Lakhmir Singh solutions for class 9 chemistry Chapter 4: Structure of Atom

Question 1:

Which subatomic particle is not present in an ordinary hydrogen atom?

ANSWER:

The subatomic particle that is not present in an ordinary hydrogen atom is neutron.

Question 2:

Name the scientists who described the arrangement of electrons in an atom.

ANSWER:

Neils Bohr was the scientist who described the arrangement of electrons in an atom.

Question 3:

What is the maximum number of electrons which can be accommodated in the K shell of an atom?

ANSWER:

2 electrons can be accommodated in the K shell of an atom.

Question 4:

What is the maximum number of electrons which can be accommodated in the L shell of an atom?

ANSWER:

The maximum number of electrons that can be accommodated in the L shell of an atom given by
$2(n)^2$, where n is the number of shell.

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Therefore, number of electrons in L (2^{nd}) shell

$2 \times 2^2 = 2 \times 4 = 8$

Question 5:

What is the maximum number of electrons an M shell of the atom can accommodate?

ANSWER:

For 3^{rd} (M) energy level, n = 3.

The maximum number of electrons that can be accommodated in the M (3^{rd}) shell of an atom is
$2 \times 3^2 = 2 \times 9 = 18$

Question 6:

What is the maximum number of electrons that can go into the N shell of an atom?

ANSWER:

N is the 4^{th} shell in an atom
For 4^{th} energy level, n = 4.

The maximum number of electrons that can be accommodated in N shell of an atom is
$2 \times 4^2 = 2 \times 16 = 32$

Question 7:

What is the maximum number of electrons which can be accommodated in the :

(a) innermost shell of an atom?

(b) outermost shell of an atom?

ANSWER:

(a) The innermost shell of an atom can accommodate 2 electrons.
(b) The outermost shell of an atom can accommodate 8 electrons.

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Question 8:

Name the three subatomic particles present in an atom.

ANSWER:

The three subatomic particles present in an atom are: electron, proton and neutron.

Question 9:

Name the negatively charged particle present in the atoms of all the elements.

ANSWER:

Electron (symbol: e^-) is the negatively charged particle present in the atoms of all elements.

Question 10:

Name the scientist who discovered electron.

ANSWER:

J. J. Thomson discovered electron (e^-).

Question 11:

What is the usual symbol for (a) and electron (b) a proton, and (c) a neutron?

ANSWER:

(a) The symbol of an electron is e^-.
(b) The symbol of a proton is p^+.
(c) The symbol of a neutron is n.

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Question 12:

State whether the following statements are true or false :

(a) Thomson proposed that the nucleus of an atom contains protons and neutrons.

(b) The cathode rays obtained from all the gases consist of negatively charged particles called electrons.

(c) The anode rays obtained from all the gases consist of positively charged particles called protons.

ANSWER:

(a) False - Rutherford proposed that nucleus consist of neutrons and protons.
(b) True
(c) False - anode ray is a beam of positive ions or cations.

Question 13:

Name the central part of an atom where protons and neutrons are held together.

ANSWER:

The nucleus is the central part of an atom where protons and neutrons are held together.

Question 14:

What are the various letters used by Bohr to represent electron shells in an atom?

ANSWER:

K, L, M, and N are the letters used by Niels Bohr to represent electron shells in an atom.

Question 15:

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

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ANSWER:

The particles which actually determine the mass of an atom are neutrons and protons.

Question 16:

Name the positively charged particle present in the atoms of all the elements.

ANSWER:

The proton is a positively charged particle present in the atoms of all elements.

Question 17:

What is the electronic configuration of a hydrogen atom?

ANSWER:

Electronic configuration of a hydrogen atom is: K = 1

Question 18:

How many times is a proton heavier than an electron?

ANSWER:

We know,
Mass of an electron = 9.1×10^{-31} kg
Mass of a proton = 1.6×10^{-27} kg

Thus, a proton is 1840 times heavier than an electron.

Question 19:

Name the gas which produces anode rays consisting of protons in the discharge tube experiment.

ANSWER:

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Hydrogen gas produces anode rays consisting of protons in the discharge-tube experiment.

Question 20:

Which part of an atom was discovered by Rutherford's alpha particle scattering experiment?

ANSWER:

The nucleus was discovered in Rutherford’s alpha particle-scattering experiment.

Question 21:

What is the positive charge on the nucleus of an atom due to?

ANSWER:

The positive charge in the nucleus of an atom is due to the presence of protons.

Question 22:

State the number of electrons present in the outermost shell of the atoms of the following elements :

(i) Neon

(ii) Chlorine

ANSWER:

(a) 8 electrons are present in the outermost shell of Neon
(b) 7 electrons are present in the outermost shell of Chlorine

Question 23:

Which shell of an atom can accommodate a maximum of :

(a) 8 electrons?

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(a) 32 electrons?

ANSWER:

(a) L shell of an atom can accommodate a maximum of 8 electrons.
(b) N shell of an atom can accommodate a maximum of 32 electrons.

Question 24:

Name the shell of an atom which can accommodate a maximum of :

(a) 2 electrons?

(b) 18 electrons?

ANSWER:

(a) K shell of an atom can accommodate a maximum of 2 electrons.
(b) M shell of an atom can accommodate a maximum of 18 electrons.

Question 25:

Which subatomic particle was discovered by :

(i) Chadwick?

(ii) Thomson?

(iii) Goldstein?

ANSWER:

(i) Neutron was discovered by James Chadwick.
(ii) Electron was discovered by J.J Thomson.
(iii) Proton was discovered by Goldstein.

Question 26:

Name the subatomic particle whose relative charge is :

(a) +1

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(b) –1

(c) 0

ANSWER:

(a) A Proton has a relative charge of +1.
(b) An electron has a relative charge of –1.
(c) The neutron has a relative charge of 0.

Question 27:

Fill in the blanks in the following statements :

(a) The number of protons in the nucleus of an atom is called its .....

(b) The total number of protons and neutrons in the nucleus of an atom is called its .....

(c) An atom has atomic mass number 23 and atomic number 11. The atom has ..... electrons.

(d) An atom of an element has 11 protons, 11 electrons and 12 neutrons. The atomic mass of the atom is .....

(e) If the nucleus of an atom has atomic number 17, mass number 37 and there are 17 electrons outside the nucleus, the number of neutrons in it is .....

(f) Almost all the mass of an atom is concentrated in a small region of space called the .....

(g) Cathode rays are a beam of fast moving .....

(h) The anode rays obtained from hydrogen gas consist of particles called .....

(i) The maximum number of electrons that can be accommodated in L shell are .....

(j) The maximum number of electrons that can go into the M shell is .....

(k) The subatomic particle not present in a hydrogen atom is .....

(l) The electron has ..... charge, the proton has ..... charge, and the neutron has ..... charge.

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ANSWER:

(a) The number of protons in the nucleus of an atom is called its atomic number.
(b) The total number of protons and neutrons in the nucleus of an atom is called its mass number.
(c) In general, an atom has an atomic mass number 23 atomic number 11 and 11 electrons.
(d) An atom of an element has 11 protons, 11 electrons and 12 neutrons. The atomic mass of an atom is 23.
(e) If the nucleus of an atom has atomic number 17, mass number 37 and there are 17 electrons outside the nucleus, the number of neutrons in it is 20.
(f) All the mass of an atom is concentrated in a small region called the nucleus.
(g) Cathode rays are a beam of fast moving electrons.
(h) The anode rays obtained from hydrogen gas consist of protons.
(i) The maximum number of electrons that can be accommodated in the L shell are 8.
(j) The maximum number of electrons that can be accommodated in the M shell is 18.
(k) The subatomic particle not present in a hydrogen atom is neutron.
(l) An electron has negative charge, a proton has positive charge, and a neutron has no charge.

Question 28:

What is an electron? State its relative mass and charge.

ANSWER:

An electron (e^-) is a fundamental subatomic particle with a negative elementary electric charge. Its mass is $1/1840^{th}$ of that of a hydrogen atom.

Question 29:

What is the absolute mass and charge of an electron?

ANSWER:

The absolute mass of an electron is approximately 9.108×10^{-28}.
Its absolute charge is 1.6×10^{-19} C.

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Question 30:

Give the evidence for the existence of nucleus in an atom.

ANSWER:

The evidence for the existence of a nucleus in an atom comes from these observations in Rutherford's experiment:
(1) Few of the rays get deviated from their path.
(2) One out of 12000 rays return on their path

From these two observations, the following conclusions can be drawn that support the existence of a nucleus in an atom: -
(1) Deviation shows the presence of some positive particle.
(2) The returning back of the ray on its own path shows, there is something which is solid in nature and its number (i.e $1/12000^{th}$ ray) shows the particle is very small in size.

Question 31:

What important information is furnished about the nucleus of an atom by the alpha particle scattering experiment of Rutherford?

ANSWER:

Some important facts about the nucleus of an atom gathered after Rutherford's alpha-particle scattering experiment are –
1. The scattering of alpha particles was due to the repulsion from a positively charged centre in the gold foil.
2. The heavy central part of the atom was called nucleus. The nucleus of an atom is positively charged and is extremely hard and dense.
3. The nucleus of an atom is very small as compared to the size of an atom as a whole and is concentrated in the centre of an atom.

Question 32:

How was it shown that an atom has a lot of empty space within it?

ANSWER:

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Rutherford's alpha- particle scattering experiment demonstrated that there is a lot of empty space in an atom. Almost all the alpha particles passed through the gold foil without any deflection. This is possible only when a higher fraction of space in an atom is empty.

Question 33:

Why is an atom neutral inspite of the presence of charged particles in it?

ANSWER:

An atom consists of protons which are positively charged, neutrons which are neutral and electrons which are negatively charged. The number of electrons is same as the number of protons. So, the two opposite charges balance each other and the atom remains neutral.

Question 34:

(a) Which of the nuclear particles is present in the same fixed number in the atoms of any particular element?

(b) What do we call this number which is characteristic of a particular element?

ANSWER:

(a) The number of protons present in the atom of any particular element i.e., the atomic number is fixed.
(b) This number which is the characteristic of a particular element is called its atomic number.

Question 35:

What is a proton? State its relative mass and charge.

ANSWER:

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Protons are the fundamental particles in an atom that carry one unit positive charge and have a mass, which is almost equal to that of a hydrogen atom. The relative mass of a proton is 1 U. The relative charge of a proton is +1.

Question 36:

What is the absolute mass and charge of a proton?

ANSWER:

Absolute mass of a proton is 1.6×10^{-24} gram.
Absolute charge of a proton is 1.602×10^{-19} coulomb .

Question 37:

How does a proton differ from an electron?

ANSWER:

Difference between protons and neutrons:
Based on charge: Protons are positively charged subatomic particles, whereas electrons are negatively charged particles.
Based on mass: Mass of a proton is approximately 1840 times more than the mass of an electron.

Question 38:

State two observations which show that atom is not indivisible.

ANSWER:

Two observations, which show that an atom is divisible are-

(1) Discharge-tube experiment:

In J. J. Thomson's experiment, the stream of cathode rays in the gas-discharge tube shows the presence of negatively charged subatomic particles called electrons.

(2) In Goldstein's experiment, the faint red glow in the gas discharge tube shows the

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presence of positively charged subatomic particles called protons.

These experiments show that atoms are divisible and made up of subatomic particles, electrons, protons and neutrons.

Question 39:

All the gases from cathode rays and anode rays when electricity is passed through them :

(i) What does the formation of cathode rays tell us about the atoms?

(ii) What does the formation of anode rays tell us about the atoms?

ANSWER:

(i) A cathode ray is a stream of high velocity electrons that are produced in a vacuum tube between a negatively charged cathode and a positively charged anode. Formation of cathode rays tells about the presence of electrons in all the atoms.
(ii) When a perforated cathode is used in a discharge tube, another set of rays travelling in the direction opposite to that of the cathode rays is seen. These rays are called anode rays. Formation of anode rays tells about the presence of protons in all the atoms.

Question 40:

What do you understand by the term "electronic configuration" of an element? Write down the electronic configuration of oxygen (At. No. = 8).

ANSWER:

Electron configuration is the distribution of electrons of an atom in various shells or orbits of the atom (K, L, M etc.).
Electronic configuration of oxygen (atomic no = 8) is

K_2 L_6K2 L6

Question 41:

An element has an atomic number 12. How many electrons will be present in the K, L and M energy shells of its atom?

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ANSWER:

Electronic configuration of element with atomic number 12 is:

K_2 L_8 M_2K2 L8 M2

There will be 2 electrons in the K shell, 8 electrons in the L shell and 2 electrons in the M shell of its atom.

Question 42:

(a) What is the nucleus of an atom and what is the nature of charge on it?

(b) Name the scientist who discovered the nucleus of atom.

ANSWER:

(a) The nucleus is a very dense region at the centre of an atom, consisting of protons and neutrons. The charge of the nucleus is positive as it contains protons which are positively charged and neutrons which are neutral.

(b) Ernest Rutherford discovered the nucleus of an atom.

Question 43:

Name the particles used by Rutherford in his experiment on the discovery of nucleus. Also state the charge on these particles.

ANSWER:

Rutherford used Alpha particles in his experiment.
These particles are positively charged.

Question 44:

An element has atomic number 13 and an atomic mass of 27.

(a) How many electrons are there in each atom of the element ?

(b) How are these electrons distributed in the various energy levels ?

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ANSWER:

(a) The atomic number of given element is 13 which is defined by the number of protons in an atom. Thus, there are 13 e^-(s) in each atom of the given element because in a neutral atom, number of protons is equal to the number of electrons.

(b) Electronic configuration of given element (2,8,3) is

K = 2; L = 8; M = 3

Question 45:

Write the distribution of electrons in an atom of element whose atomic number is 18. What is special about the outermost electron shell (or valence shell) of the atom of this element?

ANSWER:

Atomic number is 18
Electron configuration or the distribution of electrons in this atom is :

(2, 8, 8), i.e.,

K = 2; L = 8; M = 8.

The special thing about the outermost shell of this atom is that it is completely filled with electrons. The element will be inert in nature.

Question 46:

What is a neutron? State its relative mass and charge.

ANSWER:

A neutron is a subatomic particle denoted by symbol 'n'. It has no net electric charge and has a mass slightly more than that of a proton. The neutron is a neutral particle found in the nucleus of an atom. Its relative mass is 1u.

Question 47:

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Compare an electron, a proton and a neutron in respect of their relative masses and charges.

ANSWER:

Relative masses: relative mass of a neutron is 1u, that of a proton is also 1u and that of an electron is (1/1840) u.

Charge: Charge of a proton is +1, that of an electron is –1 and that of a neutron is zero.

Question 48:

What is a proton? How does it differ from a neutron?

ANSWER:

A proton is a positively charged particle found in the atoms of all elements.
Protons carry a positive charge, whereas neutrons are neutral.

Question 49:

Compare an electron and a proton in respect of mass and charge.

ANSWER:

The relative mass of a proton is 1u, as the mass of the proton is almost same as that of a hydrogen atom. The relative mass of an electron is (1/1840) u, as the mass of an electron is $1/1840^{th}$ of the mass of a hydrogen atom.
A proton is positively charged, whereas an electron is negatively charged.

Question 50:

Compare a proton and a neutron in respect of mass and charge.

ANSWER:

Proton: The relative mass of a proton is 1u and its absolute mass is approximately 1.602×10^{-24}g. Charge on a proton is +1.

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Neutron: Relative mass of a neutron is 1u and its absolute mass is approximately 1.602×10^{-24}g . Charge on a neutron is zero.

Question 51:

How does an electron differ from a neutron?

ANSWER:

Electron	Neutron
• Relative mass is 1/1840 u	• Relative mass is 1u
• Absolute mass is 9×10^{-28} g	• Absolute mass is 1.602×10^{-24} g
• Charge is -1	• It is neutral

Question 52:

State the location of electrons, protons and neutrons in an atom.

ANSWER:

In an atom, the position of subatomic particles is as follows:

Protons: They are positively charged particles present at the centre of the nucleus of an atom.
Neutrons: They are neutral subatomic particles also present in the nucleus of an atom.
Electrons: They are negatively charged particles which revolve in particular orbits around the nucleus of an atom.

Question 53:

Fill in the following blanks :

Atomic Number	*Mass Number*	*Protons*	*Neutrons*	*Electrons*	*Symbol*
10	22	.....	.....	.....	.....

ANSWER:

ATOMIC NO.	MASS NO.	PROTONS	NEUTRONS	ELECTRONS	SYMBOL
10	22	10	12	10	Ne

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Question 54:

Fill in the following blanks in respect of an atom of an element :

No. of protons	*No. of neutron*	*Mass number*	*Atomic number*	*No. of electrons*	*Symbol*
11	12	.....	.....	.....	.....

ANSWER:

NO. OF PROTONS	NO. OF NEUTRONS	MASS NO.	ATOMIC NO.	NO. OF ELECTRONS	SYMBOL
11	12	23	11	11	Na

Question 55:

(a) What are cathode rays? What is the nature of charge on cathode rays?

(b) Explain how, cathode rays are formed from the gas taken in the discharge tube.

(c) What conclusion is obtained from the fact that all the gases from cathode rays?

ANSWER:

(a) In an experiment, Thomson passed electricity at high voltage through a gas, in a discharge tube. Stream of minute particles were emitted by the cathode. This stream of particles was called cathode ray as it was emitted from the cathode.
Nature of cathode rays: Cathode rays consist of small negatively charged particles called electrons.

(b) Formation of cathode rays: When electricity at high voltage is passed through a gas taken in a discharge tube, streams of minute particles are given out by the cathode. This happens because the gas taken in the discharge tube consists of atoms, and all the atoms contain electrons. When high electrical voltage is passed, the electrical energy excites and pushes out some of the electrons from the atoms of the gas. These fast moving electrons form the cathode rays.

(c) Formation of cathode rays show that one of the subatomic particles present in all atoms is the negatively-charged electrons.

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Question 56:

(a) Describe Thomson's model of the atom. Which subatomic particle was not present in Thomson's model of the atom?

(b) The mass number of an element is 18. It contains 7 electrons. What is the number of protons and neutrons in it? What is the atomic number of the element?

ANSWER:

(a) Thomson proposed a model of an atom that is similar to a Christmas pudding. The electrons, in a sphere of positive charge, are like currants (dry fruits) in a spherical Christmas pudding. We can also compare an atom to a watermelon. The positive charge in the atom is spread all over like the red edible part of the watermelon, while the electrons are studded in the positively charged sphere like the seeds in the watermelon.

Thomson proposed that:
(i) An atom consists of a positively charged sphere and the electrons are embedded in it.
(ii) The negative and positive charges are equal in magnitude. So, the atom as a whole is electrically neutral.

This model did not tell us about the presence of neutrons in the atom.

Although Thomson's model explained that atoms are electrically neutral, the results of experiments carried out by other scientists could not be explained by this model, as we will see below.



Neutron was not considered in Thomson's model of the atom.

(b) When mass number is 18 and number of electrons is 7, then:
(i) No. of protons = No. of electrons = 7
(ii) No. of neutrons = Mass no. – No. of protons = 18 – 7 = 11
(iii)Atomic no. = 7

Question 57:

(a) Describe the Rutherford's model of an atom. State one drawback of Rutherford's model of the atom.

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(b) The mass number of an element is 23 and it contains 11 electrons. What is the number of protons and neutrons in it? What is the atomic number of the element?

ANSWER:

(a) Rutherford's model of atom-

Ernest Rutherford was interested in knowing how the electrons are arranged within an atom. He conducted an experiment in which a thin gold foil was bombarded with fast moving alpha (α) particles.

• He selected a gold foil because he wanted a layer as thin as possible. The gold foil was about 1000 atoms thick.
• The particles used for bombarding the gold foil were doubly-charged helium ions. Since, they have a mass of 4 u, the fast-moving α particles have a considerable amount of energy.
• It was expected that α particles would be deflected by the sub-atomic particles in the gold atoms. Since, the α particles were much heavier than the protons, he did not expect to see large deflections.
But the α particle scattering experiment produced totally unexpected results.

The following observations were made:

(i) Most of the fast moving α-particles passed straight through the gold foil.
(ii) Some of the α-particles were deflected by the foil by small angles.
(iii) Surprisingly, one out of every 12000 particles appeared to rebound.

Conclusions:

(i) The first observation led to the conclusion that most of the atom is hollow.
(ii) The small angle deviation of the α particles confirms the presence of a positively charged centre called nucleus.
(iii) The third observation confirms that the nucleus of an atom is solid as the ray returns on its path and is very small in size because 1 out of 12000 rays returns.

Drawbacks of Rutherford's model of the atom
The major drawback of Rutherford's model is that it does not explain the stability of an atom. The orbital revolution of an electron is not expected to be stable. Any particle in a circular orbit would undergo acceleration. During acceleration, charged particles would radiate energy. Thus, the revolving electron would lose energy and finally fall into the nucleus. If this were so, the atom should be highly unstable. Therefore, matter would not exist in the form that we know. However, we know that atoms are stable. So, this model could not explain this reasoning.

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(b) Given:
Mass no. = 23
No. of electrons = 11,
No of protons = No. of electrons = 11
No. of neutrons = 23 – 11 = 12
Atomic number of the element = 11

Question 58:

(a) Describe Bohr's model of the atom. How did Neils Bohr explain the stability of atom?

(b) An element has an atomic number of 11 and its mass number is 23. What is the arrangement of electrons in the shells? State nuclear composition of an atom of the element.

ANSWER:

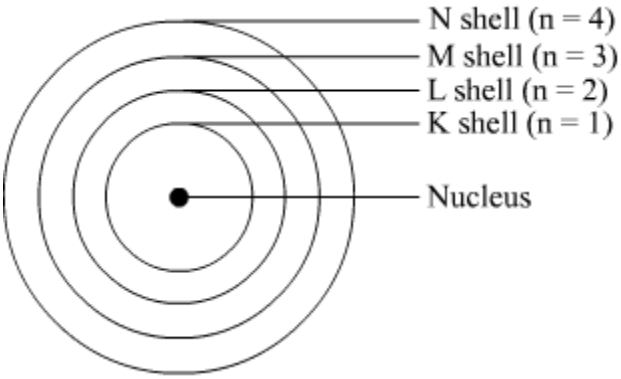
(a) Bohr's model of atom

An atom is made up of three particles: electrons, protons, and neutrons.

(i) The protons and neutrons are located in a small nucleus at the centre of the atom.
(ii) The electrons revolve rapidly around the nucleus in fixed circular paths called energy levels or shells.
(iii) There is a limit to the number of electrons that each energy level can hold.
(iv) Each energy level is associated with a fixed amount of energy.
(v) There is no change in the energy of electrons as long as they keep revolving in the same energy level, and the atom remains stable.

Niels Bohr explained the stability of the atoms through the concept of revolution of electrons in different energy levels. The change in the energy of an electron occurs when it jumps from a lower energy level to a higher energy level or vice versa. When it gains energy, it jumps from a lower energy level to a higher energy level, and when it loses energy it comes down from a higher energy level to a lower energy level. In this way, energy is not lost and the atom remains stable.

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A few energy levels in an atom

(b).Given: Atomic no. = 11
Mass no. = 23,
Electronic configuration – (2, 8, 1)

K	L	M
2	8	1

Nuclear composition of an atom of the element is – 11 protons and 12 neutrons

Question 59:

(a) What is meant by (i) atomic number, and (ii) mass number, of an element? Explain with the help of an example.

(b) What is the relation between the atomic number and mass number of an element?

(c) If an element M has mass number 24 and atomic number 12, how many neutrons does its atom contain?

ANSWER:

(a)
(i) Atomic number is the number of protons in the nucleus of an atom. In other words, each element has a unique number that identifies how many protons or electrons are present in one atom of that element. For example, all hydrogen atoms contain one proton and have an atomic number of 1. All carbon atoms contain six protons or electrons and have an atomic number of 6.

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(ii) The mass number (A), also called atomic mass number or nucleon number, is the total number of protons and neutrons (together known as nucleons) in an atomic nucleus. The mass number is different for each isotope of a chemical element. This is not the same as the atomic number (Z), which denotes the number of protons in a nucleus. Thus, it uniquely identifies an element. Therefore, the difference between the mass number and the atomic number gives the number of neutrons (N) in a given nucleus: N = A − Z.
Example- One atom of Na contains 11 protons and 12 neutrons; so its mass no. is 23.

(b) Relation between mass number and atomic number:

Mass No. = Atomic no. + No. of neutrons

(c) No. of neutrons = Mass No. - Atomic no.
= 24 – 12 = 12

Question 60:

Rutherford's alpha particle scattering experiment led to the discovery of :

(a) Nucleus

(b) Electrons

(c) Protons

(d) Neutrons

ANSWER:

(a) Nucleus

Rutherford conducted an experiment using alpha particles which led to the discovery of a nucleus situated at the centre of an atom.

Question 61:

Which of the following is the correct electronic configuration of sodium?

(a) 2, 8, 1

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(b) 8, 2, 1

(c) 2, 1, 8

(d) 2, 8, 2

ANSWER:

(a) 2, 8, 1

2, 8, 1 is the correct electronic configuration as the first shell can accommodate 2 electrons and second shell can accommodate 8 electrons. When the inner shell is full, electrons are filled in the outer shell.

Question 62:

The particle not present in an ordinary hydrogen atom is :

(a) proton

(b) neutron

(c) nucleus

(d) electron

ANSWER:

(b) neutron
A hydrogen atom H_{11}H11 has 1 proton and 1 electron, but it does not have any neutron.

Question 63:

The subatomic particle called electron was discovered by :

(a) J.J. Thomson

(b) Neils Bohr

(c) James Chadwick

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(d) E. Goldstein

ANSWER:

(a) J.J. Thompson
J.J. Thompson discovered electrons by conducting a cathode-ray experiment.

Question 64:

Which of the following represents the correct electron distribution in magnesium ion?

(a) 2, 8

(b) 2, 8, 1

(c) 2, 8, 2

(d) 2, 8, 3

ANSWER:

(a) 2,8
Magnesium ion, Mg^{2+} has 10 electrons; so, its electronic configuration is 2, 8.

Question 65:

The correct electronic configuration of a chloride ion is :

(a) 2, 8

(b) 2, 8, 4

(c) 2, 8, 8

(d) 2, 8, 7

ANSWER:

(c) 2, 8, 8
Chloride ion, Cl^- has 18 electrons; so, its electronic configuration is 2, 8, 8.

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Question 66:

Goldstein's experiments which involved passing high voltage electricity through gases at very low pressure resulted in the discovery of :

(a) electron

(b) proton

(c) nucleus

(d) neutron

ANSWER:

(b) protons
Goldstein's experiment, which involved passing high-voltage electricity through gases at very low pressure, resulted in the discovery of protons.

Question 67:

The number of electrons in the atom of an element X is 15 and the number of neutrons is 16. Which of the following is the correct representation of an atom of this element ?

(a) X_{1531}X1531

(b) X_{1631}X1631

(c) X_{1516}X1516

(d) X_{1615}X1615

ANSWER:

(a) X_{1531}X1531

In an atom, the number of electrons is equal to number of protons ,which in turn is equal to the atomic number of the element. Also, the sum of number of protons and neutrons represents the mass number of the element. Therefore, the correct option is (a).

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Question 68:

The ion of an element has 3 positive charges. The mass number of atom of this element is 27 and the number of neutrons is 14. What is the number of electrons in the ion?

(a) 13

(b) 10

(c) 14

(d) 16

ANSWER:

(b) 10
Mass number of the element = 27
Number of neutrons = 14
Number of protons = mass number – number of neutrons
= 27 – 14 = 13
As the ion of this element has 3 positive charges, it means that it has lost 3 electrons.
Therefore, there are now 10 electrons in the ion.

Question 69:

The first model of an atom was given by :

(a) Neils Bohr

(b) Ernest Rutherford

(c) J.J. Thomson

(d) Eugen Goldstein

ANSWER:

(c) J.J. Thompson

J.J. Thompson gave the first model of an atom.

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Question 70:

Which of the following statement is always correct?

(a) an atom has equal number of electrons and protons

(b) an atom has equal number of electrons and neutrons

(c) an atom has equal number of protons and neutrons

(d) an atom has equal number of electrons, protons and neutrons

ANSWER:

(a) An atom has equal number of protons and electrons

An atom always has equal number of protons and electrons in order to maintain electrical neutrality.

Question 71:

From the symbol P_{15}^{31}P1531, state :

(i) mass number of phosphorus,

(ii) atomic number of phosphorus, and

(iii) electron configuration of phosphorus.

ANSWER:

(i) Mass no. = 31
(ii) Atomic no. = 15
(iii) Electronic configuration: (2, 8, 5)

That is,

K_2 L_8 M_5K2 L 8 M5

Question 72:

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The atom of an element *X* has 7 electrons in its M shell.

(a) Write the electronic configuration of element *X*.

(b) What is the atomic number of element *X*?

(c) Is it a metal or a non-metal?

(d) What type of ion will be formed by an atom of element *X*? Write the symbol of the ion formed.

(e) What could element *X* be?

ANSWER:

(a) Electronic configuration of the element X is
Element X: K_2 L_8 M_7 K2 L 8 M7

(b) Atomic number of the element X will be 17.

(c) Element X is a non-metal because there are 7 electrons in its outermost orbit. In order to complete its octet (to get 8 electrons), it will gain one electron. An element which gains electrons in order to complete its octet is a non-metal.

(d) The element will form an anion by gaining an extra electron in order to complete its octet.
Symbol of an ion of X will be X^-.

(e) X is Chlorine.

Question 73:

An atom of element E contains 3 protons, 3 electrons and 4 neutrons :

(a) What is its atomic number?

(b) What is its mass number?

(c) Write the electronic configuration of the element E.

(d) State whether element E is a metal or non-metal. Why?

(e) What type of ion, cation or anion, will be formed by an atom of element E? Why?

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(f) Write the symbol of the ion formed by an atom of element E.

(g) What could element *X* be?

ANSWER:

(a) Its atomic number is 3.

(b) Mass no. = 3 + 4 = 7

(c) Electronic configuration is

K_2 L_1K2 L1

(d) Element E is a metal because in order to complete its octet, the element loses 1 electron from its outermost orbit and attains a stable configuration with 2 electrons in its first shell. Elements which lose electrons to attain stability are called metals.

(e) A Cation will be formed by an atom of element A because its outermost single electron can be easily donated.

(f) E^+

(g) Element X is lithium.

Question 74:

An atom of an element *X* may be written as X_{49}X49.

(a) What does the figure 9 indicate?

(b) What does the figure 4 indicate?

(c) What is the number of protons in atom *X*?

(d) What is the number of neutrons in atom *X*?

(e) What is the number of electrons in atom *X*?

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(f) How many electrons are there in the outermost shell of an atom of element *X*?

(g) Write the symbol of ion formed by an atom of element *X*.

ANSWER:

(a) Figure 9 indicates the mass number.
(b) Figure 4 indicates the atomic number.
(c) No. of protons in atom X = 4
(d) No. of neutrons in atom X = 9 – 4 = 5
(e) No. of electrons in atom X = 4
(f) Electrons in the outermost shell of an atom of element X = 2
(g) X^{2+}

Question 75:

The electronic configuration of an element Z is 2, 8, 8.

(a) What is the atomic number of the element?

(b) State whether element Z is a metal or a non-metal.

(c) What type of ion (if any) will be formed by an atom of element Z? Why?

(d) What is special about the outermost electron shell of the atom of this element?

(e) Give the name and symbol of element Z.

(f) Name the group of elements to which Z belongs.

ANSWER:

(a) Atomic no. of the element = 18.
(b) Element Z is a non-metal
(c) Element Z will not form any ion because its outermost shell is complete.
(d) Outermost electronic shell of the atom of this element is completely filled with electrons.
(e) Name of element Z is Argon Symbol is Ar.
(f) Z belongs to the noble gases group or the zero group of the periodic table.

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Question 1:

The total number of electrons in a nitrogen atom is 7. Find the number of valence electrons in it.

ANSWER:

Nitrogen contains 7 electrons. So, the electronic configuration is 2, 5. As the outermost orbit has 5 electrons, there are 5 valence electrons in it.

Question 2:

What is the general name of the elements having 8 electrons in the valence shell of their atoms?

ANSWER:

The general name given to the elements with 8 electrons in their outermost orbit is noble gases.

Question 3:

Which noble gas has less than 8 electrons in the valence shell of its atom? What is this number?

ANSWER:

Helium is the noble gas which has less than 8 electrons in the valence shell of its atom. Its atomic no. is 2.

Question 4:

State one use of radioactive isotopes in medicine.

ANSWER:

Radioactive isotopes are used as tracers in medicine to detect the presence of tumours and blood clots.

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Question 5:

Give one example of a radioactive isotope which is used as a fuel in the reactors of nuclear power plants.

ANSWER:

Uranium-235 is used as a fuel in the reactors of nuclear power plants.

Question 6:

Name the radioactive isotope which is used in the treatment of cancer.

ANSWER:

Cobalt-60 is a radioactive isotope used in the treatment of cancer.

Question 7:

Which radioactive isotope is used to determine the activity of thyroid gland?

ANSWER:

Iodine-131 is a radioactive isotope of iodine used to determine the activity of the thyroid gland.

Question 8:

State one use of radioactive isotopes in industry.

ANSWER:

Radioactive isotopes are used in industries to detect the leakage in underground oil pipelines, gas pipelines and water pipes.

Question 9:

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State whether the following statement is true or false :

Radioactive isotope of iodine is used for making the medicine called tincture iodine.

ANSWER:

The given statement is false.

The true statement is, iodine-131, the radioactive isotope of iodine is used as a tracer to determine the manner and rate of iodine intake by the thyroid gland in our body.

Question 10:

What name is given to those atoms which contain the same number of protons and electrons but different number of neutrons?

ANSWER:

Atoms which contain the same number of protons and electrons, but different number of neutrons are known as isotopes of an element.

Question 11:

What is the relationship between an atom containing 11 protons, 11 electrons and 11 neutrons, and another atom containing 11 protons, 11 electrons and 12 neutrons?

ANSWER:

As the number of electrons and protons are same but the number of neutrons are different, these atoms are isotopes of each other.

Question 12:

What name is given to the pair of atoms such as N_{7}^{14}N714 and N_{7}^{15}N715 ?

ANSWER:

The given elements are isotopes of nitrogen because they contain the same number of protons and electrons but different number of neutrons.

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Question 13:

What name is given to those isotopes which have unstable nuclei and emit various types of radiations ?

ANSWER:

Radioactive isotopes are the isotopes that have unstable nuclei and emit various types of radiation.

Question 14:

Fill in the following blanks in respect of an atom of an element :

Number of protons	*Number of neutrons*	*Mass number*	*Atomic number*	*Number of electron*	*Valency*
11	12	.....	.....	.....	.....

ANSWER:

No. of protons	No. of neutrons	Mass no.	Atomic no.	No. of electrons	Valency
11	12	23	11	11	1

Question 15:

Complete the following statements :

(a) Magnesium has 2 valence electrons in the ..... shell.

(b) The valency of nitrogen in N_2 molecule is .....

(c) Isotopes have different mass numbers because their nuclei contain different number of .....

(d) Some boron atoms have mass number 10 and some have mass number 11. These boron atoms with different mass numbers are called .....

ANSWER:

(a) Magnesium has 2 valence electrons in the M shell.
(b) The valency of nitrogen in N_2 molecule is 3.

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(c) Isotopes have different mass numbers because their nuclei contain different number of neutrons.
(d) Some boron atoms have mass number 10 and some have mass number 11. These boron atoms with different mass numbers are called isotopes.

Question 16:

The nucleus of an atom has 5 protons and 6 neutrons. What would be the (a) atomic number, (b) mass number, (c) the number of electrons, and (d) the number of valence electrons, per atom of this element?

ANSWER:

(a) Atomic number = 5
(b) Here, mass no. = 6 + 5 = 11
(c) No. of electrons = 5
(d) Here no. of valence electrons per atom of the element is 3.

Question 17:

Write the electronic configuration of the element with atomic number 17. Indicate the valency of the element.

ANSWER:

Atomic number is 17
So, the no. of protons and no. of electrons is 17.

Electronic configuration is

$K_2L_8M_7$K2L8M7

Here, the outermost orbit has 7 electrons. In order to make it 8, the element will have to gain 1 electron. So, the valency of the element is 1.

Question 18:

The atomic number of an element X is 16.

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(a) Write down the electronic configuration of X.

(b) What will be the valency of X ?

ANSWER:

Atomic No. of X = 16
Electronic configuration of X is

$K_2L_8M_6$K2L8M6

Here, the outermost orbit has 6 electrons. In order to make it 8, X will have to gain 2 electrons. So, the valency of X is 2.

Question 19:

What valencies will be shown by the elements A, B, C, D and E having atomic number 2, 4, 8, 10 and 13 respectively.

ANSWER:

Elements	Atomic no.	No. of protons	Electronic configuration	Valence electrons	valency
A	2	2	2	2	0
B	4	4	2, 2	2	2
C	8	8	2, 6	6	2
D	10	10	2, 8	8	0
E	13	13	2, 8, 3	3	3

Question 20:

Give one use each of the following radioactive isotopes :

(a) Uranium-235

(b) Cobalt-60

ANSWER:

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(a) Uranium-235:
It is used as a fuel in nuclear reactors of nuclear power plants for generating electricity.

(b) Cobalt-60:
It is used in the treatment of cancer cells.

Question 21:

Explain why H_{13}H13 and H_{23}H23 are not considered isotopes.
ANSWER:

Isotopes are the atoms of an element with the same atomic number but different mass numbers. There are three isotopes of hydrogen atom, namely protium (H_{11})(H11), deuterium (H_{12})(H12) and tritium (H_{13})(H13). H_{13}H13 and H_{23}H23 are not considered as isotopes because they do not have the same atomic number. Such atoms that have same mass number but different atomic numbers are called isobars.

Question 22:

What is the reason for the different atomic masses of the isotopes of an element ?

ANSWER:

It has been found that, in nature, atoms of certain elements might have the same number of protons i.e., same atomic number but different mass numbers. This difference in the masses of isotopes of an element is due to difference in the number of neutrons in their nuclei.

Question 23:

What is the reason for the identical chemical properties of all the isotopes of an element ? Explain with the help of an example.

ANSWER:

Many elements consist of a mixture of isotopes.The chemical properties of isotopes are similar. This is due to the fact that isotopes of an element have the same atomic number, which means that they have the same number of valence electrons.

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Their physical properties are slightly different because the mass numbers of the isotopes are different.
For example- Cl_{17}^{35}Cl1735 and Cl_{17}^{37}Cl1737 show identical chemical properties as they have the same number of valence electrons (7).

Question 24:

What is the reason for the slightly different physical properties of all the isotopes of an element ?

ANSWER:

The mass numbers of the isotopes of an element are slightly different. So, the physical properties of isotopes are slightly different from each other.

Question 25:

Explain why, the atomic masses of many elements are in fractions and not whole numbers.

ANSWER:

The mass of an atom of any natural element is taken as the average mass of all the naturally-occurring atoms of that element. If an element has no isotopes, then the mass of its atom would be the same as the sum of the protons and neutrons in it. But if an element occurs in isotopic forms, then we have to know the percentage of each isotopic form and then calculate the average mass.

average atomic mass of chlorine=$35\times[\frac{75}{100}]+37[\frac{25}{100}]$ $=\frac{262}{5100}+\frac{925}{100}$ $=26.25+9.25$ $=35.5$ u

average atomic mass of chlorine=$35\times\frac{75}{100}+37\frac{25}{100}$ $=\frac{2625}{100}+\frac{925}{100}$ $=26.25+9.25$ $=35.5$ u

Therefore, the masses of certain elements are in fractions and not whole numbers.

Question 26:

Which of the following are isotopes and which are isobars ?

Argon, Deuterium, Calcium, Tritium, Protium

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ANSWER:

Deuterium (H_{12})(H12), protium (H_{11})(H11) and tritium (H_{13})(H13) are isotopes of hydrogen.

Ar_{1840} and Ca_{2040}Ar1840 and Ca2040 (Argon and Calcium, respectively) are isobars with same mass number but different atomic numbers.

Question 27:

Hydrogen has three isotopes written as :

$H_{11},\ H_{12},\ H_{13}$H11, H12, H13

Explain why :

(i) these isotopes have almost identical chemical properties.

(ii) they are electrically neutral.

ANSWER:

(i) The chemical properties of isotopes of hydrogen are similar because they have the same number of protons, which means that they have the same number of electrons that are responsible for the chemical nature of the isotopes.
(ii) All of them have 1 electron and 1 proton. So, they are electrically neutral.

Question 28:

Given that the percentage abundance of the isotope Ne_{1020}Ne1020 is 90% and that of the isotope Ne_{1022}Ne1022 is 10%, calculate the average atomic mass of neon.

ANSWER:

Isotopes of Neon are Ne_{1020} and Ne_{1022}Ne1020 and Ne1022 with 90% and 10% abundance, respectively.

average atomic mass of Neon$=20\times[_{90100}]+22[_{10100}]$ $=_{1800100}+_{220100}$ $=18.00+2.2$ $=20.2$ uaverage atomic mass of Neon$=20\times90100+2210100$ $=1800100+220100$ $=18.00+2.2$ $=20.2$ u

Question 29:

What are isobars ? Explain with an example.

ANSWER:

Isobars are atoms of different chemical elements that have the same mass number but different atomic number i.e., same number of protons but different number of neutrons.

For example, Ar_{18}^{40} and Ca_{20}^{40}Ar1840 and Ca2040 are isobars with same mass number but different atomic numbers.

Question 30:

For the symbols H, D and T, write the subatomic particles (protons, neutrons and electrons) found in each one of them.

ANSWER:

H- 1 proton, 1 electron and no neutron.
D- 1 proton, 1 electron and 1 neutron.
T- 1 proton, 1 electron and 2 neutrons.

Question 31:

An element has Z = 7. What is the valency of the element ? Also name the element.

ANSWER:

We know that protons are present in the nucleus of an atom. It is the number of protons of an atom that determines its atomic number. It is denoted by 'Z'. Here,
Atomic number = 7
Number of electrons = 7
Electronic configuration is

K_2L_5K2L5

There are 5 electrons in the outermost orbit. So, in order to complete its octet the atom will

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have to gain 3 electrons. Therefore, the valency of the atom is 3.
Given element is nitrogen.

Question 32:

(a) What are valence electrons? Where are valence electrons situated in an atom ?

(b) What is the number of valence electrons in the atoms of an element having atomic number 13 ? Name the valence shell of this atom.

ANSWER:

(a) In an atom, the electrons are arranged in different shells. The electrons found in the outermost orbit of an atom are called valence electrons.
So, valence electrons are situated in the outermost orbit of an atom.

(b) The electronic configuration of the element with atomic number 13 is (2, 8, 3). There are 3 valence electrons present in the outermost shell in the given element.
Valence shell of this atom is M.

Question 33:

(a) What are isotopes ? Explain by giving an example.

(b) Give one similarity and one difference between a pair of isotopes.

(c) Give the number of protons, neutrons and electrons per atom in the two isotopes of chlorine Cl_{1735}Cl1735 and Cl_{1737}Cl1737.

ANSWER:

(a) Isotopes are the atoms of the same element with the same atomic number but different mass numbers. It means that the isotopes have same number of electrons and protons but different number of neutrons. For example, hydrogen has three isotopes- protium, deuterium and tritium .
Here, all three of them have same atomic number i.e. 1 but different mass numbers.

(b) Similarity –A pair of isotopes have the same atomic number.
Difference – A pair of isotopes have different mass numbers.

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(c) In Cl_{17}^{35}Cl1735, there are 17 protons, 17 electrons and 18 neutrons.
In Cl_{17}^{37}Cl1737, there are 17 protons, 17 electrons and 20 neutrons.

Question 34:

(a) What are radioactive isotopes ? Give two examples of radioactive isotopes.

(b) Give any two uses of radioactive isotopes.

(c) An element Z contains two naturally occurring isotopes Z_{17}^{35}Z1735 and Z_{17}^{37}Z1737. If the average atomic mass of this element be 35.5 u, calculate the percentage of two isotopes.

ANSWER:

(a) Those isotopes which are unstable due to the presence of extra neutrons in their nuclei and emit various types of radiations are called radioactive isotopes. The radiations emitted are in the form of alpha particles, beta particles and gamma rays.
Common examples of radioactive isotopes are Arsenic−74, Iodine−131 and Cobalt−60.

(b) Uses of isotopes−
(i) Cobalt−60 is used in the treatment of cancer cells. When the high−energy gamma radiations emitted by cobalt−60 isotopes are directed at the cancerous tumours , the cells are burnt.
(ii) Iodine−131 is used as a tracer to determine the rate at which the thyroid gland takes up iodine.

(c) Average atomic mass of Z = 35.5u
Let the % of isotope with mass number 35 be x
Then the % of isotope with mass number 37 will be 100−x.

Average atomic mass of chlorine $= 35[_{x100}]+37[_{100-x100}]35=_{35x100}+_{37(100-x)100}x=75$Aver age atomic mass of chlorine = 35x100+37100-x10035=35x100+37100-x100x=75

It means that the % of the isotope Cl_{17}^{35}Cl1735 is 75 and the % of the isotope Cl_{17}^{35}Cl1735 is 25.

Question 35:

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(a) Define valency of an element. What valency will be shown by an element having atomic number 14 ?

(b) What is the relation between the valency of an element and the number of valence electrons in its atoms ? Explain with examples.

ANSWER:

(a) Valency of an element is the number of electrons which an atom of the element loses or gains or shares during a chemical reaction, in order to complete its octet.
By sharing electrons an element with atomic number 14 will show a valency of 4, as it has 4 electrons in its outermost shell. Electronic configuration (2,8,4).

(b) The electrons present in the outermost shell of an atom are known as the valence electrons. The valency of an element is either equal to the number of valence electrons in its atom or equal to the number of electrons required to complete eight electrons in the valence shell.
When an atom has to lose an electron to completely fill its outermost orbit , the valency of the atom is equal to the number of the valence electrons. But when an atom has to gain electrons in order to complete its octet, valency of the atom is equal to the number of electrons gained and not the number of valence electrons.
For example, in chlorine (atomic number = 17), the number of valence electrons is 7, but here the atom will not lose these electrons. Here, the atom will gain 1 electron to complete its octet. Therefore, here the valency will be 1.
On the other hand, if we consider the example of magnesium (atomic number = 12), the number of valence electrons is 2. Here, the atom will lose 2 electrons to fill its outermost orbit. Therefore, the valency is also 2.

Question 36:

The mass number of two atoms X and Y is the same (40 each) but their atomic number are different (being 20 and 18 respectively). X and Y are examples of :

(a) chemically similar atoms

(b) isotopes

(c) solid and liquid metals

(d) isobars

ANSWER:

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(d) Isobars

Isobars are the atoms of different elements with same mass number but different atomic numbers.

Question 37:

Which of the following statement is correct about the atom of an element ?

(a) an atom can have only protons and neutrons but no electrons.

(b) an atom can have only electrons and neutrons but no protons

(c) an atom can have only electron and proton but no neutron

(d) an atom must always have a proton, neutron and electron

ANSWER:

(c) an atom can have only electron and proton but no neutron

An atom must have a proton and an electron, but it may not have a neutron. For example, in hydrogen atom, there is 1 proton, 1 electron but no neutron.

Question 38:

There are two species represented as ^{35}Cl and ^{37}Cl. Which of the following statement is correct regarding these species ?

(a) they have different chemical properties

(b) their physical properties are the same

(c) they have the same number of protons

(d) they are isobars of the same element

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ANSWER:

(c) they have same number of protons

As the mass numbers are different, the correct option is (c). They have the same number of protons.

Question 39:

The radioactive isotope used in the treatment of cancer is :

(a) plutonium-239

(b) arsenic-74

(c) cobalt-60

(d) iodine-131

ANSWER:

(c) cobalt-60

Cobalt-60 is used in the treatment of cancer. High-energy gamma rays emitted by cobalt-60 isotopes destroy cancerous tumours.

Question 40:

Elements having valency 'one' are :

(a) always metals

(b) always non-metals

(c) always metalloids

(d) either metals or non-metals

ANSWER:

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(d) either metals or non metals

Elements with valency 1 can be either metals or non-metals.
When an atom loses one electron to gain stability, it is a metal. When an atom gains an electron to complete its octet it is a non-metal.

Question 41:

In a sample of ethyl ethanoate ($CH_3COOC_2H_5$), the two oxygen atoms have the same number of electrons but different number of neutrons. Which of the following is the correct reason for it ?

(a) one of the oxygen atoms has gained electrons

(b) one of the oxygen atoms has gained protons

(c) the two oxygen atoms are isotopes

(d) the two oxygen atoms are isobars

ANSWER:

(c) the two oxygen atoms are isotopes

As the number of protons is same but the number of neutrons is different, the mass number of the two oxygen atoms is different. So, these two are isotopes of each other.

Question 42:

Which of the following elements does not exhibit electrovalency ?

(a) calcium

(b) chromium

(c) carbon

(d) cadmium

ANSWER:

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(c) carbon

Carbon has 4 electrons in its outermost orbit. It completes its octet by sharing 4 electrons.

Question 43:

The number of valence electrons in a graphite atom is :

(a) 2

(b) 4

(c) 3

(d) 5

ANSWER:

(b) 4
Graphite is an allotrope of carbon. It is made up of all C atoms. The atomic number of carbon is 6; so, the number of valence electrons is 4.

Question 44:

The atomic number of four elements A, B, C and D are 12, 13, 15 and 3 respectively. The element which cannot form a cation is :

(a) A

(b) B

(c) C

(d) D

ANSWER:

(c) C
Element C has 15 electrons; so, the electronic configuration is 2 , 8 , 5. This element will gain 3 electrons in order to complete its octet; so, it cannot form cations.

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Question 45:

The number of valence electrons in a sulphide ion, S^{2-}, is :

(a) 16

(b) 10

(c) 9

(d) 8

ANSWER:

(d) 8

Atomic number of a sulphur atom S is 16. It has 6 electrons in its outermost orbit. After gaining 2 electrons it becomes S^{2-}. So, now the outermost orbit will have 8 electrons.

Question 46:

For an element, Z = 9. The valency of this element will be :

(a) 4

(b) 2

(c) 1

(d) 3

ANSWER:

(c) 1
Atomic number is 9, which means that number of electrons is also 9. Electronic configuration is 2 , 7. So, the atom will gain 1 electron to complete its octet. Therefore, the valency is 1.

Question 47:

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Four elements W, X, Y and Z contain 8, 11, 9 and 17 protons per atom respectively. The element which cannot form an anion is most likely to be :

(a) W

(b) X

(c) Y

(d) Z

ANSWER:

(b) X

Element X can't form anions as the outermost orbit contains only 1 electron. The atom will rather lose this electron to complete its octet and will become a cation.

Question 48:

The four atomic species can be represented as follows. Out of these, the two species which can be termed isobars are :

(a) $X_{60\ 201}$X60 201

(b) $X_{61\ 200}$X61 200

(c) $X_{58\ 200}$X58 200

(d) $X_{60\ 203}$X60 203

ANSWER:

(b) (ii) and (iii)

X_{61200} and X_{58200}X61200 and X58200 are isobars because they have the same mass number but different atomic numbers.

Question 49:

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There are four elements P, Q, R and S having atomic numbers of 4, 18, 10 and 16 respectively. The element which can exhibit covalency as well as electrovalency will be :

(a) P

(b) Q

(c) R

(d) S

ANSWER:

(d) S
Element S has electronic configuration 2, 8, 6. It can exhibit covalency as well as electrovalency.

Question 50:

The atomic number of an element X is 8 and that of element Y is 4. Both these elements can exhibit a valency of :

(a) 1

(b) 2

(c) 3

(d) 4

ANSWER:

(b) 2

Atomic number of element X is 8.
Electronic configuration is 2, 6. It will gain 2 electrons to complete its octet; so, its valency is 2.
Atomic number of Y is 4.
Electronic configuration is 2, 2. It will lose 2 electrons in order to completely fill its outermost orbit . So, the valency of Y is also 2.

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Question 51:

The isotopes of an element contain :

(a) same number of neutrons but different number of protons

(b) same number of neutrons but different number of electrons

(c) different number of protons as well as different number of neutrons

(d) different number of neutrons but same number of protons

ANSWER:

(d) different number of neutrons but same number of protons

Isotopes are the atoms of the same element with the same atomic number but different mass numbers. It means that they have the same number of protons and electrons but different number of neutrons.

Question 52:

What is the number of valence electrons in :

(a) sodium ion, Na^+

(b) oxide ion, O^{2-}

ANSWER:

(a) Atomic number of sodium atom = 11
In Na^+ ion, there are only 10 electrons. The electronic configuration is 2 , 8. Therefore, the number of valence electrons in sodium ion is 8.

(b) Atomic number of oxygen atom = 8
In O^{2-} ion, there will be 10 electrons, as it has gained two electrons. The electronic configuration is 2, 8. Therefore, the number of valence electrons in O^{2-} is 8.

Question 53:

Atom A has a mass number 209 and atomic number 82.

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Atom B has a mass number 209 and atomic number 83.

(i) How many protons atom A has ?

(ii) How many protons atom B has ?

(iii) Are atoms A and B isotopes of the same element ?

ANSWER:

Atom A – A_{82}^{209}A82209
Atom B – A_{83}^{209}A83209

(i) A has 82 protons as the atomic number is 82.
(ii) B has 83 protons as the atomic number is 83.
(iii) No, A and B are not isotopes of each other because their atomic numbers are not same.

Question 54:

Which of the following pairs are isotopes ? Give reasons for your choice :

(i) A_{2658}, B_{2858}A2658, B2858 or (ii) X_{3579}, Y_{3580}X3579, Y3580
ANSWER:

(i) Atoms of the same element can have different numbers of neutrons; the different possible versions of each element are called isotopes. A_{2658}A2658 and B_{2858}B2858 are not isotopes because they have different atomic numbers.
(ii) X_{3579}X3579and Y_{3580}Y3580 are isotopes as they have same atomic number.

Question 55:

Three different atoms of oxygen are represented as :

$O_{8\ 16}$, $O_{8\ 17}$O8 16, O8 17 and $O_{8\ 18}$O8 18

(i) What do the subscripts (lower figures) and superscripts (upper figures) represent ?

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(ii) What factor is responsible for the change in the superscripts 16, 17 and 18, though the element is the same ?

(iii) What is the usual name for such atoms of an element ?

(iv) Give the nuclear composition of $O_{8\ 18}$O8 18

ANSWER:

(i) Subscript represents atomic number, whereas superscript represents atomic mass.
(ii) Number of neutrons is responsible for the change in superscripts.
(iii) Isotope is the usual name for such atoms of an element.
(iv) Nuclear composition of O_{818}O818 is-
No. of protons = 8
No. of neutrons = 18 − 8 = 10

Question 56:

The atomic species *A* and *B* have different number of protons but the same number of nucleons. On the other hand, the atomic species *X* and *Y* have the same number of protons but different number of nucleons. Which pair is an example of isobars ? Why ?

ANSWER:

Atoms of different elements with different atomic numbers but same mass number are known as isobars.
Here, A and B are the examples of isobars, as they have same number of nucleons.

Question 57:

Composition of the nuclei of two atomic species A and B is given as under :

	A	B
Protons :	18	20
Neutrons :	22	20

Give the mass numbers of A and B. What is the relation between the two species and which element or elements they represent ?

ANSWER:

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Mass number is the sum of the number of neutrons and the number of protons. So, mass number of A and B is 40. As the mass number of A and B is same, the two are isobars. Therefore, A represents Argon (Ar^{40}_{18})Ar1840 while B represents (Ca^{40}_{20})Ca2040 Calcium.

Question 58:

Which of the following pairs are isobars ?

(i) A^{58}_{26}A2658, B^{58}_{28}B2858

(ii) X^{79}_{35}X3579, Y^{80}_{35}Y3580

Give reasons for your choice.

ANSWER:

A^{58}_{26}A2658 and B^{58}_{28}B2858 are isobars because they have same number of nucleons i.e. their mass numbers are same but atomic number is different.

Question 59:

The number of protons, neutrons and electrons in particles A to E are given below :

Particle	*Protons*	*Neutrons*	*Electrons*
A	17	18	17
B	3	4	2
C	18	22	18
D	17	20	17
E	9	10	10

Giving reasons, find a pair of isotopes from the above particles.

ANSWER:

Here, A and D are isotopes as they have the same number of protons but different number of neutrons.

Question 60:

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The composition of two atomic particles is given below :

	X	Y
Protons :	8	8
Neutrons :	8	9
Electrons :	8	8

(i) What is the mass number of X ?

(ii) What is the mass number of Y ?

(iii) What is the relation between X and Y ?

(iv) Which element/elements do they represent ?

ANSWER:

(i) Mass number of X = 8+8 = 16
(ii) Mass number of Y = 8+9 = 17
(iii) X and Y are isotopes, as they have the same number of protons but different number of neutrons.
(iv) X and Y represent the isotopes of oxygen.

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