Section A

1. The mass number of an atom is equal to the sum of the number of _____.

A) Protons, neutrons, and electrons
B) Protons and neutrons
C) Protons and electrons
D) Electrons and neutrons

Answer: B) Protons and neutrons

Explanation: The mass number of an atom is the sum of the number of protons and neutrons in the nucleus. Electrons have negligible mass compared to protons and neutrons.

2. What is the maximum number of electrons that the third shell of an atom can hold?

A) 8 B) 18 C) 32 D) 10

Answer: B) 18

Explanation: The maximum number of electrons that can be accommodated in a shell is $2n^2$. So for n=3, we get $2\times3^2=18$

3. Which of the following particles is responsible for the chemical behaviour of an atom?

A) Neutron B) Proton C) Electron D) Nucleus

Answer: C) Electron

Explanation: The chemical behavior of an atom is primarily determined by the electrons, particularly the valence electrons. These electrons participate in chemical reactions and bond formation.

4. Which of the following best describes an anion?

A) A positively charged ion formed by gaining electrons.
B) A negatively charged ion formed by losing electrons.
C) A positively charged ion formed by losing electrons.
D) A neutral atom.

Answer: A) A positively charged ion formed by gaining electrons.

Explanation: An anion is a negatively charged ion, formed when an atom gains electrons. For example, a chlorine atom gains one electron to form a chloride anion (Cl^-).

5. The atomic mass of an atom is approximately equal to the sum of the masses of its _____.

A) Protons and electrons
B) Neutrons and electrons
C) Protons and neutrons
D) Protons, neutrons, and electrons

Answer: C) Protons and neutrons

Explanation: The atomic mass (or mass number) is nearly equal to the combined mass of protons and neutrons because electrons have negligible mass compared to protons and neutrons.

6. Which of the following best describes an ion?

A) A neutral atom with equal protons and electrons.
B) An atom with an unequal number of protons and electrons, giving it a charge.
C) An atom that has no protons.
D) An atom with the same number of neutrons and protons.

Answer: B) An atom with an unequal number of protons and electrons, giving it a charge.

Explanation: An ion is formed when an atom gains or loses electrons, resulting in a charged species. If electrons are lost, a positive ion (cation) is formed; if electrons are gained, a negative ion (anion) is formed.

7. What is the number of protons, neutrons, and electrons in an atom of carbon-14 (atomic number 6, mass number 14)?

A) 6 protons, 6 neutrons, 6 electrons B) 6 protons, 8 neutrons, 6 electrons
C) 6 protons, 8 neutrons, 14 electrons D) 6 protons, 14 neutrons, 6 electrons

Answer: B) 6 protons, 8 neutrons, 6 electrons

Explanation: Carbon-14 has an atomic number of 6, so it has 6 protons and 6 electrons. The mass number is 14, so the number of neutrons is 14 – 6 = 8

8. Which of the following is true about the atomic number of an element?

A) It is the total number of protons and neutrons.
B) It is the number of neutrons in an atom.
C) It determines the chemical properties of the element.
D) It is the total number of electrons in an atom.

Answer: C) It determines the chemical properties of the element.

Explanation: The atomic number, which is the number of protons in an atom, defines the element and determines its chemical properties. The number of protons distinguishes one element from another.

9. Which of the following elements has its outermost shell completely filled with electrons?

A) Neon B) Oxygen C) Nitrogen D) Sodium

Answer: A) Neon

Explanation: Neon is a noble gas with a full outer electron shell (8 electrons in its second shell). This makes it chemically stable and inert.

10. The atomic mass of an atom is the sum of the number of _____ and _____.

A) Electrons, protons B) Protons, neutrons
C) Neutrons, electrons D) Protons, electrons

Answer: B) Protons, neutrons

Explanation: The atomic mass is the sum of the protons and neutrons in the nucleus. Electrons are too small to contribute significantly to the mass of the atom

11. The number of protons in an atom determines the _____.

A) Mass number B) Atomic number
C) Neutron number D) Electron number

Answer: B) Atomic number

Explanation: The atomic number is determined by the number of protons in the nucleus of an atom. It defines the element and determines its position in the periodic table.

12.Which of the following statements about isotopes is correct?

A) Isotopes have the same number of protons and neutrons.
B) Isotopes have the same number of neutrons but different numbers of protons.
C) Isotopes have the same number of protons but different numbers of neutrons.
D) Isotopes have different numbers of electrons.

Answer: C) Isotopes have the same number of protons but different numbers of neutrons.

Explanation: Isotopes of an element have the same number of protons (which determines the element) but a different number of neutrons. This results in different mass numbers. For example, carbon-12 and carbon-14 are isotopes of carbon.

13. What is the charge on an atom of chlorine (Cl) after it gains one electron?

A) +1 B) -1 C) +2 D) 0

Answer: B) -1

Explanation: When chlorine (Cl) gains one electron, it becomes negatively charged and forms an anion with a charge of -1. Chlorine originally had 17 protons and 17 electrons, but after gaining one electron, it has 18 electrons and thus a negative charge.

14. Which of the following elements has a full outer electron shell and is chemically inert?

A) Nitrogen B) Oxygen C) Argon D) Fluorine

Answer: C) Argon

Explanation: Argon is a noble gas in Group 18 of the periodic table, which means it has a full outer electron shell and is chemically inert. This makes it stable and unreactive.

15. Which of the following represents the Bohr model of an atom?

A) Electrons are distributed in fixed orbits around the nucleus.
B) Electrons are scattered throughout the atom.
C) Electrons move randomly in the electron cloud.
D) Electrons are fixed at the center of the atom.

Answer: A) Electrons are distributed in fixed orbits around the nucleus.

Explanation: The Bohr model proposed that electrons revolve in fixed orbits or energy levels around the nucleus. Each orbit corresponds to a specific energy level.

16. The number of neutrons in an atom can be calculated by subtracting the atomic number from the:

A) Atomic mass B) Mass number
C) Number of protons D) Number of electrons

Answer: B) Mass number

Explanation: The number of neutrons in an atom can be found by subtracting the atomic number (number of protons) from the mass number (total number of protons and neutrons).

17. Which of the following is the correct symbol for a neutron?

A) n B) p C) e D) γ

Answer: A) n

Explanation: The symbol for a neutron is **n**. Neutrons have no charge and are located in the nucleus of the atom along with protons.

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

A) ${}^{31}_{15}X$ B) ${}^{31}_{16}X$ C) ${}^{16}_{15}X$ D) ${}^{15}_{16}X$

Answer: A) $\mathbf{{}^{31}_{15}X}$

Explanation: Given that, number of electrons in element X = 15 number of neutrons = 16 Atomic number = number of protons = number of electrons in neutral atom = 15. Mass number = number of protons + number of neutrons = 15 + 16 = 31

19.Which of the following statements about Rutherford's model of atom are correct?

(i) considered the nucleus was positively charged.

(ii) established that the α–particles are four times as heavy as a hydrogen atom.

(iii) can be compared to the solar system.

(iv) was in agreement with Thomson's model.

(a) (i) and (iii)

(b) (ii) and (iii)

(c) (i) and (iv)

(d) only (i)

Answer: (a) (i) and (iii)

Explanation: Alpha particles are positively charged and are deflected by the nucleus. This showed that the nucleus is positively charged. Rutherford also proposed that electrons in an atom are organized around the nucleus in the same way that planets in the Milky Way are clustered around the Sun.

20. In Thomson's model of atoms, which of the following statements are correct?

(i) The mass of the atom is assumed to be uniformly distributed over the atom.

(ii) the positive charge is assumed to be uniformly distributed over the atom.

(iii) the electrons are uniformly distributed in the positively charged sphere.

(iv) The electrons attract each other to stabilize the atom.

(a) (i), (ii) and (iii)

(b) (i) and (iii)

(c) (i) and (iv)

(d) (i), (iii) and (iv)

Answer: (a) (i), (ii), and (iii)

Explanation: Thomson proposed that negatively charged electrons are stabilized by positively charged nuclei. Hence, option (iv) is not correct as like charges cannot attract each other. The rest of the options are correct according to Thomson's model of an atom.

21. Rutherford's α- particle scattering experiment showed that:

(i) Electrons have a negative charge.

(ii) the mass and positive charge of the atom is concentrated in the nucleus.

(iii) neutrons exist in the nucleus.

(iv) Most of the space inside an atom is empty.

Which of the above statements is correct?

(a) (i) and (iii)

(b) (ii) and (iv)

(c) (i) and (iv)

(d) (iii) and (iv)

Answer: (b) (ii) and (iv)

Explanation: The mass and positive charge of the atom are concentrated in the nucleus, and most of the atom's space is empty, according to Rutherford's particle scattering experiment.

22. The ion of an element has 3 positive charges. Mass number of the atom 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

Explanation: Mass number (A) of the element = 27

Number of neutrons in the atom =14

Hence, the number of electrons in atom

=Mass number(A) – number of neutrons in atom

=27 – 14 = 13

Since the ion of the element has 3 positive charges, so number of electrons in the ion is

13 - 3.

The number of electrons in the ion is 10.

23. In a sample of ethyl ethanoate (CH3COOC2H5CH3COOC2H5), the two oxygen atoms have the same number of electrons but different numbers 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 two neutrons.

(c) The two oxygen atoms are isotopes.

(d) The two oxygen atoms are isobars.

Answer: (c) The two oxygen atoms are isotopes.

Explanation: Isotopes are atoms of the same element (with a same atomic number) with different mass numbers. The difference in mass number is because of the different number of neutrons present in the atoms.

24. Elements with valency 1 are:

(a) always metals. (b) always metalloids.

(c) either metals or non-metals. (d) always non-metals.

Answer: (c) either metals or non-metals.

Explanation: If an element shows positive valency (like sodium), it is a metal; otherwise (negative valency like chlorine) it is a non-metal.

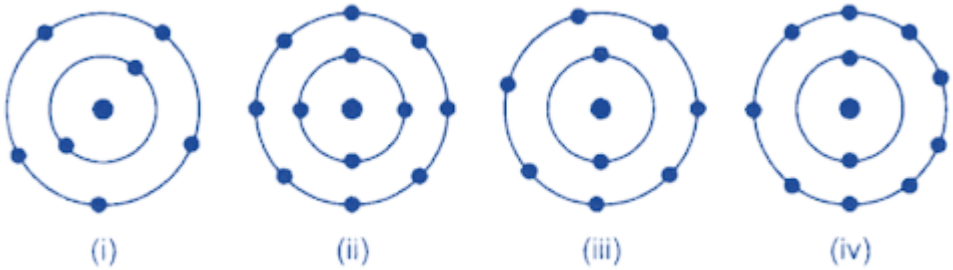
25. An atom with 3 protons and 4 neutrons will have a valency of:

(a) 3 (b) 7 (c) 1 (d) 4

Answer: (c) 1

Explanation: The electronic configuration of this element will be 2, 1 (Atomic number Z=3) Since the number of electrons in the outermost shell is 1, hence the valency of the atom will be 1.

26. Which of the following in Fig. 4.2 do not represent Bohr's model of an atom correctly?



(a) (i) and (ii)

(b) (ii) and (iii)

(c) (ii) and (iv)

(d) (i) and (iv)

Answer: (c) (ii) and (iv)

Explanation: The first shell cannot have more than 2 electrons and the second shell cannot have more than 8 electrons.

27. Atomic models have been improved over the years. Arrange the following atomic models in the order of their chronological order:

(i) Rutherford's atomic model

(ii) Thomson's atomic model

(iii) Bohr's atomic model

(a) (i), (ii) and (iii)

(b) (ii), (iii) and (i)

(c) (ii), (i) and (iii)

(d) (iii), (ii) and (i)

Answer: (c) (ii), (i) and (iii)

Section B

Short Answer Questions:

Q1. Is it possible for the atom of an element to have one electron, one proton and no neutron? If so, name the element.

Answer: Hydrogen is the element having only 1 electron,1 proton, and no neutron. Hydrogen has an atomic number of 1, which means it has only one proton as the atomic number is equal to the number of protons.

Q2. Write any two observations which support the fact that atoms are divisible.

Answer: The discovery of electrons and protons bolsters the idea that atoms are divisible. During a chemical reaction, electrons are transferred or shared between distinct atoms, causing atoms to rearrange.

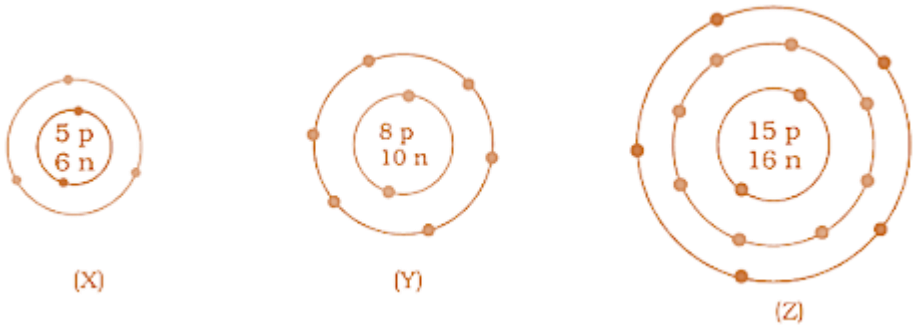
Q3. Will ^{35}Cl and ^{37}Cl have different valencies. Justify your answer.

Ans: ^{35}Cl and ^{37}Cl are isotopes of the same element - chlorine. Isotopes have the same number of electrons. Hence, their valencies do not differ. They have the same valency.

Q4. In the atom of an element X, 6 electrons are present in the outermost shell. If it acquires a noble gas configuration by accepting a requisite number of electrons, then what would be the charge on the ion so formed?

Answer: Since 6 electrons are already present in the outermost shell of the atom, this element requires two more electrons in order to acquire the noble gas configuration. When the atom accepts 2 more electrons, the charge on the ion formed would be -2.

Q5. What information do you get from the given figure about the atomic number, mass number and valency of atoms X, Y and Z? Give your answer in a tabular form.



Answer: The atomic number, mass number, and valency of the atoms X, Y, and Z are given in the table below:-

	Atomic No.	Mass No.	Valency
X	5	11	3
Y	8	18	2
Z	15	31	3,5

Q6. Calculate the number of neutrons present in the nucleus of an element X which is represented as $_{15}^{31}X$

Answer: Mass number (A) = No. of protons (Z) + No. of neutrons

The mass number, on the other hand, is provided as 31, and the number of protons is reported as 15.

No. of protons (Z) + No. of neutrons = 31

Number of neutrons = 31 − number of protons

Number of neutrons = 31 − 15 =16

16 neutrons are present in the nucleus of the element X.

Q7. Complete Table 4.1 based on information available in the symbols given below:

(a) $_{17}^{35}Cl$

(b) $_{6}^{12}C$

(b) $_{35}^{81}Br$

Element	n_p	n_n

Answer: The table can be completed as follows:-

Element	n_p	n_n
Cl	17	18
C	6	6
Br	35	46

n_p of Cl= Atomic number =17

n_n of Cl= Mass number − Atomic number = A − Z = 35 − 17 =18

n_p of C = Atomic number = 6

n_n of C= Mass number − Atomic number = A − Z= 12 – 6 = 6

n_p of Br = Atomic number =35

n_n of Br = Mass number − Atomic number = A − Z= 81−35 = 46

Q8. Helium atom has 2 electrons in its valence shell but its valency is not 2. Explain.

Answer: The outermost shell of the helium atom possesses two electrons, and the duplet is complete.

As a result, the helium atom's valency is zero. It has no proclivity for giving or receiving electrons.

Q9. An element X has a mass number of 4 and an atomic number of 2. Write the valency of this element.

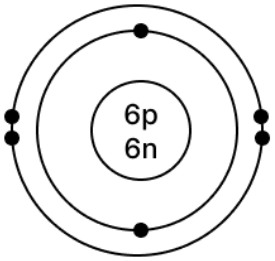
Answer: The valency of the element is zero as the K shell is completely filled with 2 electrons.

Draw the atomic diagrams of the following elements showing the distribution of - protons, neutrons & electrons in the various shells of the atoms.

(a) Carbon - $^{12}_{6}C$

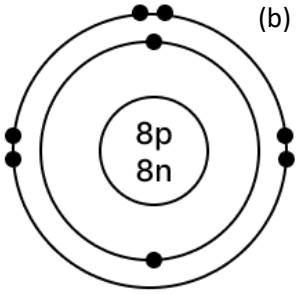
(b) Oxygen - $^{16}_{8}O$

Answer:



(a) Carbon - $^{12}_{6}C$

(b) Oxygen - $^{16}_{8}O$



Q10. 'Valency' is also the number of electrons - donated or accepted by an atom so as to achieve stable electronic configuration of the nearest noble gas'. With reference to this definition -

(a) State what is meant by 'stable electronic configuration'.

(b) State why the valency of -

(i) sodium, magnesium & aluminium is: +1, +2 & +3 respectively.

(ii) chlorine, oxygen & nitrogen is: -1, -2 & -3 respectively.

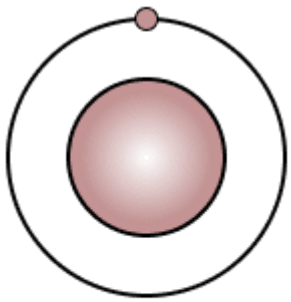
Answer:

(a) **Stable electronic configuration** — The atom's outermost shell needs 2 electrons for stability (**duplet rule**) if it has only one shell. If it has multiple shells, it requires 8 electrons (**octet rule**) in the outermost shell for stability.

(b) (i) The atoms of sodium, magnesium and aluminium donate 1, 2 and 3 electrons, respectively, in order to achieve a stable electronic configuration of 8 electrons (**octet rule**) in the outermost shell. Hence, their valencies are +1, +2 & +3.

(ii) The atoms of chlorine, oxygen and nitrogen accept 1, 2 and 3 electrons, respectively, in order to achieve a stable electronic configuration of 8 electrons (**octet rule**) in the outermost shell. Hence, their valencies are -1, -2 & -3.

Q11. The diagram represents an isotope of hydrogen [H]. Answer the following:



At. no. = 1
Mass no. = 1

1. Are isotopes atoms of the same element or different elements.
2. Do isotopes have the same atomic number or the same mass number.

3. If an isotope of 'H' has mass no. = 2, how many electrons does it have?
4. If an isotope of 'H' has mass no. = 3, how many neutrons does it have?
5. Which sub-atomic particles in the 3 isotopes of 'H' are the same?

Answer:

1. Isotopes are atoms of the same element.
2. Isotopes have same atomic number.
3. Number of electrons in an isotope of 'H' having mass no. = 2 is 1 as its atomic number is 1.
4. Number of neutrons in an isotope of 'H' having mass no. [A] = 3 is 2, because, atomic number [Z] is 1 so number of protons = number of electrons = 1 and number of neutrons [n] = A - Z = 3 - 1 = 2.
5. Number of electrons and protons are same in the 3 isotopes of 'H' as atomic number is the same.

Q12. (a) What are the two main features of Rutherford's atomic model?

(b) State its one drawback.

Answer:

(a) The two main features of Rutherford's atomic model are:

1. An atom consists of mainly two parts : the centrally located nucleus and the outer circular orbits.
2. The nucleus is positively charged mass and the entire mass of the atom is concentrated on it. The size of the nucleus is very small and it is the densest part of the atom. Electrons revolve around the nucleus in circular orbits called shells. An atom is electrically neutral i.e., number of protons is equal to number of electrons.

(b) Rutherford could not explain the structural stability of an atom.

Q13. What is variable valency? Name two elements having variable valency and state their valencies.

Answer: Some elements exhibit more than one valency and they are said to have variable valency.

Examples: Iron and copper.

Metal	Radicals	Valency
Iron (Fe)	Ferrous, Ferric	2, 3
Copper (Cu)	Cuprous, Cupric	1, 2

Q14. The atomic number and the mass number of sodium are 11 and 23 respectively. What information is conveyed by this statement?

Answer: Atomic number of sodium is 11 means the number of protons present in the nucleus of sodium atom is 11 and the number of electrons present is 11. Mass number of sodium is 23 means the number of protons + number of neutrons is 23. So number of neutrons present is 12.

Q15. The atom of an element is made up of 4 protons, 5 neutrons and 4 electrons. What is its atomic number and mass number?

Answer:

Atomic number = number of protons = 4.

Mass number = number of protons + number of neutrons = 4 + 5 = 9.

Q16. Complete the table below by identifying A, B, C, D, E, and F.

Element	Symbol	Number of protons	Number of neutrons	Number of electrons
Fluorine	$_{9}F^{19}$	9	**A**	**B**
Aluminium	**C**	**D**	14	13
Potassium	$_{19}K^{39}$	**E**	**F**	19

Answer:

A → 10

B → 9

C → $_{13}Al^{27}$

D → 13

E → 19

F → 20

Completed table is shown below:

Element	Symbol	Number of protons	Number of neutrons	Number of electrons
Fluorine	$_{9}F^{19}$	9	***10***	***9***
Aluminium	***$_{13}Al^{27}$***	**13**	14	13
Potassium	$_{19}K^{39}$	***19***	***20***	19

Q17. Compare the properties of electrons, protons, and neutrons.

Answer: The differences between electrons, protons, and neutrons are as follows:

Electron	**Proton**	**Neutron**
1. It is present outside of the nucleus of an atom.	1. It is present inside the nucleus of an atom.	1. It is present inside the nucleus of an atom.
2. Carry negative charge.	2. Carry a positive charge	2. It is neutral.
3. Its weight is negligible.	3. It weighs around 2000 times the mass of electrons.	3. Weight is the same as a proton.

Q18. State the mass number, the atomic number of neutrons, and the electronic configuration of the following atoms.

Name of elements	Atomic number	Atomic mass	No. of proton	No. of electrons	No. of neutrons	Electronic configuration
$^{12}_{6}C$						
$^{16}_{8}O$						
$^{19}_{9}F$						
$^{20}_{10}Ne$						
$^{27}_{13}Al$						
$^{35}_{17}Cl$						

Answer:

Name of elements	Atomic number	Atomic mass	No. of proton	No. of electrons	No. of neutrons	Electronic configuration
$^{12}_{6}C$	6	12	6	6	6	2,4
$^{16}_{8}O$	8	16	8	8	8	2,6
$^{19}_{9}F$	9	19	9	9	10	2,7
$^{20}_{10}Ne$	10	20	10	10	10	2,8
$^{27}_{13}Al$	13	27	13	13	14	2,8,3

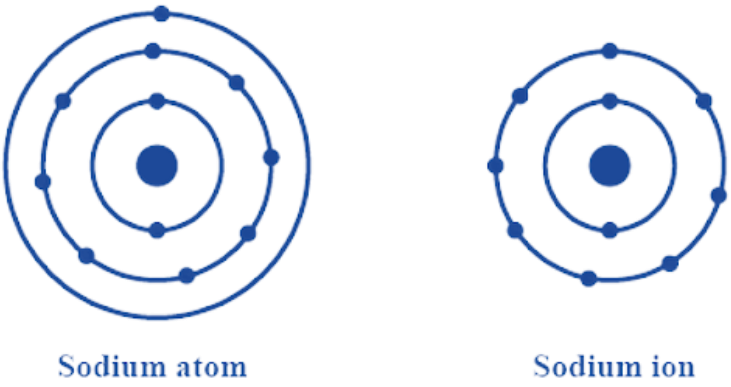
$^{35}_{17}Cl$	17	35	17	17	18	2,8,7

Section C

Q1. What were the drawbacks of Rutherford's model of an atom?

Answer: Rutherford suggested a model in which the electrons moved in well-defined orbits around the nucleus. However, it was believed that the electron's orbital revolution would not be stable. Any charged particle in a circular orbit would accelerate and emit energy. As a result, the spinning electrons lose energy and fall into the nucleus. The atom would become extremely unstable as electrons whirled about it, and matter would cease to exist. This, however, goes against what we've seen before.

Q2. Show diagrammatically the electron distributions in a sodium atom and a sodium ion and also give their atomic number.



Answer: The number of protons in an atom determines an element's atomic number (Z). The sodium atom has 11 protons because its atomic number is 11. Number of electrons = number of protons = 11 since the atom as a whole is electrically neutral. A positively charged sodium ion (Na^+) is formed by the removal of one electron from a sodium atom. So, a sodium ion has 11-1=10 electrons. As a result, the sodium ion's electronic distribution will be 2,8. Because both the sodium atom and the sodium ion have the same amount of protons, the atomic number of both the sodium atom and the sodium ion is 11.

Q3. Why are atoms electrically neutral?

Answer: Atoms are electrically neutral because they contain an equal number of protons (positively charged) and electrons (negatively charged). The positive charge of protons balances the negative charge of electrons, resulting in a neutral overall charge.

Explanation:

- Protons have a positive charge, and electrons have a negative charge.
- Neutrons are neutral and do not contribute to the charge of the atom.
- For an atom to be neutral, the number of protons must be equal to the number of electrons, so their charges cancel out.

Q4. Why is the number of neutrons in an atom important?

Answer: The number of neutrons in an atom is important because it determines the isotope of an element. Different isotopes of the same element have different physical properties, such as stability and radioactivity.

Explanation:

- Neutrons affect the mass of an atom but do not affect its chemical properties, as chemical properties are determined by the number of electrons.
- Isotopes of an element can be stable (non-radioactive) or unstable (radioactive), and the difference in the number of neutrons influences this.

Q5. Why do electrons in an atom occupy discrete energy levels or shells?

Answer: Electrons in an atom occupy discrete energy levels or shells because of the quantized nature of energy. Electrons can only exist in specific energy states and must absorb or emit a specific amount of energy to move from one shell to another.

Explanation:

- The energy of electrons is quantized, meaning they can only have certain fixed energy values (quantum states).
- These fixed energy levels correspond to specific orbits or shells around the nucleus.

- If an electron absorbs or emits a specific amount of energy (usually in the form of photons), it can jump from one energy level to another.

Q6. What is the role of electrons in chemical bonding?

Answer: Electrons play a key role in chemical bonding because atoms bond by sharing or transferring electrons to achieve a stable electron configuration, usually resembling the nearest noble gas configuration.

Explanation:

- In ionic bonds, electrons are transferred from one atom to another, leading to the formation of positively and negatively charged ions that attract each other.
- In covalent bonds, electrons are shared between atoms, allowing them to achieve full outer electron shells.
- Electrons in the outermost shell (valence electrons) are involved in these bonding processes.

Q7. Why do atoms of noble gases not form bonds easily?

Answer: Atoms of noble gases do not form bonds easily because they already have a stable electron configuration, with a full outer shell of electrons, making them chemically inert or non-reactive.

Explanation:

- Noble gases, such as helium, neon, and argon, have completely filled outer electron shells (except for helium, which has 2 electrons in its outer shell).

Since these gases have stable configurations, they do not readily gain, lose, or share electrons, making them unreactive and unlikely to form chemical bonds.

Q8. Why do atoms of different elements have different atomic numbers?

Answer: Atoms of different elements have different atomic numbers because the atomic number is defined by the number of protons in the nucleus, and each element has a unique number of protons.

Explanation:

- The atomic number of an element is the number of protons in its nucleus, and this determines the identity of the element.

- For example, hydrogen has 1 proton, so its atomic number is 1, while oxygen has 8 protons, so its atomic number is 8.
- No two elements have the same number of protons, which is why their atomic numbers are distinct.

Q9. Why is the mass number of an element a whole number but its atomic mass usually a decimal?

Answer: The mass number of an element is a whole number because it represents the total number of protons and neutrons in the nucleus, which are counted as whole particles. However, the atomic mass is usually a decimal because it is the weighted average of the masses of all naturally occurring isotopes of that element.

Explanation:

- Mass number is the sum of protons and neutrons and is always a whole number.
- Atomic mass is calculated based on the isotopes of the element and their relative abundance, leading to a decimal value.
- For example, carbon has isotopes like carbon-12 and carbon-14, and their relative abundances result in an atomic mass of approximately 12.01.

Q10. Why is the atomic model of Bohr more accurate than Rutherford's model?

Answer: Bohr's atomic model is more accurate than Rutherford's model because it explains the stability of the atom and the discrete energy levels (orbits) where electrons are found, avoiding the problem of electron spiralling into the nucleus.

Explanation:

- Rutherford's model proposed that electrons revolve around the nucleus in continuous orbits, which would cause them to lose energy and spiral into the nucleus, causing the atom to collapse.
- Bohr corrected this by suggesting that electrons occupy fixed orbits or energy levels and can only move to another orbit by absorbing or emitting a specific amount of energy, thus preventing them from spiralling into the nucleus.

Q11. Why do atoms of metals tend to lose electrons and form positive ions?

Answer: Atoms of metals tend to lose electrons and form positive ions because they have fewer electrons in their outer shell and can achieve a more stable configuration by losing these electrons.

Explanation:

- Metals typically have one to three electrons in their outermost electron shell.
- By losing these electrons, metals achieve a stable electron configuration, similar to that of the nearest noble gas.
- When a metal loses electrons, it becomes positively charged, forming a cation. For example, sodium (Na) loses one electron to form Na^+.

Q12. Why do non-metals tend to gain electrons in chemical reactions?

Answer: Non-metals tend to gain electrons in chemical reactions because they have more than half of their outer electron shell filled and need to gain electrons to achieve a stable electron configuration.

Explanation:

- Non-metals typically have four to seven electrons in their outer shell and require additional electrons to complete the shell.
- By gaining electrons, non-metals achieve a stable electron configuration similar to that of the nearest noble gas.
- When non-metals gain electrons, they become negatively charged, forming anions. For example, chlorine (Cl) gains one electron to form Cl^-.

Q13.Why does an atom of sodium form a positively charged ion, while an atom of chlorine forms a negatively charged ion?

Answer: An atom of sodium forms a positively charged ion because it loses one electron from its outermost shell, while an atom of chlorine forms a negatively charged ion because it gains one electron to complete its outer shell.

Explanation:

- Sodium (Na) has one electron in its outermost shell. To achieve stability, it loses this electron, becoming Na^+ with a positive charge.
- Chlorine (Cl) has seven electrons in its outer shell and needs one more electron to complete the octet. When it gains an electron, it becomes Cl^-, a negatively charged ion.

- The loss of an electron by sodium makes it positively charged, and the gain of an electron by chlorine makes it negatively charged, leading to the formation of an ionic bond between them.

Q14. Why is the electron configuration of an atom important in determining its chemical behavior?

Answer: The electron configuration of an atom is important in determining its chemical behavior because it dictates how the atom will bond with other atoms, based on the number of valence electrons it has.

Explanation:

- The chemical properties of an atom are largely determined by its valence electrons, which are the outermost electrons involved in chemical bonding.
- Atoms with similar electron configurations, especially the same number of valence electrons, tend to have similar chemical properties.
- For example, elements in Group 1 of the periodic table have one valence electron and are highly reactive, while elements in Group 18 (noble gases) have full outer shells and are chemically inert.

Q15. Why do atoms form ions during chemical reactions?

Answer: Atoms form ions during chemical reactions because they tend to lose or gain electrons in order to achieve a more stable electron configuration, often resembling that of the nearest noble gas.

Explanation:

- Atoms with an incomplete outer shell of electrons are chemically reactive.
- They either lose electrons (becoming positively charged) or gain electrons (becoming negatively charged) to achieve a stable electron configuration.

For example, sodium (Na) loses one electron to form Na^+, and chlorine (Cl) gains one electron to form Cl^-. The resulting oppositely charged ions can form ionic bonds.

Q16. State how electrons are distributed in an atom. Explain in brief the rules which govern their distribution.

Answer: Electrons revolve around the nucleus in imaginary paths called orbits or shells. Different Orbits are K shell [first shell, n=1], L shell [second shell, n=2] M, N..... etc.

Rules governing the distribution of electrons are summarized below:

1. The maximum number of electrons in each shell or orbit is determined by the formula $2n^2$, where n is the number of shell.

   K shell, n=1, no. of electrons = $2 \times 1^2 = 2$

L shell, n=2, no. of electrons = 2 x 2^2 = 8

M shell, n=3, no. of electrons = 2 x 3^2 = 18

2. Electrons are not accommodated in a given shell, unless the inner shells are filled. Shells are filled in step-wise manner.

3. The atom's outermost shell needs 2 electrons for stability (**duplet rule**) if it has only one shell. If it has multiple shells, it requires 8 electrons (**octet rule**) in the outermost shell for stability.

Q17. With reference to formation of compounds from atoms by electron transfer - electrovalency, state the basic steps in the conversion of sodium & chlorine atoms to sodium & chloride ions leading to the formation of the compound - sodium chloride.

[electronic configuration of: Na = 2,8,1 & Cl = 2,8,7]

Answer: Formation of compounds from atoms by electron transfer

- Electronic configuration of Na = 2,8,1
- Nearest noble gas = Neon [2,8]
- Na loses one electron from the outermost shell to attain stability
- Electronic configuration of Cl = 2,8,7
- Nearest noble gas = Argon [2,8,8]
- Cl gains one electron in the outermost shell to attain stability.

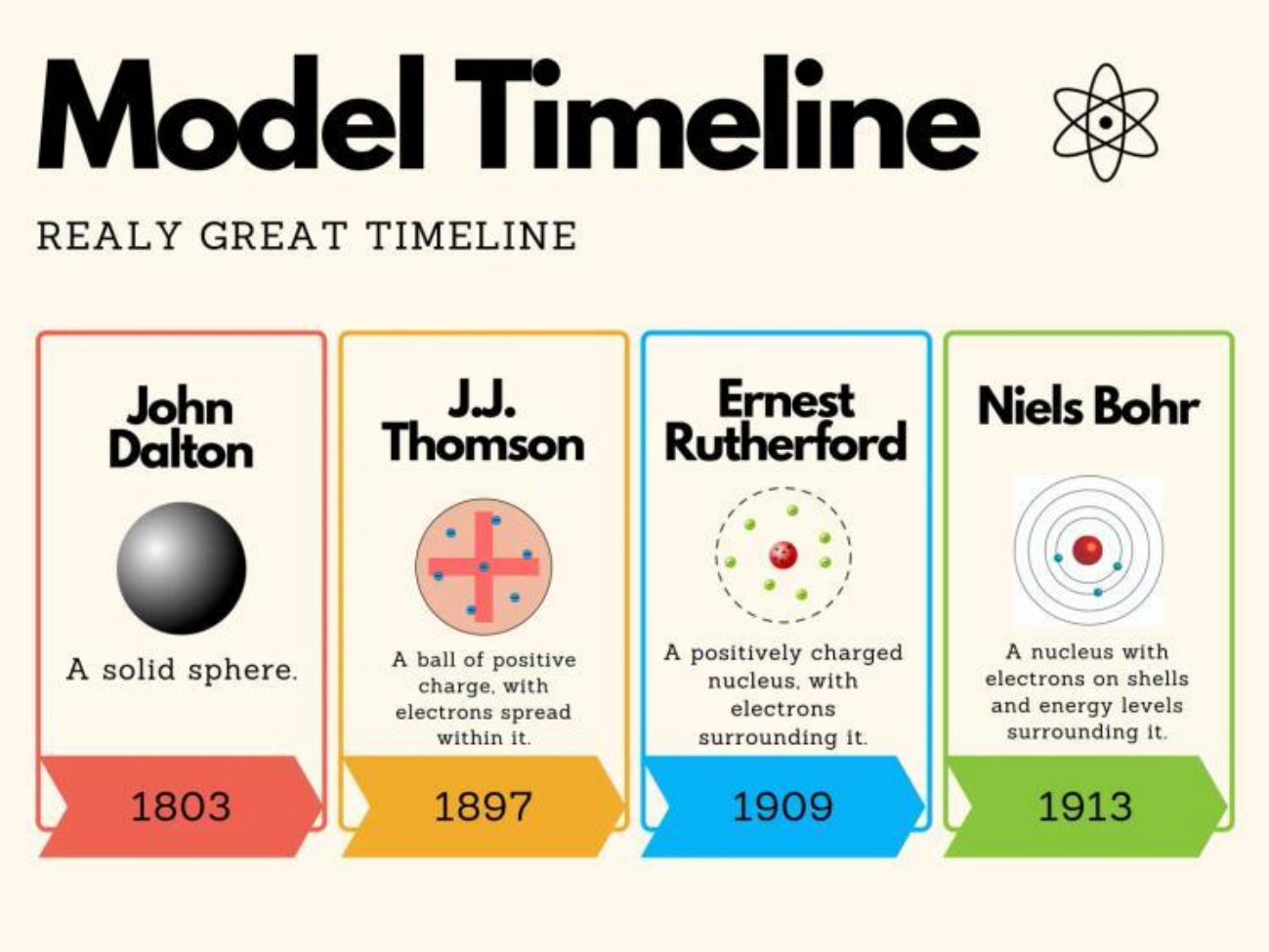
Hence, the electron given by Na is gained by Cl, both attain a stable configuration and sodium chloride is formed.

Q18. What are isotopes? How does the existence of isotopes contradict Dalton's atomic theory?

Answer: Isotopes are the atoms of the same element with the same atomic number but a different mass number due to the difference in the number of neutrons in their nucleus.

According to Dalton's theory, atoms of an element are identical in all respects like size, mass, density, chemical properties. But isotopes of an element have atoms that have same atomic number i.e. same number of protons and electrons but different mass number i.e. number of neutrons are different. So isotopes differ from each other in their physical properties like density, melting point, boiling point, etc. This is a contradiction to Dalton's atomic theory.

An atom is essentially a positively charged sphere into which negatively charged electrons are implanted. Because the charges are of similar size, they cancel each other out and neutralize the atom.	Thomson's atomic model
Describes an atom as having a nucleus at its center, surrounded by electrons that orbit the nucleus in fixed paths:	Rutherford model
Atoms are the tiniest particles that comprise all matter. In a chemical reaction, atoms are indivisible particles that cannot be formed or destroyed.	John Dalton's atomic model
failed to explain how the positive charge holds on the electrons inside the atom. It also failed to explain an atom's stability (total mass of an atom is uniformly distributed all over the atom)	Limitation of J.J Thomson Model
Failed to depict the position of electrons with respect to each other and the positively charged nucleus (arrangement of electrons in an atom)	Limitation of Rutherford's Model
In an atom, electrons (negatively charged) revolve around the positively charged nucleus in a definite circular path called orbits or shells. Each orbit or shell has a fixed energy and these circular orbits are known as orbital shells.	Bohr's atomic model
All matter is made up of tiny, indivisible particles called atoms. Atoms can neither be created nor destroyed. Furthermore, atoms cannot be divided into smaller particles.	Dalton's Atomic Theory
stated that atoms were indivisible. later of subatomic particles (such as protons, electrons, and neutrons) were discovered. Does not account for isotopes (different isotopes of elements have different atomic masses) and allotropes (differences in property of a diamond and graphite although both are carbon forms)	Limitations of Dalton's Atomic Theory


Model Timeline
REALY GREAT TIMELINE
John Dalton
A solid sphere.
1803
J.J. Thomson
A ball of positive charge, with electrons spread within it.
1897
Ernest Rutherford
A positively charged nucleus, with electrons surrounding it.
1909
Niels Bohr
A nucleus with electrons on shells and energy levels surrounding it.
1913