CHEMISTRY

BOOKS - CBSE COMPLEMENTARY MATERIAL CHEMISTRY (HINGLISH)

STRUCTURE OF ATOM

Multiple Choice Questions Mcq

1. What is the packet of enegry called?

A. Electron

B. Photon

C. Position

D. Proton

Answer: B

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2. Orbital which is not possible

A. 2p

B. 3d

C. 3s

D. 3f

Answer: D

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3. The magnetic quantum number of an atom

is releted to the

A. size of the orbital

B. spin angular momentum

C. orbital angular momentum

D. orientation of the orbital in space

Answer: D

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4. The principal quantum number of an atom

is related to the

A. size of the orbital

B. spin angular momentum

C. orbital angular momentum

D. orientation of the orbital in Space

Answer: A

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5. The designation of a sub-shell with $n = 4$ and $l = 3$ is

A. 4s

B. 4p

C. 4d

D. 4f

Answer: D

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

A. $n = 4$ to n=1

B. n=3 to n=2

C. n=3 to n=1

D. n=2 to n=1

Answer: D

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7. The wave number of the first line of Balmer series of hydrogen is $15200 cm^{-1}$ The wave number of the first Balmer line of Li^{2+} ion is

A. $15200cm^{-1}$

B. $60800cm^{-1}$

C. $76000cm^{-1}$

D. $136, 800cm^{-1}$

Answer: D

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8. An electron is moving in Bohr's fourth orbit. Its de Broglie wavelength is λ. What is the circumference of the fourth orbit?

A. $2/\lambda$

B. 2λ

C. 3λ

D. $3/\lambda$

Answer: C

9. Which of the following statement is correct in relation to the hydrogen atom :

A. 3s-orbital is lower in energy than 3p-orbital

B. 3p-orbital is lower in energy than 3-d-orbital

C. 3s and 3p orbitals all have the same energy

D. 3s, 3p and 3d orbitals all have the same energy

Answer: D

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10. For principle quantum number n=4,the total number of orbitals having l=3 is

A. 3

B. 7

C. 5

D. 9

Answer: B

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11. The number of d-electron retained in Fe^2 (At no. of $Fe = 26$) ion is.

A. 3

B. 4

C. 5

D. 6

Answer: D

12. Pauli exclusion principle helps to calculate the maximum number of electrons that can be accommodated in any

A. orbital

B. subshell

C. shell

D. All of these

Answer: A

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1. Bohr's theory is based on _____ of radiation.

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2. The angular momentum of the electron in the 4th energy shell in the hydrogen atom is _____.

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3. Lines of Balmer series appear in _____ region.

4. The maximum number of electrons in Fe^{3+} (At. No. 26) is _____.

5. Li^{2+} and He^+ ions have spectrum similar to _____ atom.

6. Bohr's atomic theory is not able to explain the atomic spectra of atoms containing _____ electron.

7. An electron in the first shell will have _____ stability and _____ energy than an electron in the third shell.

8. The space or three-dimensional region round the nucleus where there is maximum probability of finding an electron of specific energy is called an____

9. According to ____ no two electrons in an atom will have all the four quantum numbers ____

10. When there are two electron is the same orbitals , they have ....spins.

11. The s-subhells have _____ shape and the p-subshells have_____

12. The maximum number of electrons on a subshell is equal to _____ where l = _____

True And False Type Questions

1. State whether the statement is true or false .Bohr's theory cannot explain the spectra of multi-electron atoms.

2. Bohr's theory based on the Planck's quantum theory.

3. Size of orbital is determined by principal quantum number.

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4. Fe^{2+} ion has more number of unpaired electrons than Fe^{3+}.

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5. The outer electronic configuration of chromium atom is $3d^4 4s^2$

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6. The designation of an orbital n=4 and l=0 is 4s.

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7. All photons of light have same energy.

8. $Fe^{3+} has 3d^5$ configuration

9. The number of subshells is always equal to the order of the orbit.

10. Two electrons in the same orbital has antiparallel spin.

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11. The second orbit in He^+ ion has radius as the first orbit in hydrogen atom.

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12. Heisenberg principle is applicable to microscopic particles.

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13. 3s orbital has 2 radial nodes

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Match The Columns

1. Match the following

	List-I		List-II
a.	Lyman series	p.	Visible region
b.	Balmer series	q.	Infrared region
c.	Paschen series	r.	Absorption spectrum
d.	Brackett series	s.	Ultraviolet region

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2. Match the following

	List-I		List-II
a.	Principal quantum number	p.	Spin of electrons
b.	Azimuthal quantum number	q.	Size of orbital
c.	Magnetic quantum number	r.	Orientation of the orbital
d.	Spin quantum number	s.	Shape of the orbital

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3. Match the following

	List-I		List-II
a.	$2s$	p.	Dough not shape
b.	$2p_x$	q.	Spherical
c.	$3d_{xy}$	r.	Dumb bell
d.	$3d_{z^2}$	s.	Double dumb bell

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4. Match the following

	List-I		List-II
a.	$2s$	p.	Two nodal planes
b.	ψ^2	q.	One radial node
c.	Heisenberg's uncertainty	r.	Electron probability density principle
d.	$3d_{yz}$	s.	Microscopic particles

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1. Assertion : Number of orbitals in 3rd shell is 9.

Reason : Number of orbitals for a particular value of $n = n^2$.

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

   B. If both Assertion & Reason are true but the reason is not the correct explanation

of the assertion.

C. If Assertion is true statement but Reason is false.

D. If both Assertion and Reason are false statements.

Answer: A

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2. Assertion : Two nodal planes are present in

$3d_{xy}$.

Reason : Number of nodal planes = 1

A. If both Assertion & Reason are true and

the reason is the correct explanation of

the assertion.

B. If both Assertion & Reason are true but

the reason is not the correct explanation

of the assertion.

C. If Assertion is true statement but Reason is false.

D. If both Assertion and Reason are false statements.

Answer: C

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3. Assertion : The energy of an electron is mainly determined by principal quantum number.

Reason : The principal quantum number is the measure of the most probable distance of finding the electron around the nucleus.

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

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion.

C. If Assertion is true statement but Reason is false.

D. If both Assertion and Reason are false statements.

Answer: A

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4. Assertion : An orbital cannot have more than two electrons, moreover, if an orbital has two electrons they must have opposite spins.

Reason : No two electrons in an atom can have same set of all the four quantum numbers.

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

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion.

C. If Assertion is true statement but Reason is false.

D. If both Assertion and Reason are false statements.

Answer: A

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1. Write the name of the theory which explain the wave nature of light.

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2. Write the name of the theory which explain the Black body radiations and photo electric effect

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3. If the length of the crest of a wave is 4 pm. Write the wavelength of this wave.

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4. A radiation emitted from a hot iron is photon or quantum ?

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5. Which d-orbital does not have four lobes?

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6. What is the lowest value of n that allows g orbitals to exist?

7. The quantum number not obtained from the schrodinger's wave equation is

8. Define Aufbau principle. Which of the following orbitals are possible ?

1p, 2s, 2p and 3f.

9. Write the name of non-directional subshell.

10. Write the name of quantum number which determines the orientation of orbitals ?

11. Write the name of quantum number which determines the shape of orbitals.

12. How many orbitals are present in g-subshell ?

1 Mark Questions

1. Write the relation between frequency and wave number.

2. Cs shows maximum photoelectric effect, why

?

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3. Distinguish between a photon and

quantum.

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4. Why line spectra is regarded as the fingerprints of atoms ?

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5. What is the value of the Bohr's radius for the third orbit of hydrogen atom?

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6. What type of metals are used in photoelectric cells ? Give one example.

7. Which series of lines of the hydrogen spectrum lie in the visible region'?

8. Mention the physical significance of Ψ and Ψ^2

9. Why did Heisenberg's uncertainty principle replace the concept of definite orbit by the concept of probability?

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10. What is uncertain in uncertainty principle ?

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11. Can a moving cricket ball have a wave character ?

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12. Heisenberg uncertainty principle has no significance in our every day life. Explain.

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13. Write the Schrodinger wave equation.

14. Why uncertainty in position is more when uncertainty in velocity is less for an electron ?

15. What are the four quantum numbers of 19th electron of copper ? (Given : Atomic number of copper = 29)

16. a. How many sub-shell are associated with $n = 4$?

b. How many electron will be present in the sub-shell having m_s value of $-1/2$ for $n = 4$?

17. Write the electronic configuration of Ni^{3+}.

(At. No. of Ni = 28)

18. How many radial and angular nodes are present in 2p orbital.

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2 Mark Questions

1. Define black body and black body radiations.

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

3. What transition of Li^{+2} spectrum will have same wavelength as that of second line of Balmer series in He^+ spectrum ?

4. Calcultte the enrgy required for the process

,

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

The ionization energy for the H-atom in the grounds state is $2.\,18 \times 10^{-18} J atom^{-1}$.

5. Calculate the wave number for the longest wavelength transition in the Balmer series of atomic hydrogen.

6. To which orbit the electron in H atom will jump on absorbing 12.1 eV energy ?

7. Calculate the energy associated with the first orbit of He^+. What is the radius of this orbit?

8. What is the distance of separation between 3rd and 4th orbit of H-atom ?

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9. The energy of the electron in the ground state of H-atom is $-13.6eV$. The energy of the first excited state will be

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10. Calculate the number of protons emitted in 10 hours by a 60 W sodium lamp emitting radiations of wavelength 6000 Å.

11. Which has a higher energy, a photon of violet light with wavelength 4000Ã... or a photon of red light with wavelength 7000Ã...? [$h = 6.62 \times 10^{-34} Js$]

12. A 100 watt bulb emits monochromatic light of wavelength 400 nm. Calculate the number of photons emitted per second by the bulb.

13. What are the maximum number of emission lines when the excited electron of a H atom in n = 4 drops to the ground state ?

14. Which has more energy, light radiation of wavelength 400 pm or light radiation of frequency $10^{15} Hz$?

15. Find the energy of electron in 4th shell of Li^{2+} ion.

16. What is the wave number of an electron with shortest wavelength radiation in Lyman spectrum of He^+ ion?

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17. Write short note on :

Continuous and discontinuous spectrum.

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18. Write short note on :

Absorbtion and emission spectrum.

19. Calculate the mass of a photon with wavelength 3.6Å.

20. Calculate the mass of the photon with wavelength of 5 pm.

21. On the basis of uncertainty principle show that an electron cannot exist with in atomic nucleus. (Given : Nuclear radius = 10^{-15} m)

22. 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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23. What is the difference between the terms orbit and orbital?

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24. 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.

25. Comment on "Bohr's model is against the Heisenberg uncertainty principle".

26. What are the similarities and difference in 2s and $2p_x$ orbitals and 1s and 2s orbitals ?

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27. Draw shape of $d_{x^2-y^2}$ orbital.

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28. With the help of Pauli's exclusion principle and the concept of atomic numbers for orbtials, show that an M shell can not accommodate more than 18 electrons.

29. Designate each subshell with n = 4.

30. List the possible values for all the quantum numbers for the following subshell.

(a) 2p (b) 4f

31. Write down the electronic configuration of Fe^{3+} and Ni^{2+} . How many unpaired electrons are present? (Given Atomic number, Fe = 26, Ni = 28).

32. Out of principal, angular, magnetic and spin quantum number, which quantum number determines the ?

(a) Shape of the orbital

(b) Number of orbitals in an orbit

(c) Size of the orbital

(d) Spin orientation of the electron.

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33. What is Hund's rule of maximum multiplicity ? Explain by taking example of nitrogen.

34. Explain why :

(i) The three electrons present in 2p sub-shell of nitrogen remain unpaired.

(ii) In potassium , the 19th electron enters 4s sub-shell instead of 3d sub-shell.

(iii) Chromium has configuration $3d^5 4s^1$ and not $3d^4 4s^2$.

35. Chromium has the electronic configuration $4s^1 3d^5$ rather than $4s^2 3d^4$ because

36. What is the difference between the notations l and L ?

37. Nitrogen has 7 proton, 7 electron and 7 neutrons. Calculate the number of electron, protons and neutrons in N^{3-} ion.

38. Which one is having higher energy ?

(a) Last electron of Cl^- or last electron of O^{2-}

3 Marks Questions

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

2. From the given data calculate the radius of the third orbit of a hydrogen atom.

3. A bulb emits light of wavelength $4500\,\text{Å}$ .The bulb is rated as 150 W and $8\,\%$ of the energy is emmitted as light. How many photons are emitted by the bulb per second?

4. When light with a wavelength of 400 nm falls on the surface of sodium , electrons with a kinetic energy of 1.05×10^5 J mol^{-1} are emitted .

What is the minimum energy needed to remove an electron from sodium ?

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5. When light with a wavelength of 400 nm falls on the surface of sodium , electrons with a kinetic energy of 1.05×10^5 J mol^{-1} are

emitted .

What is the maximum wavelength of light that will cause a photoelectron to be emitted ?

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6. Calculate the number of waves by a Bohr electron in one complete revolution in its third orbit.

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7. What should be the ratio of the velocities of CH_4 and O_2 molecules so that they are associated with de Broglie waves of equal wavelength?

8. Calculate the wavelength of an electron that has been accelerated in a particle accelerator through a potential difference of 1 kv. $\left[\text{ Given } 1 \text{ eV} = 1.6 \times 10^{-19} J \right]$

9. (i) Discuss the similarities and differences between a 1s and 2s orbital.

(ii) Draw the shape of d_{z^2} .

10. Calculate the wavelength of a tennis ball of mass 60 gm moving with a velocity of 10 m per second. $\left(h = 6.626 \times 10^{-34} kgm^2 s^{-1}\right)$

11. Calculate the wavelength of 1000 kg rocket moving with a velocity of 3000 km/hr. $\left(h = 6.626 \times 10^{-34} kgm^2 s^{-1}\right)$

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12. Calculate the uncertain it in the velocity of a cricket ball of mass 150 g, if uncertainity in its position is of the order of 1 Å.

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13. (a) What is de-Broglie wavelength for an electron moving with velocity of light?

(b) What is the angular momentum of electron in 5th shell?

14. Two particle A and B have wavelength $\lambda_A = 5 \times 10^{-10}m$ and $\lambda_B = 10 \times 10^{10}m$. Find their frequency , wave number and

energies. Which has more penetrating power and why ?

15. (a) Which has max. uncertainty regarding positin and why ? Electron, proton and neutron.

(b) Find the number of waves associated with a light radiation of time period 5 ns.

16. (a) Write the maximum number of electron in a subshell with $l = 3$ and $n = 4$.

(b) Write the maximum number of electron that can be associated with the following set of quantum numbers ? $n = 3$, $l = 1$ and $m_l = -1$

(c) Write the maximum number of electron that can be accomodated in an atom in which the highest principal quantum number value is 4.
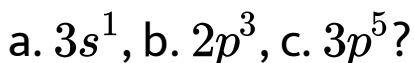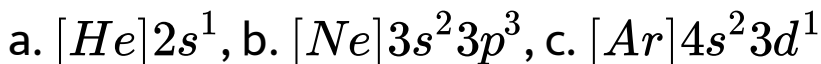
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17. i. Write the electronic conifigurations of the following ions:

a. $H^{\ominus}$, b. $Na^{\oplus}$, c. O^{2-}, d. $F^{\ominus}$

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

a. $3s^1$, b. $2p^3$, c. $3p^5$?

iii. Which atoms are indicated by the following configurations?

a. $[He]2s^1$, b. $[Ne]3s^23p^3$, c. $[Ar]4s^23d^1$

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18. Calculate :

(a) Total number of spherical nodes in 3p orbital.

(b) Total number of nodal planes in 3p orbital.

(c) Nodal planes in 3d orbital.

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5 Marks Questions

1. (a) Define Photoelectric effect ? Mention its one practical application in daily life.

(b) Electrons are emitted with zero velocity from a mental surface when it is exposed to radiation of wavelength 6800 Å. Calculate thresholds freqency (V_o) and work function (W_o) of the mental.

2. (a) The electronic in Bohr's orbit is negative. How will you account for it ?

(b) The ionisation energy of hydrogen atom is 13.6 eV. What will be the energy of the first orbit of He^+ and Li^{2+} ions are ?

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3. (a) Define the following terms :

(i) Threshold frequency (ii) Work function.

(b) The work function for Cs atom is 1 .9 eV.

Find threshold wavelength (λ_0) and threshold frequency (v_0) of this light radiation. If Cs metal is irradiated with a radiation of wavelength 500 nm find kinetic energy and velocity of emitted electron.

4. (a) State de Broglie equation . Write its significance .

(b) A beam of helium atoms moves with a velocity of $2.0 \times 10^3 ms^{-1}$. Find the

wavelength of the particle constituting the beam .

$$\left(h = 6.626 \times 10^{-34} Js\right)$$

5. (a) State Heisenbergs uncertainty principle. Give its mathematical expression. Also give its significance.

(b) Calculate the uncertainity in the position of a dust particle with mass equal to 1 mg if

the uncertainity in its velocity is $5.5 \times 10^{-20} ms^{-1}$.

6. (a) Write short notes on: (i) Aufbau principle (ii) Pauli's principle (iii) Hund's rule.

(b) Write the electronic configuration of the following ions :

(i) Fe^{3+} (ii) Cu^+ [Given Atomic number of Fe and Cu are 26 & 29]

7. (a) Draw the shapes of the following orbitals.

(i) $3d_{xy}$ (ii) d_{x^2}

What is the total number of orbitals associated with the principal quantum number n=3 ?

(c) Using s,p,d,f notations , describe the orbital with the following quantum numbers :-

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8. (a) A neutral atoms has 2K, 8L and 15M electrons. Find the total numbers of electrons in s,p,d and f subshell.

(b) How many unpaired electrons are present in the following ions :

Al^+ , Cr^{2+} , Co^{3+} and Mn^{2+}
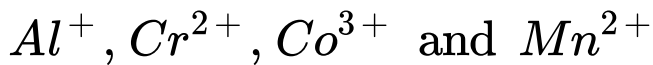
(Given Atomic number : Al=13 , Cr=24 , Co=27 & Mn=25)

(c)One electron is present in 4f subshell. What is the sum $n + l + m_1 + m_s$ values assuming 'f' subshell follows -3 to +3 order of filling electron .

9. Answer the following :

(a) n + l value for 14th electron in an atom.

(b) Increasing order of filling electron in 4f, 5p and 6d subshells.

(c) ' m' and 'l' value for last electron of Mg atom. (Given atomic number of Mg is 12)

(d) Subshell in which last electron is present in Ga. (Given Atomic number of Ga is 31)

(e) Sum of spin of all the electron in element having atomic number 14.

Unit Test

1. Designation for an orbital with n = 4 and l = 3 is

  A. 4s

  B. 4p

  C. 4d

  D. 4f

Answer:

2. Maximum number of unpaired electrons in chromium is (1) (Given: Atomic number of Cr = 24)

A. 4

B. 5

C. 6

D. 7

Answer:

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3. Which series of lines of the hydrogen spectrum lie in the visible region'?

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4. Write the Schrodinger wave equation.

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5. Which of the following is not possible ?

A. 2p

B. 3d

C. 3f

D. 4p

Answer:

6. Write four difference between orbit and orbital

7. Calculate the wave number for the longest wavelength transition in the paschen series of atomic hydrogen.

8. Calculate the uncertainty in the position of

a dust particle with mass equal to 1 mg if the

uncertainty in its velocity is $5.5 \times 10^{-20} ms^{-1}$

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