 V is $4.37 \times 10^5 ms^{-1}$. If the böckey ball of mass 0.1 kg is moving with this velocity, calculate the wavelength associated with this velocity.

Watch Video Solution

61. If the position of the electron is measured within an accuracy of + 0.002 nm, calculate the uncertainty in the momentum of the electron. Suppose the momentum of the electron is $h/4\pi_m \times 0.05nm$, is there any problem in defining this value

Watch Video Solution

62. 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:

1. $n = 4, l = 2, m_i = -2, m_s = -1/2$

2. $n = 3, l = 2, m_l = 1, m_s = +1/2$

3. $n = 4, l = 2, m_l = -2, m_s = -1/2$

4. $n = 3, l = 2, m_i = -1, m_s = +1/2$

5. $n = 3, l = 1, m_l = -1, m_s = +1/2$

$n = 4, l = 1, m_l = 0, m_s = +1/2$

Watch Video Solution

63. The bromine atom possesses 35 electrons. It contains 6 electrons in 2p orbital, 6 electrons in 3p orbital and 5 electrons in 4p orbital. Which of these electron experiences the lowest effective nuclear charge

Watch Video Solution

64. Among the following pairs of orbitals which orbital will experience the larger effective nuclear charge? (i) 2s and 3s, (ii) 4d and 4f, (iii) 3d and 3p

Watch Video Solution

65. The unpaired electrons in Al and Si are present in 3p orbital. Which electrons will experience more effective nuclear charge from the nucleus?

Watch Video Solution

66. Indicate the number of unpaired electrons in: (a) P, (b) Si, (c). Cr, (d) Fe and (e) Kr

Watch Video Solution

67. (a) How many sub-shells are associated with n = 4? (b) How many electrons will be present in the sub-shells having m_s value of $-1/2f$ or $n = 4$?

Watch Video Solution