

the electrons will go to K shell which has minimum energy. It can accommodate 2 electrons. After this, electrons will go to L shell that can accommodate 8 electrons. Thus K and L shells have accommodated 10 electrons. The remaining 1 electron will go to M shell, the outermost shell of maximum energy in this case.

The electronic configuration will be written as:

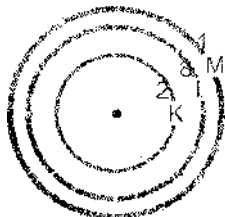
KLM

Therefore, it is simply written as 2, 8 and 1. Further distribution of electrons in subshells will be: $1s^2, 2s^2, 2p^6, 3s^1$.

Q17. Write down the electronic configuration of _____ ion.

Solution:

We know that chlorine has 17 electrons and chloride ion (Cl^-) has $17 + 1 = 18$ electrons. Its electronic configuration will be 2, 8, 8, which is presented in the figure. The further distribution of electrons in subshells will be $1s^2, 2s^2, 2p^6, 3s^2, 3p^6$.



Short Answer Questions

Q1. What is the nature of charge on cathode rays?

Ans. Cathode rays are negatively charged particles. J.J. Thomson discovered the e/m (charge/mass) ratio of cathode rays and found it equal to electron.

Q2. Give five characteristics of cathode rays.

- Ans. i. These rays travel in straight line perpendicular to the cathode surface. ii. They can cast a sharp shadow of an opaque object if placed in their path. iii. They raise temperature of the body on which they fall. iv. J.J. Thomson discovered their e/m ratio. v. Light is produced when these rays hit the sides of the discharge tube.

Q3. The atomic symbol of phosphorous ion is given as $^{31}_{15}P^{3-}$.

- i. How many protons, electrons and neutrons are there in the ion? ii. What is name of the ion. iii. Draw electronic configuration of the ion.

iv. Name the noble gas which has the same electronic configuration as the has.

31

15

Ans. a. No. of Protons 15

No. of neutrons = $31 - 15 = 16$

No. of electrons = 18 (P^{3-} has three more electrons)

b. Phosphide ion

c. KL M

2 8 8

In the form of sub shells: $1s^2, 2s^2, 2p^6, 3s^2, 3p^6$

d. Argon

(24. Differentiate between shell and sub-shell with example. Ans.

Shell	Sub Shell
1. Each principle energy level is called shell.	1. Each shell further contains one or more sub shells.
2. These are represented by K, L, M, N etc.	2. These are represented by s, p, d, f.

(25. An element has an atomic number 17. How many electrons are present in K, L and M shells of the atom?

Ans. Atomic number of element = 17, Its electronic configuration will be

KL M

Or $1s^2, 2s^2, 2p^6, 3s^2, 3p^5$.

2 8 7

(26. Write down the electronic configuration of Al. How many electrons are present in its outermost shell?

Ans. Atomic number of Aluminium = 13, Its electronic configuration is:

KL M

2 8 3

But Al^{3+} ion is formed by losing 3 electrons from Al atom and hence has electronic configuration.

In terms of sub shells. $1s^2,$

$2s^2, 2p^2$.

It has 8 electrons in its outermost shell.

Q7. Magnesium has electronic configuration 2,8,2.

(i) How many electrons are in its outer most shell?

(ii) In which sub shell of the outer most shell electrons are present? (iii)

Why magnesium tend to lose electrons? Ans. (a) K L M

2 8 2

It has two electrons in the outer most shell.

(b) $1s^2, 2s^2, 2p^6, 3s^2$

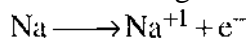
It has electron in s-subshell.

(c) Magnesium is electropositive in character. It has the ability to lose its two electrons from its outer most shell.



Q8. What will be the nature of charge on an atom when it loses an electron or when it gains an electron?

Ans. When an atom loses an electron, It acquires positive charge due to more number of protons in the nucleus e.g.



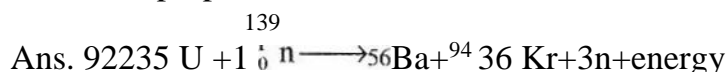
2,8,1 2,8

When an atom gains an electron, It possesses negative charge due to more electron than protons in the atom e.g.



2,8,7 2,8,8

Q9. For what purpose is U-235 used?



A large amount of energy is released which is used to convert water into steam in boilers. The steam then drives the turbines to generate electricity. This is peaceful use of atomic energy.

Q10. A patient has goiter, how will it be detected?

Ans. Isotopes of iodine-131 are used for diagnosis of goiter in thyroid gland.

QII. Give three properties of positive rays.

Ans. (i) They travel in straight line in a direction opposite to cathode rays.

(ii) Their deflection in electric and magnetic field proved that these were positively charged.

(iii) Mass of these particles was found equal to that of proton or simple multiple of it.

Q12. What are the defects of Rutherford's atomic model?

Ans. It had following defects:

(i) According to classical theory, electrons being the charged particles should release or emit energy continuously and they should ultimately fall into the nucleus.

(ii) If the electrons emit energy continuously, they should form a continuous spectrum but in fact, line spectrum was observed.

Q13. As long as electron remains in an orbit; it does not emit or absorb energy. When does it emit or absorb energy?

Ans. The energy is emitted or absorbed only when an electron jumps from one orbit to another.

When an electron jumps from lower orbit to higher orbit it absorbs energy and when it jumps back from higher orbit to lower orbit, it radiates energy. This change in energy is given by following Planck's equation.

Where E_2 Energy of higher energy orbit

E_1 = Energy of lower energy orbit h is Planck's constant its value is 5.63×10^{-34} Js. ν is frequency of light.

Q14. Define plum pudding model. Who presented it?

Ans. Thomson put forth his plum pudding theory.

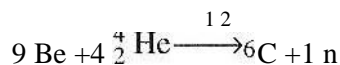
According to this theory.

Atoms are solid structures of positively charge with tiny negative particles stuck inside.

It is like plums in the pudding.

Q15. Who discovered neutrons and how?

Ans. Chadwick discovered neutrons in 1932. He bombarded beryllium with alpha particles. He observed that highly penetrating radiations were produced. These rays were called neutrons.



Q16. Write three properties of neutrons. Ans. The properties of neutrons are.

(i) Neutrons carry no charge.

(ii) They are highly penetrating.

(iii) Mass of neutrons are nearly equal to the, mass of proton.

Q17. Write electronic configuration of an element having 15 electrons.

Ans. The electronic configuration can be written as

KL M

2 8 1

Further distribution of electrons in sub shell will be $1s^2, 2s^2, 2p^6, 3s^1$.

Q18. Write down the electronic configuration of Cl^- ion.

Ans. Chlorine has 17 electrons while chloride (Cl^- ion has $17+1=18$ electrons. Therefore its electronic configuration will be

Cl^- = KL M
Ion

2 8 8

In sub shells electronic configuration will be $1s^2, 2s^2, 2p^6, 3s^2, 3p^6$

Q19. An element has 5 electrons in M shell. Find out its atomic number.

Ans. To have 5 electrons in M shell means its K and L shell are completely filled. Hence its electronic configuration will be

KL M

2 8 5

It means it has

$2 + 8 + 5 = 15$ electrons

As we know that no. of electrons in an atom = no. of protons = atomic number

Therefore its atomic number is 15.

Q20. Write electronic configuration of Fluorine.

Ans. $9F = 1s^2, 2s^2, 2p^5$.

Q21. Write electronic configuration of Aluminium.

Ans. $13Al = 1s^2, 2s^2, 2p^6, 3s^2, 3p^1$. (222. Define isotopes.

Ans. Atoms of an element that have same atomic number but different atomic masses are called isotopes e.g. Hydrogen has three isotopes

Protium (1H) Deuterium (2H) Tritium (3H)

(223. Write names of two isotopes used for the treatment of skin cancer.

Ans. I - Phosphorous — 32 or P-32

2 — Strontium — 90 or Sr-90

These isotopes emit less penetrating beta radiations.

Q24. Write use of Co-60.

Ans. Cobalt-60 emits strongly penetrating gamma rays and hence used for cancer treatment within the body.

Q25. Define radioactive-isotope dating.

Ans. The age determination of very old objects based on the half-lives of the radioactive isotope is called radioactive-isotope dating.

Q26. What is meant by radio carbon dating or carbon dating?

Ans. This is an important method of age determination of old carbon containing objects (fossils) by measuring the radioactivity of C-14 in them is called radio-carbon dating or simply carbon dating.

Q27. What is Dalton's atomic theory?

Ans. In the beginning of 19th century John Dalton put forward atomic theory. According to it.

1. All matter is made up of very small indivisible particles called atoms.
2. An atom is indivisible, hard, dense sphere
3. Atoms of same element are alike
4. They combine in different ways to form compounds (228. Write contribution of J.J. Thomson.)

Ans. J.J. Thomson (1856-1940) was a British physicist. He was awarded the 1906 Nobel Prize in Physics for the discovery of electron and for his work on the conduction of electricity in gases,

(229. What is meant by plum pudding Model?)

Ans. Thomson put forth his "plum pudding" theory. He postulated that atoms were solid structures of positive charge with tiny negative particles stuck inside. It is like plums in the pudding.

Q30. Write contribution of Sir William Crookes.

Ans. Sir William Crookes (1832-1919) was a British chemist and physicist. He was pioneer of vacuum tubes. He worked on spectroscopy.

(231 Write the contribution of Rutherford.)

Ans. Rutherford was a British-New Zealand chemist. He performed a series of experiments using alpha particles. He won the Nobel Prize in Chemistry in 1908. In 1911, he proposed the nuclear model of the atom and performed the first experiment to split atom. Because of his great contributions, he is considered the father of nuclear science.

Q32. Write contribution of Neil Bohr.

Ans. Neil Bohr was a Danish physicist who joined Rutherford in 1912 for his post doctoral research. In 1913, Bohr presented his atomic model based upon Quantum theory. He won the 1922 Nobel Prize for Physics for his work on the structure of an atom.

Q33. What is meant by Quantum?

Ans. Quantum means fixed energy. It is the smallest amount of energy that can be emitted or absorbed as electromagnetic radiation. Quanta are plural of quantum.

(234. Write contribution of max Planck.

Ans. In 1918 Noble prize in physics was awarded to German physicist Max Planck (1858-1947) for his work on the quantum theory

Q35. What is the maximum number of electrons that can be accommodated in p-subshell?

Ans. p-subshell can accommodate maximum six electrons.

Q36. How many subshells are there in second shell?

Ans. There are two subshell[s are present in second shell that is s and p subshells.

Q37. Why does an electron first fill 2P orbital and then 3s orbital?

Ans. An electron first fill 2P orbital because the electrons fill the shells in order of their increasing energy, i.e. lower energy level is occupied first then the higher energy level. So 2P orbital as lower energy level then 3s orbital.

(238. If both K and L shells of an atom are completely filled what is the total number of electrons present in them?

Ans. There are 10 total number of electrons present in K and L shells.

Q39. How many electrons can be accommodated in M shell?

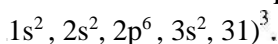
Ans. M shells can accommodate maximum 18 electrons.

(240. What is the electronic configuration of hydrogen atom?

Ans. The electronic configuration of hydrogen atom is $1s^1$.

(241. What is atomic number of phosphorus? Write down its electronic configuration.

Ans. The atomic number of phosphorus is 15 and its electronic configuration is



Q42. If an element has atomic number 13 and atomic mass 27; how many electrons are there in each atom of the element?

Ans. There are 13 electrons are present in each atom of the element.

(243. How many electrons will be in M shell of an atom having atomic number 15.

Ans. There are 5 electrons present in M shell.

Q44. What is maximum capacity of a shell?

Ans. The maximum capacity of shells to accommodate the electrons is as following:

K shell can accommodate 2 electrons.

L shell can accommodate 8 electrons.

M shell can accommodate 18 electrons.

N shell can accommodate 32 electrons.

Q45. How was it proved that the whole mass of an atom is located at its centre?

Ans. Rutherford observed that atomic mass of the element could not be explained on the basis of the masses of electron and proton only. He predicted in 1920 that some neutral particle having mass equal to that of proton must be present in an atom. He proved in his experiment that nucleus is an extremely small positively charged part. It is situated at the center of an atom and carries nearly the whole mass of an atom.

Q46. How was it shown that atomic nuclei are positively charged?

Ans. Rutherford observed in his experiment, that the deflection of a few particles proved that there is a center of positive charges in an atom, which is called 'nucleus' of an atom.

Q47. Name the particles which determine the mass of an atom.

Ans. Proton and neutron are the particles which determine the mass of an atom. These are also known as nucleons.

Q48. What is the classical theory of radiation? How does it differ from quantum theory? Ans.

Classical theory	Quantum theory
According to classical theory, electrons being the charged particles should release or emit energy continuously and they should ultimately fall into the nucleus.	Quantum means fixed energy. It IS the smallest amount of energy that can be emitted or absorbed as electromagnetic radiation.

Q49. How can you prove that angular momentum is quantized?

Ans. Let angular momentum (mvr) of orbit is $mvr = \frac{nh}{2\pi}$ by putting the values of h and $2\pi r$

$$mvr = \frac{6.63 \times 10^{-34}}{2 \times 3.14} = 1.0 \times 10^{-34} \text{ kg m}^2 \text{ s}^{-1}$$

[Rt angular momentum (mvr) of 2^{11} orbit is $mvr = \frac{nh}{2\pi}$

by putting the values of h and $2\pi r$

$$mvr = \frac{2 \times 6.63 \times 10^{-34}}{2 \times 3.14} = 2.08 \times 10^{-34} \text{ kg m}^2 \text{ s}^{-1}$$

(250, Do you know any element having no neutrons in its atoms?

Ans. Yes the isotope of hydrogen (Protium) has no neutron. (251.

Who discovered an electron, proton and neutron?

Ans. In 1886, Goldstein discovered positively charged particles called protons. In 1897, J.J.

Thomson found in an atom, the negatively charged particles known as electrons. In 1932

Chadwick discovered neutron.

Q 52. How does electron differ from a neutron?

Ans.

Electrons	Neutrons
Electron is the negative charge particle	Neutron is the neutral particle
Electron is revolving around the nucleus	Neutron is present in the nucleus

(253. Explain how anode rays are formed from the gas taken in the discharge tube.

Ans. Anode rays do not originate from the anode. In fact these rays are produced when the cathode rays or electrons collide with the residual gas molecules present in the discharge tube and ionize them as follows:



Q54. Why do the isotopes of an element have different atomic masses?

Ans. Because the isotopes of an element have different number of neutrons

(255. How many neutrons are present in C- 12 and C -13?

Ans. In C— 12 there are six neutrons present and in C-13 there are seven neutrons present in the nucleus.

Q56. Which of the isotopes of hydrogen contains greater number of neutrons?

Ans. Isotopes of hydrogen tritium has greater number of neutrons. It has 2 neutrons.

(257 Give one example each of the use of radioactive isotope in medicine and radiotherapy.

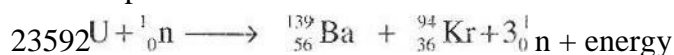
Ans. A radioactive Isotope uscd in medicine IS Iodine-131. Radioactive Isotope used in Radiotherapy is P-32, Sr-9() and Co-6().

(258. How is the goiter in thyroid gland detected?

Ans. Isotope of Iodine- 131 is used for diagnosis of goiter in the thyroid gland.

Q59. Define nuclear fission reaction.

Ans. Nuclear fission is the type of nuclear reaction in which an isotopic element is bombarded with slow moving neutrons that isotope of element emits three neutrons and split into same other isotopic elements.



Q6(). When U-235 breaks up, it produces a large amount of energy. How is this energy used?

Ans. ${}_{92}^{235}\text{U} + \text{n} \longrightarrow \text{1st B a} + \text{+30 n} + \text{energy.}$

During this reaction, a large amount of energy is released which may be used to convert water into steam in boilers. The steam then drives the turbines to generate electricity. In this way, this energy is used for peacetill development of a nation.

Q61. How many neutrons are produced in the fission reaction of U-235. Ans.

${}_{92}^{235}\text{U} + {}_0^1\text{n} \longrightarrow {}_{56}^{139}\text{Ba} + 3{}_0^1\text{n} + \text{energy}$ During this reaction three neutrons are produced.

(262. U-235 fusion produces two atoms of which elements? .

Ans. ${}_{92}^{235}\text{U} + {}_0^1\text{n} \longrightarrow {}_{56}^{139}\text{Ba} + {}_{36}^{94}\text{Kr} + 30{}_0^1\text{n} + \text{energy}$

The isotopes of barium and krypton are produce by the fission of U-235.