



CHEMISTRY

BOOKS - BHARATI BHAWAN

CHEMISTRY (HINGLISH)

ATOMIC STRUCTURE

Example

1. The atomic number of an element is 12. How many protons and electrons are there in an

atom of the element ?



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2. The nucleus of an atom of an element contains 11 protons and 12 neutrons . Determine the atomic number and mass number of the element.



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3. The atomic number and the mass number of an element M are 12 and 24 respectively . Calculate the number of neutrons in an atom of the element.



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4. An element has 2 electrons in the M shell. What is the atomic number of the element ?



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5. Which of the two elements would be more reactive, element A of atomic number 36 or element B of atomic number 19 ?



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6. The valency of hydrogen is 1, magnesium, 2 aluminium 3 and carbon 4 . Can you see any connection between the valency of an element and the number of electrons it has in its outermost electron shell ? What would you predict the valencies of helium (He),

phosphorus (P), sulphur (S) and neon (Ne) to be ?



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7. What is the number of valence electrons in the atom of an element A having atomic number 17 ? Name the valence shell of this atom.



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8. Natural chlorine consists of two isotopes :

75% ${}_{17}^{35}\text{Cl}$ and 25 % ${}_{17}^{37}\text{Cl}$. Calculate the average atomic mass of chlorine .



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9. A naturally occurring sample of lithium contains 7.42% of ${}^6\text{Li}$ and 92.58% ${}^7\text{Li}$. The relative atomic mass of ${}^6\text{Li}$ is 6.015 and that of ${}^7\text{Li}$ is 7.016. Calculate the atomic mass of a naturally occurring sample of lithium.





Objective Questions

1. α Particles are

- A. negatively charged particles
- B. positively charged particles
- C. neutral particles
- D. positively charged particles having no mass.

Answer: B



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2. The element having no neutron in the nucleus of its atom is-

(a). hydrogen

(b). nitrogen

(c). helium

(d). boron

A. hydrogen

B. nitrogen

C. helium

D. boron

Answer: A



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3. In the helium atom, the number of electrons in the L shell is

A. 0

B. 2

C. 8

D. 6

Answer: A



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4. The particles present in the nucleus of an atom are-

(a). the proton and the electron

(b). the electron and the neutron

(c). the proton and the neutron

(d). none of these

A. the proton and the electron

B. the electron and the neutron

C. the proton and the neutron

D. none of these

Answer: C



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5. When a gas at reduced pressure is subjected to an electric discharge, the rays originating from the negative electrode are

A. anode rays

B. cathode rays

C. X-rays

D. radioactive rays

Answer: B



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6. In Rutherford's gold foil experiment most of the α -particles pass through the gold foil without any deviation from their paths . This indicates that

A. the atom is spherical

B. there is a positively charged nucleus at the centre of the atom

C. the entire mass of the atom is concentrated at the nucleus of the atom

D. most of the atom is an empty space

Answer: D



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7. The number of proton, neutrons and electrons in the nucleus of ${}_{11}\text{Na}^{23}$ are respectively

A. 23

B. 11

C. 34

D. 12

Answer: D



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8. The charge/mass (e/m) ratio is maximum for

A. proton

B. neutron

C. electron

D. positron

Answer: C



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9. The number of neutrons in an atom of hydrogen is

A. 1

B. 2

C. 0

D. 3

Answer: C



10. The two elements A and B have the same atomic mass but their atomic numbers are 19 and 20 respectively . A and B are

A. isotopes

B. isobars

C. isomers

D. polymers

Answer: B





11. Isotopes of an element are the atoms which have

A. the same number of protons in their nuclei

B. the same number of protons in their nuclei

C. the same mass number

D. different number of electrons in their orbits.

Answer: B



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12. Elements having the same number of valence electrons in their atoms have similar

A. combining capacities

B. Chemical properties

C. atomic sizes

D. metallic characters

Answer: B



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13. The electronic configuration of an atom is 2,8,2 . The number of valence electrons in the atom is

A. 10

B. 12

C. 8

D. 2

Answer: D



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Fill In The Blanks

1. Electrons are Charged particles.



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2. The mass of a proton is amu.



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3. The proton is charged.



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4. is a fundamental particle which has no charge.



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5. The numbers of And electrons in an atom are equal.



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6. α -Particles are Charged.



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7. A hydrogen atom does not contain any

..... .



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8. The atomic number of an element is equal to the number of



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9. An α -particle has two and two



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10. Chemically inert elements have
outermost shells.



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11. Electrons in the outermost shell of an atom are called



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12. Rutherford's nuclear model was modified by



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13. Electrons are responsible for the chemical properties of an atom.



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Mark The Statement True T Or False F

1. Electrons are positively charged.



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2. Isotopes of an element have the same atomic number.



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3. The number of protons and neutrons is always equal in an atom of an element .



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4. It was John Dalton who discovered the presence of the nucleus in an atom.



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5. Protons and neutrons have almost the same mass.



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6. Hydrogen (1_1H) are isobars.



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7. An atom contains the same number of protons and electrons.



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8. Electron in an atom remains static at a fixed distance from the nucleus .



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9. The nucleus of an atom is neutral.



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10. An α -particle contains a unit positive charge.



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11. Helium is a noble gas with 2 electrons in its outermost shell. Its valency is 0.





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Very Short Answer Questions

1. Name the fundamental particles present in an atom.



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2. Does the nature of cathode rays depend on the nature of the cathode.



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3. From which electrode do cathode rays originate?



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4. What happens to cathode rays when they are subjected to an electric field?



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5. What is the charge of an electron ? How many electrons make a coulomb of charge ?



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6. Where is the mass of an atom concentrated?



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7. The particles present in the nucleus of an atom are-

- (a). the proton and the electron
- (b). the electron and the neutron
- (c). the proton and the neutron
- (d). none of these



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8. Where are the electrons in an atom found ?



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9. What characteristic feature is seen in the configurations of chemically inactive elements ?



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10. What is the maximum number of electrons that can be accommodated in a shell? Write formula.



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11. Which atom contains only two fundamental particles ?



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12. Which particle has constant charge to mass ratio for all matter?



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Short Answer Questions

1. What is the nuclear model of the atom ?



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2. What led Rutherford to discover the existence of the nucleus ?



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3. Define atomic number.



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4. Define a mass number ?



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5. What are valence shell and valence electrons?



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6. Both ^{35}Cl and ^{37}Cl have the same valency .

Why ?



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7. Why did Rutherford select a gold foil in his α -ray scattering experiment ?



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8. What would you conclude from the observation that cathode rays rotate a light paddle wheel placed in their path ?



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9. what is the drawback of Rutherford's nuclear model of the atom ?



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10. Calculate the atomic number of an element whose atomic nucleus has mass number 23 and neutron number 12. What is the symbol of the element ?



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11. Explain how is it that oxygen can be represented by the symbols ${}^{16}_8O$ and 8_8O at the same time ?



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Long Answer Questions

1. What are cathode rays and how do they differ from positive rays ?



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2. Give experimental evidence to show that the entire mass of an atom is practically concentrated in its nucleus



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3. Give experimental evidence to show that the nucleus of an atom is positively charged.



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4. Describe Rutherford's α -ray scattering experimental and mention the observations derived from it. Cite and defect of Rutherford's model of the atom.



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5. Derive a relationship between the atomic number, mass number and number of neutrons in an atom.



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6. DISCOVERY OF ELECTRONS



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7. Describe Bohr model of the atom.



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8. Write down the electronic configurations of the Na (11)



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9. Write down the electronic configurations of the Cl^{-} (18)



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10. Write down the electronic configurations of the K (19)



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11. What are isotopes and what are their characteristics ? Name two isotopes of hydrogen .



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12. In bromine , the two isotopes are 49.7% ${}^{79}_{35}\text{Br}$ and 50.3 % ${}^{81}_{35}\text{Br}$. Calculate the atomic mass of bromine .



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Numericals

1. A sample of an element X contains two isotopes ${}^{16}_8\text{X}$ and ${}^{18}_8\text{X}$. If the average atomic mass of this sample of the element be

16.2 u, calculate the percentage of the two isotopes in this sample.



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2. The atomic number of sodium is 11. How many protons are there in the nucleus of sodium atom ? How many electrons does an atom of sodium contain ? How many electrons and protons does an ion of sodium which has a charge of +1 contain ?



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3. Calculate the atomic number and the mass number of the element whose nucleus contains 11 protons and 12 neutrons.



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4. Give the number of neutrons in an atom of the isotope $^{107}_{47}\text{Ag}$.



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5. Natural chlorine contains chlorine in the form of the isotope $^{35}\text{Cl}(75.5\%)$ and $^{37}\text{Cl}(24.5\%)$. Calculate the average atomic mass of natural chlorine.



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6. A naturally occurring sample of copper consists of 69.2% of ^{63}Cu is 62.93 and that of ^{65}Cu is 64.93 . Find the atomic mass of a naturally occurring sample of copper .



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A Objective Questions I Match

1. Match the names of scientists given in column A with their contributions in column B.



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2. Match the terms given in column A with their related terms given in column B.



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li Fill In The Blanks

1. The on a proton is equal in magnitude but opposite in sign to that of an



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2. Isotopes have the same but different



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3. The are arranged in the empty space around the of the atom .



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4. Helium and chlorine have atomic number 2 and 17 respectively. Their corresponding valencies are and



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5. The first shell of an atom cannot contain more than electrons .



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6. Mass number = number of + number of neutrons .



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7. The number of electrons or by an atom determines the of the element concerned .



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iii Write Yes Or No

1. Is the atom as a whole positively charged ?



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2. The α particle is same as



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3. Are the number of protons and electrons in an atom equal ?



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4. Are elements identified by their atomic masses ?



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5. Isotopes of an element have :

(a) the same physical properties

(b) different chemical properties

(c) different number of neutrons

(d) different atomic numbers



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6. Is the positively charged particle produced from the hydrogen gas called the proton ?



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7. Do electrons in a particular orbit in an atom possess a fixed amount of energy ?



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iv Mark The Statements True T Or False F

1. Thomson's model of the atom explains the arrangement of fundamental particles in the atom.



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2. Rutherford concluded from his α -ray scattering experiment that there exists a heavy and dense body at the centre of the nucleus .



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3. The valency of an element is determined by the valence electrons present in an atom of the element .



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4. The two isotopes of carbon, C-12 and C-14, possess the same physical properties .



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5. The cathode rays are produced when a gas at a very low pressure is subjected to an electric discharge .



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6. The atomic masses are always whole numbers .



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7. The mass of an electron is $\frac{1}{1838}$ times that of a proton .



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V Multiple Choice Questions Pick The Correct Option S

1. Which of the following statements is (are) in conformity with Thomson's model of an atom ?

- A. An atom is a uniform sphere of positive charges with electrons embedded in it.
- B. An atom is electrically neutral .
- C. The mass of an atom is concentrated at the centre of the atom .
- D. Positive and negative charges in an atom do not interact with each other .

Answer: A::B



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2. Which of the following statements about the unreactive nature of noble gases is (are) true ?

A. The inner shells of noble gas atoms are filled to capacity .

B. Noble gas atoms cannot give up electrons to or accept electrons from other atoms .

C. The valence shells of the atoms of noble gases are filled to capacity .

D. None of these

Answer: B::C



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3. The presence of nucleus in an atom was first detected by

A. Dalton

B. Niels Bohr

C. Thomson

D. Rutherford

Answer: D



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4. What is the valency of the element with atomic number 36 and mass number 84 ?

A. 2

B. 4

C. 0

D. 3

Answer: C



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5. Which of the following electronic configurations represents the atom of aluminium ?

A. 2,8,2

B. 2,8,4

C. 2,8,3

D. 2,8,7

Answer: B::D



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6. Which of the following conclusions were drawn from the α -rays scattering experiment?

A. The atom as a whole is positively charged.

B. The mass of the atom is concentrated at the centre of the atom , called the nucleus.

C. The empty space around the nucleus is occupied by electrons in well-defined orbits .

D. The atoms as a whole may be assumed to be an empty space .

Answer: A:B:C:D



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7. Which of the following statements is (are) incorrect ?

A. Atomic number = number of neutrons +
number of electrons

B. Mass number = number of protons +
number of neutrons

C. Atomic number = number of neutrons

D. Atomic mass = number of neutrons

Answer: A::C:D



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8. Which of the following statements about the anode rays is (are) wrong ?

A. The anode rays originate from the cathode .

B. The anode rays are deflected towards the negative plate of an electric field.

C. The e/m ratio for the particles of the anode rays is the same for all gases used in the discharge tube .

D. The anode rays can rotate a light paddle wheel placed in their path.

Answer: C



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9. The numbers of protons , neutrons and electrons present in an atom of argon are , respectively ,

A. 18,18 and 22

B. 22,18 and 18

C. 18,22 and 18

D. 18,16 and 18

Answer: C



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B Very Short Answer Questions

1. Name the element whose atom contains only one proton and one electrons.



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2. Which atom contains only two fundamental particles ?



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3. Why do ${}_{17}^{35}\text{Cl}$ and ${}_{17}^{37}\text{Cl}$ have the same chemical properties though their atomic masses are different ?



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4. The foil of which metal was used by Rutherford in his α -ray scattering experiment?



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5. The atomic number of calcium is 20. What is the number of electrons in its M-shell ?



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6. Name the scientist who proposed the concept of the distribution of electrons in discrete energy levels.



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7. The atoms of two element A and B contain the same number of protons but different number of neutrons in their nuclei. What kind of element are A and B?



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8. Which isotope is used in nuclear reactors ?



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9. Which isotope is used to diagnose restricted circulation of blood ?



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10. What are isobars? Are the physical and chemical properties of isobars similar ?



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11. What is the valency of the element with mass number 4 and atomic number 2?



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12. Show by a diagram the distribution of electrons in sodium ion.



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13. An element A is represented by ${}_{18}^{31}\text{A}$. Find the number of neutrons present in the nucleus of an atom of the element .



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14. An atom of an element has two electrons in its outermost shell. Find the nature and value of charge on the ion produced when these two electrons are lost .



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15. Which one of the three fundamental particles is present in the cathode rays ?



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C Short Answer Questions

1. Why are noble gas unreactive ?



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2. The atom of an element (not helium) contains two electrons in its valence shell . How will the atom complete its octet ?



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3. The mass number of fluorine is 19 and its atomic number is 9. Calculate the number of protons , electrons and neutrons in the fluorine atom. How will the fluorine atom form an ion ?



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4. What is an electron? Give the values of charge and mass of an electron.



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5. Though electrons are negatively charged , they do not move towards the positively charged nucleus and finally not fall on it . Why ?



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6. Why are Bohr orbits called stationary states ?



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7. How was the neutrons discovered ? Mention the characteristics of neutrons.



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8. What are valence electrons ? Discuss any two significance of valence electrons.



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9. Define atomic number and mass number .



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10. What are isotopes ? Give one example .



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11. How are cations and anions formed ?



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12. Most elements have fractional atomic masses. ' Explain.



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13. What are isobars ? Give one examples .



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14. Mention any three characteristics of cathode rays .



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15. Give three points of distinction between isotopes and isobars.



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16. Describe an experiment to show that cathode rays are made up of material particles.



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17. Compare the charge to mass ratio (e/m) for the cathode rays and the anode rays .



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1. Describe in brief the experiments to demonstrate that cathode rays

(i) travel along straight path ,

(ii) are made up of material particles ,

(iii) are negatively charged .



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2. Discuss in chronological order the development of the structure of atom .



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3. Write two conclusions which have been derived from Rutherford's α -ray scattering experiment .ll



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4. Mention the main postulates of Bohr theory with respect to the structure of atom .



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5. Explain the following : (i) mass number , (ii) atomic number and (iii) isotopes .



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6. Does Rutherford's model suffer from some limitations ? If yes, discuss them .



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7. What are isotopes ? Discuss the isotopes of any two elements . How do isotopes and

isobars differ ?



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8. What observations in α -rays scattering experiment conducted by Rutherford led to the following inferences?

- (i) Most of the space in the atom is empty .
- (ii) The entire mass of the atom is concentrated in the nucleus .
- (iii) The nucleus carries positive charge .



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9. DISCOVERY OF ELECTRONS



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10. Explain in brief the Bohr-Bury scheme of the distribution of electrons in orbits .



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11. Describe an activity to show that cathode rays travel in straight lines .



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12. Crossword Puzzle

Solve the crossword puzzle as per the guidelines given in the table below.



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