CHEMISTRY

BOOKS - PEARSON IIT JEE FOUNDATION

ATOMIC STRUCTURE

Very Short Answer Type Question

1. How did the discovery of isotopes contradict Dalton's atomic theory ?

2. How is Rutherford's theory in contradiction with the laws of electrodynamic ?

3. According to Dalton, atoms combine in _____ ratio to form compounds.

4. Which postulate of Dalton's atomic theory is more or less valid even today?

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5. What are the conditions maintained in a discharge tube for the generation of cathode ray ?

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6. According to Rutherford electrons revolve around the nucleus in _____.

7. What are isobars ? Give one examples .

8. What is an α -particles ?

9. Give the geometrical representations of electronic arrangements of the following elements:

(a) fluorine (b) phosphorus

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10. What is the maximum number of electrons that can be present in the nth shell of an atom?

11. What were the comparative values of diameter of nucleus of an atom given by Rutherford ?

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12. When electric field is applied, the cathode rays bend towards _____

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13. Find the number of valence electrons in the following elements by writing the electronic arrangement in their atoms: (a) nitrogen (b) sulphur (c) chlorine

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14. Why is Rutherford model called a nuclear model ?

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15. Define atomic number and mass number. How can you represent an atom by using atomic number and mass number? Give two examples.

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16. Who discovered neutrons ? How was the discovery made ?

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17. Why is a partially evacuated discharge tube taken for Thomson's experiment ?

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18. Atoms of different elements having the same mass number are known as _____

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19. The nature of _____ rays depends upon the nature of the gas in the discharge tube.

20. How did Rutherford explain the stability of atom ?

21. Name the isotopes of hydrogen and give the number of neutrons present in each of them.

22. What is the relative mass of proton with respect to hydrogen atom ?

23. Which experiment led to the discovery of nucleus ?

24. Most of the α-particles passed straight through the gold foil. This proved the existence of in an atom.

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25. According to Rutherford _____ force of nucleus is balanced by the high velocity of revolving electrons.

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26. The atoms of the same element may differ in the number of _____

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27. Isobars do not differ in the number of _____ .

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28. The valence shell of an element of atomic number 35 is the _____ shell.

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29. Give the mass and charge of an electron , a proton and an neutron in kg and coulombs repectively .

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30. According to Bohr's atomic model, electrons revolve in _____ orbits.

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Short Answer Type Questions

1. Explain Thomson's atomic model. What are the drawbacks of this model ?

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2. An atoms 'X' is made up of 20 protons and 20 neutrons. Write the atomic number and mass number and represent the atom with atomic number and number.

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3. Why does chlorine have fractional atomic mass ?

▶ **Watch Video Solution**

4. How did Neils Bohr explain the stability of atom?

▶ **Watch Video Solution**

5. Give the postulates of Dalton's atomic theory.

▶ **View Text Solution**

6. What are the observations of α-ray scattering experiment ? Based on thse

obervations , how did Rutherford disprove Thomson's model ?

7. Write the electronic arrangment for the following elements. Also give the geometrical representations.

(a) Oxgyen (b) Argon (c) Calcium (d) Potassium

8. When different gases are taken in the discharge tube, how do the e/m values of cathode rays and canal rays vary ?

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9. Give the differences between isotopes and isobars.

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10. In J.J Thomson's experiment , what obervations were found when (a) a small obstruction was placed in the path of cathode rays.
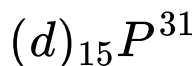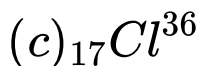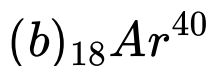
(b) a paddle wheel is placed between cathode and anode.

What were the conclusions drawn on the basis of these observations ?

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11. Calculate the number of neutrons for the following elements.

(a)

$_{11}Na^{23}$ $(b)_{18}Ar^{40}$ $(c)_{17}Cl^{36}$ $(d)_{15}P^{31}$

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12. What happens to the cathode rays under a strong magnetic field or an electric field ? What is conclusion made from this ?

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13. An atom of an element has 4th shell as the valence shell. The difference between electrons present in L and M and N shells are 1 and 0 respectively. Find the atomic number of an element.

14. An atom of an element has one electron in the valence shell and the two inner shells have

8 electrons each. Find the atomic number of that element.

15. Mass of total positive charge present in an atom is 16533 times to that of mass of electron. Find the atomic number of an element.
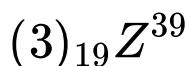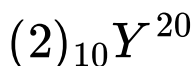
1. Write down the

(a) electronic configuration,

(b) number of protons and

(c) number of neutrons and

(d) nature of the element, for the following .

(1) $_6X^{12}$ (2)$_{10}Y^{20}$ (3)$_{19}Z^{39}$
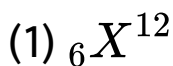
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2. Explain how the result of α-ray scattering experiment led to Rutherford's model of atom. Give the postulates and drawbacks of Rutherford's atomic model.

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3. State the postulates of Bohr's theory.

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4. Find out the maximum number of electrons that can be accommodated in K shell, L shell, M shell and N shell by using Bohr-Bury scheme.

5. Give the properties of cathode rays in comparison to the properties of canal rays.

1. In Thomson's atomic model, positive mass occupies more space than the negative charge in an atom.

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2. α-ray scattering experiment proved the presence of neutrons in an atom.

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3. Thomoson could successfully explain the electrical neutrality of an atom.

4. High pressure and low voltage should be maintained in the discharge tube for the production of cathode rays.

5. Mass number is the sum of the number of protrons in an atom.

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6. Cathode rays deflect in the presence of magnetic field.

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7. The discovery of _____ proved that atom in divisible.

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8. The maximum number of electrons present in 5th shell is _____.

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9. Electron present in _____ orbit cannot lose its energy.

10. The fundamental particle present in anode rays produced by $_1H^1$ is _____.

11. The electrode connected to the negative teminal of a battery in a discharge tube is called _____.

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12. The specific charge value of anode rays produced by _____ is the maximum.

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13. The sum of protons and neutrons is same in _____.

14. Which of the following particles is largely responsilbe for the chemical behaviour of elements ?

A. Proton

B. Electron

C. Neutron

D. Positron

Answer: B::C

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15. $_8X^{16}$ and $_8X^{17}$ represent

A. Isotones

B. Isobars

C. Isotopes

D. Isosters

Answer: C

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16. The isotope with zero neutrons is

A. protium

B. deutuium

C. tritium

D. None of these

Answer: A::C

17. Two elements X and Y have 6 and 7 electrons in their N-shell and M-shell respectively . Find the ratio of atomic numbers of X and Y.

A. $3:4$

B. $1:2$

C. $2:1$

D. $6 : 7$

Answer: C

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18. The number of valence electrons in $_4X^8$

atom is

A. 1

B. 2

C. 3

D. 4

Answer: B::C

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19. The number of valence electrons in $_{20}^{40}X$ is

A. 7

B. 9

C. 5

D. 2

Answer: C::D

20. Two elements A, B have 14 and 8 electrons in M and N shells respectively. Then the ratio of their atomic numbers is

A. $2 : 3$

B. $3 : 4$

C. $3 : 2$

D. $1 : 2$

Answer: A

21. According to Thomson

A. Negative charge of an atom is uniformly distributed throughout the atom.

B. the volume occupied by positive charge is less than that occupied by the negative charge.

C. electrons are embebbed in the positive charge which is spread uniformly.

D. None of the above

Answer: C

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22. $_x^y A, _x^{y+1} A$ are two isotopes of element A. Difference between number of neutrons in the isotopes is

A. 1-2y

B. 1-x

C. 1

D. 2x-1

Answer: C

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23. Low pressure is maintained in the discharge tube due to

A. increase the number of molecules

B. increase ionisation of gas molecules

C. decreaes the velocity of the rays coming

from the cathode.

D. All the above

Answer: B

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24. The velocity of α particels increases then angle of deviation

    A. increases

    B. decreases

    C. remains same

    D. Cannot be predicated

Answer: B::C

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25. Which of the following uni-positive ions possesses all the three sub-atomic particles

    A. Helium

    B. Deuterium

    C. Tritium

    D. Hydrogen

Answer: A::C

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26. The ratio of the number of electrons in the N-shell of A and the M-shell of B with atomic numbers 40 and 32, respectively, is

A. $5:3$

B. $9:5$

C. $5:9$

D. $5:4$

Answer: C

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27. Total number of electrons present in the penultimate shell of an element with atomic number 36 is

    A. 18

    B. 10

    C. 8

    D. 16

Answer: A::C

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28. To draw the geometrical representation for the structure of the oxygen atom the following steps are given . Identify the correct sequence of steps.

(a) The eight electrons present in the extra-nuclear part would be distributed in the first two orbits that is K and L. As per the rules , two electrons would occupy K orbit and the remaining six electrons occupy the L orbit.

(b) The atomic number of oxygen is 8. ltbr. (c) In the nucleus , 8 protons and 8 neutrons and present and in the extra-nuclear part, that is in

the orbits, 8 electrons are present.

(d) Oxygen atom has 8 electrons and 8 protrons . The mass number is 16 , hence number of neutrons is equal to $8\left[{}_{8}O^{16}\right]$

A. b a c d

B. c a d b

C. b d c a

D. c d b a

Answer: C

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29. Arrange the following statements in a sequence which involves the calculation of the atomic number and mass number for an atom of an element with 15 electrons and 16 neutrons.

(a) A=Number of protons + Number of neutrons

A=Z+ Number fo neutrons

A=15+16=31

(b) Number of protrons and number of electrons are equal in a neutral atom. Hence

the atomic number Z is equal to 15.

(c) Mass number is equal to the total number of protons and neutrons.

(d) Atomic number is 15 and mass number is 31.

    A. b d c a

    B. b c a d

    C. c b a d

    D. c b d a

Answer: B

30. Many theories and experiments carried out for the studey of atom eventually led to the development of its structure . Arrange the given theories or models of atom proposed by different scientists in chronological order.

(a) Planetary model

(b) Watermelon model

(c) Bohr's atomic model

(d) Dalton's atomic theory

A. c b a d

B. d a b c

C. b a d c

D. d b a c

Answer: D

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31. Rutherford's α-ray scattering experiment led to the discovery of the nucleus and to the conclusion that an atom consists of large empty space. Arrange the following steps in

sequence which explains the experiment and also the above mentioned conclusions.

(a) To make out the observations a spherical ZnS screen was placed surrounding the gold foil.

(b) The substance which acts as a source of α-particles is taken in a lead container and made to pass through a slit between like charged positive plates.

(c)It was observed that most of the particles passed straight through the gold foil, few were deflected through small angles and very few through large angles. Very very few

completely rebounded .

(d) A narrow, condensed beam consisting of α-particles is made ot bombard on a thin a gold foil.

A. a c b d

B. b c a d

C. d b a c

D. b d a c

Answer: D

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32. The mass of which of the following fundamental particles is negligible ?

A. Electrons

B. Protons

C. Neutrons

D. Both (1) and (3)

Answer: A

33. Identify the electronic configuration of manganese (Z=25)

A. 2,8,13,2

B. 2,8,8,7

C. 2,8,15

D. 2,8,10,5

Answer: A
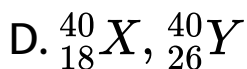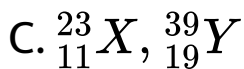
34. Which among the following set of elements contain same number of valence electrons?

A. $^{23}_{11}X$, $^{40}_{20}Y$

B. $^{20}_{10}X$, $^{39}_{19}Y$

C. $^{23}_{11}X$, $^{39}_{19}Y$

D. $^{40}_{18}X$, $^{40}_{26}Y$
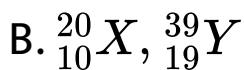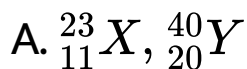
Answer: C

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35. The atoms of the same element may differ in the number of _____.

A. electrons only

B. protons only

C. neutrons only

D. both electrons and protons.

Answer: C

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36. Assertion (A): Electrons present in ground states of different single electron species (H, He^+, Li^{++}) possess different amount of energy.

Reason (R) : Distances of electrons from the nuclei of different single electron are equal.

    A. Both A and R are correct and R is the correct explanation of A.

    B. Both A and R are correct and R is not the correct explanation of A.

C. A is correct and R is wrong

D. A is wrong and R is correct

Answer: C

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37. Identify the atomic number corresponding

to least number of valence electrons

A. 19

B. 15

C. 35

D. 34

Answer: A

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38. An atom of an element has mass number 31. It has 16 neutrons. The valence shell and the number of valence electrons, respectively, could be

A. M shell and 6 electrons

B. M shell and 5 electrons

C. N shell and 5 electrons

D. L shell and 6 electrons

Answer: B

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39. The number of electrons present in each α-particle is

A. 2

B. 3

C. 0

D. 1

Answer: C

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40. An atom of an element has two electrons

in the valence shell and two consecutive inner

shells have 8 electrons each. Calculate the atomic number of the element.

A. 19

B. 20

C. 30

D. 18

Answer: B

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41. Rutherford's theory assumed which of the following paths for the electron ?

A. Spherical

B. Circular

C. Spiral

D. Not defined

Answer: B

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42. If an electron jumps from orbit A to orbit B it loses energy while it jumps from C to B it gains energy. Arrange the orbits in the increasing order of distance from the nucleus.

A. $A < B < C$

B. $C < A < B$

C. $C < B < A$

D. $A < C < B$

Answer: C

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1. A neutral atom of an element has a nucleus with nuclear charge 12 times and mass 24 times that of hydrogen. Calculate the number of electrons, protons and neutrons in its stable positively charged ion.

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2. Mass number of two isotopes of an element differ by 2 unit (A and A + 2) . Average atomic mass is 0.5 more than the lower mass number. What could be the ratio of the two isotopes.

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3. A stable neutral atom of a element contains three fully filled orbits. Find the atomic number of the element.

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4. According to Rutherford , electrons move around the nucleus in circular paths. How did the correlate this with the stability of an atom.

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5. The percentage abundance of two isotopes of boron in a natural sample are 80 and 20 . The first isotope has 6 neutrons in the nucleus. If the actual atomic mass of boron is

11.0 calculate the mass numbers of the two isotopes.

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6. A di-positive ion has an electronic arrangement 2,8,8 . Find out the number of electrons, protons and neutrons in that element if its mass number is 40.

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7. Atoms of two element P and Q have 5 electrons in 2nd shell and 3rd shell respectively . What could be the geometrical representations of P and Q ? What will the atomic numbers of these elements be ?

8. Anode rays are also produced along with cathode rays in the discharge tube under low pressure. Justify

9. Cathode rays are deflected in electric and magnetic fields. But they are made to pass straight in Thomson.s experiment. How do you account for this?

10. If the maximum permissible orbits of elements in nature are limited to n = 4, what are the number of possible elements?

11. A metallic element forms an ion with unit charge. The ion has 10 electrons and 12 neutrons . What is the number of electrons, protons and neutrons in its neutral atom ? Represent the atom with atomic number and mass number.

12. Nuclear charge of an element B is twice that of A. If A has two completely filled orbits and L shell is its outermost orbit, find out atomic numbers of A and B.

13. The number of electrons in a di-positive ion of an element X is 18. If the mass number of X is 4 units more than twice the number of

electrons of its ion, calculate of protons , electron and neutrons in X.

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14. Rutherford's α-ray scattering experiment was conducted in order to test the validity of Thomsom's model. What results were expected from this experiment ?

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15. If the average atomic mass fo chlorine is 35.5 then find the percentage abundance of the two isotopes of chlorine which have the mass number 35 and 37.

16. The electronic configuration of an atom A is a,a+b, a+2b , a and that of B a, a + b , 3a+2b, b.

(a) Write the electronic configuration of A and B.

(b) Calculate their atomic numbers,

(c) If the number of neutrons in A is 5b and that in B is 22.5a, calculate their mass number.

17. Compare and contrast and angle of deflection of α-rays in α-ray scattering experiment carried out by taking aluminium foil and gold foil. Justify.

18. Why did Thomson assume that electrons are embedded in a positive mass but not the other way round ?

19. The ratio of the number of neutrons present in the two element X and Y is 5:7 and the ratio of mass numbers is 10:13 . Element X attains stable octet configuration by losing two electrons from the fourth shell. Calculate

the number of protons , electrons and neutrons present in X and Y.

20. The di-positive and di-negative ions of different elements possesses octet configuration in their third shell. Find out the atomic number and number of valence electrons in their neutral atoms .

21. From the table given below, identify isotopes and isobars.

Atoms	Number of protons	Number of neutrons
A	X	Z + 2
B	X + 1	Z
C	X − 2	Z + 4
D	X + 1	Z + 1
E	X	Z + 1

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22. (i) Element X has two valence electrons in M-shell .

(ii) In element Y, the electrons are distributed in the first three shells. It has eight electrons

in M-shell .

(iii) Element Z has eight electrons in the penultimate shell that is M.

Based on the information given in the above three statements, answer the following questions.

(a) Give the electronic configuration of X.

(b) Which element is stable among X, Y and Z and why ?

(c) In which atom of an element is the number of electrons distributed in all four shells ?

(d) What is the atomic number of Z in which the number of electrons in the first and the

last shell are not the same ?

What are the number of electrons and protons present in 'Y' ?

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23. In an atom , the number of neutrons is 58.7% more than that of protons. The number of electrons in the neutral atom is 92. Find out the number of protons , neutrons and mass number and represent the atom with atomic number and mass number.

24. In α-ray scattering experiment what would happen if

(a) protons are used instead of α-particles.

25. An atom of an element has one electron in the valence shell and the two consecutive inner shells have 8 electrons each. Find the atomic number of that element. Write the

electronic configruation of preceding and succeding elements.

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1. Discharge doesn't take place at normal atmospheric pressure inside the cathode ray tube . Justify

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2. The e/m ratio of cathode rays does not change by changing the gas in cathode ray discharge tube. But the e/m ratio of anode rays changes by changing the gas in the discharge tube. Justify this statement.

3. When the canal ray experiment was conducted by taking helium gas in the discharge tube, e/m value of the particles was found to be less under low voltage and it was

found to be more under high voltage . How do you explain this ?

4. Different gases can produced colours in discharge tube. Explain with reason.

5. Anode rays produced by isotopes and isobars possess same charge when taken in

different discharge tubes. Which among the two sets of anode rays show different deflections in the presence of electric field ?

6. If $^{y}_{x}A^{+1}$ or $^{y-2}_{x-1}B^{+1}$ were to be used instead of α particles in Rutherford's experiment , which would be better and why ?

7. According to Bohr's theory , the electrons revolve round the nucleus in definite paths called orbits . Do the electrons revolve round with same speed in all orbits? Justify.

8. M shell of two elements A and B have 18 electrons each. The difference in the number of electrons present in N shell of A and B is 8. M shell is the penultimate shell in B. Predict

the range of probable atomic numbers of A and B.

9. Which postulate of Rutherford's theory is not derived from the results of α-ray scattering experiment ?

On what basis Rutherford's could assume that ?

10. Predict the possible atomic number(s) of an atom in which the third shell is incompletely filled and maximum 4 more electrons can be added to that shell of the atom.

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Example

1. How did the discovery of isotopes contradict Dalton.s atomic theory?

2. Why is Rutherford.s model called planetary model?

3. According to Rutherford, electrons move around the nucleus at very high speed. How did he correlate this with the stability of an atom?

4. An element X consists of 20 protons and 20 neutrons. Mention the atomic number and mass number, and represent the element with atomic number and mass number.

5. How was Bohr able to explain the stability of an atom?

6. The mass of positively charged particles present in an atom is found to be 11,022 times that of an electron. Identify the element and write its electronic configuration.

7. In an atom, the number of neutrons is 58.7% more than that of protons. The number of electrons in the neutral atom is 92. Find out

the number of protons, neutrons and mass number, and represent the atom with atomic number and mass number.

8. The mass number of an atom is 31. If the atom has 5 electrons in M-shell, calculate the number of neutrons.

1. How Rutherford.s theory contradicts the laws of electrodynamics?

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2. According to Dalton, atoms combine in ____ ratio to form compounds.

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3. Which postulate of Dalton's atomic theory is considered to be correct even toady ?

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7. Give the geometrical representations of electronic arrangements of the following

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25. The valence shell of an element of atomic number 35 is the _____ shell.

26. Give the mass and charge of an electron , a proton and an neutron in kg and coulombs repectively .

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Test Your Concepts Short Answer

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6. What are the observations of α-ray scattering experiment? Based on these observations, how did Rutherford disprove Thomson.s model?

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7. Write the electronic arrangement for the following elements. Also give the geometrical representations.

oxygen

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8. Write the electronic arrangement for the following elements. Also give the geometrical representations.

argon

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9. Write the electronic arrangement for the following elements. Also give the geometrical representations.

calcium

10. Write the electronic arrangement for the following elements. Also give the geometrical

representations.

potassium

11. When different gases are taken in a discharge tube, how do the e/m values of cathode rays and canal rays vary?

12. Give the differences between isotopes and isobars.

13. In J. J. Thomson.s experiment, what observations were found when

(a) a small obstruction was placed in the path of cathode rays.

(b) a paddle wheel is placed between cathode

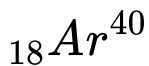and anode. What were the conclusions drawn on the basis of these observations?

14. Calculate the number of neutrons for the following elements:

$_{11}Na^{23}$

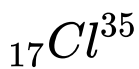**15.** Calculate the number of neutrons for the following elements:

$$_{18}Ar^{40}$$

▶ **Watch Video Solution**

16. Calculate the number of neutrons for the following elements:

$$_{17}Cl^{35}$$

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17. Calculate the number of neutrons for the following elements:

$$_{15}P^{31}$$
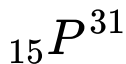
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18. What happens to the cathode rays under a strong magnetic field or an electric field? What is the conclusion made from this?

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19. An atom of an element has fourth shell as the valence shell. The difference between electrons present in L- and M-, K- and N-shells are 1 and 0, respectively. Find the atomic number of an element.

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20. An atom of an element has one electron in the valence shell and the two inner shells have 8 electrons each. Find the atomic number of that element.

21. Mass of total positive charge present in an atom is 16533 times to that of mass of electron. Find the atomic number of an element.

22. Write down the (a) electronic configuration, (b) number of valence electrons,

(c) number of neutrons and (d) nature of the element for the following: $_6X^{12}$

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23. Write down the (a) electronic configuration, (b) number of valence electrons, (c) number of neutrons and (d) nature of the element for the following: $_{10}Y^{20}$

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24. Write down the (a) electronic configuration, (b) number of valence electrons, (c) number of neutrons and (d) nature of the element for the following: $_{19}Z^{39}$

▶ Watch Video Solution

25. State the postulates of Bohr's theory.

▶ Watch Video Solution

26. Find out the maximum number of electrons that can be accommodated in K-shell, L-shell, M-shell and N-shell by using Bohr-Bury scheme.

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27. Give the properties of cathode rays in comparison to the properties of canal rays.

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1. In Thomson's atomic model, positive mass occupies more space than the negative charge in an atom.

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2. α-ray scattering experiment proved the presence of neutrons in an atom.

▶ **Watch Video Solution**

3. Thomoson could successfully explain the electrical neutrality of an atom.

4. The e/m ratio of cathode rays is different for different gases.

5. High pressure and low voltage should be maintained in the discharge tube for the production of cathode rays.

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6. Mass number is the sum of the number of protons and neutrons in an atom.

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7. Cathode rays deflect in the presence of magnetic field.

▶ Watch Video Solution

1. The discovery of _____ proved that atom in divisible.

▶ Watch Video Solution

2. The maximum number of electrons present in 5th shell is _____.

> ▶ **Watch Video Solution**

3. Electron present in _____ orbit cannot lose its energy.

> ▶ **Watch Video Solution**

4. The fundamental particle present in anode rays produced by $_1H^1$ is _____.

5. The electrode connected to the negative teminal of a battery in a discharge tube is called _____.

6. The specific charge value of anode rays produced by _____ is the maximum.

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7. The sum of protons and neutrons is same in _____.

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Concept Application Level 1 Matching

1. Match the entries in Column A with the appropriate ones in Column B.

| Column A	Column B
A. Plum pudding model ( )	a. Isobars
B. Planetary model ( )	b. Bohr's atomic model
C. Definite circular paths for electrons ( )	c. Isotopes
D. Fractional atomic weights of elements ( )	d. Rutherford's atomic model
E. Same number nucleons ( )	e. Thomson's of atomic model

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Concept Application Level 1 Select The Correct Alternative

1. Certain amount of a gas is enclosed in a discharge tube. The bulb in the arrangement given below can be made to glow when
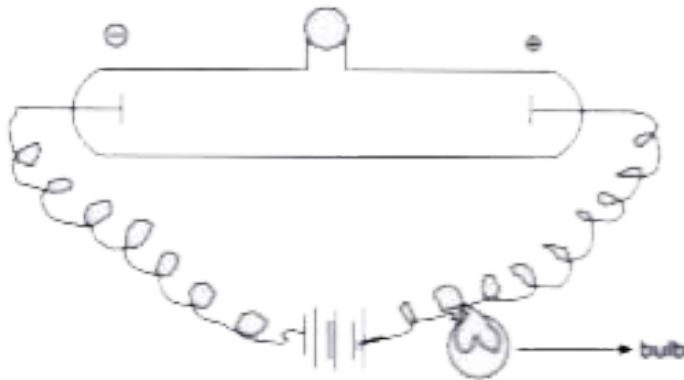
A. vacuum is created in the discharge tube.

B. the gas is replaced by the same amount of an easily ionisable gas.

C. the other gas of low molecular weight is

introduced.

D. the amount of gas in the discharge tube

is decreased.

Answer: D

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2. Which of the following particles is largely

responsible for the chemical behaviour of

elements?

A. proton

B. electron

C. neutron

D. positron

Answer: B

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3. $_8X^{16}$ and $_8X^{17}$ represent

A. isotones

B. isobars

C. isotopes

D. isosters

Answer: C

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4. The isotope with zero neutrons is

A. protium

B. deuterium

C. tritium

D. none of these

Answer: A

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5. Two elements X and Y have 6 and 7 electrons in their N- and M-shells, respectively. Find the ratio of atomic numbers of X and Y.

A. $3:4$

B. $1:2$

C. $2:1$

D. $6:7$

Answer: C

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6. The number of valence electrons in $_4X^8$

atom is

A. 1

B. 2

C. 3

D. 4

Answer: B

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7. The number of valence electrons in $^{40}_{20}X$ is

A. 7

B. 9

C. 5

D. 2

Answer: D

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8. Two elements A and B have 14 and 9 electrons in M- and N-shells, respectively. Then the ratio of their atomic numbers is

A. $2 : 3$

B. $3:4$

C. $3:2$

D. $1:2$

Answer: A

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9. According to Thomson

A. negative charge of an atom is uniformly

distributed throughout the atom.

B. the volume occupied by positive charge

is less than that occupied by the

negative charge.

C. electrons are embedded in the positive

charge which is spread uniformly.

D. none of the above

Answer: C

10. $_{x}^{y}A, _{,x}^{y+1}A$ are two isotopes of element A. Difference between number of neutrons in the isotopes is

    A. 1-2y

    B. 1-x

    C. 1

    D. 2x-1

Answer: C

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11. Low pressure is maintained in the discharge tube due to

    A. increase the number of molecules

    B. increase ionisation of gas molecules

    C. decrease the velocity of the rays coming

       from the cathode

    D. all of above

Answer: B

12. If velocity of α-particles increases, then angle of deviation

    A. increases

    B. decreases

    C. remains same

    D. cannot be predicted

Answer: B

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13. Which of the following unipositive ions possesses all the three subatomic particles?

A. helium

B. deuterium

C. tritium

D. hydrogen

Answer: A

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14. The ratio of the number of electrons in the N-shell of A and the M-shell of B with atomic numbers 40 and 32, respectively, is

A. $5:3$

B. $9:5$

C. $5:9$

D. $5:4$

Answer: C

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15. Total number of electrons present in the penultimate shell of an element with atomic number 36 is

A. 18

B. 10

C. 8

D. 16

Answer: A

16. To draw the geometrical representation for the structure of the oxygen atom the following steps are given. Identify the correct sequence of the steps.

(1) The eight electrons present in the extranuclear part would be distributed in the first two orbits, i.e., K and L. As per the rules, two electrons would occupy the K-orbit and the remaining six electrons occupy the L-orbit.

(2) The atomic number of oxygen is 8.

(3) In the nucleus, 8 protons and 8 neutrons are present and in the extranuclear part, i.e., in

the orbits, 8 electrons are present.

(4) Oxygen atom has 8 electrons and 8 protons. The mass number is 16, and hence, the number of neutrons is equal to 8 $\left[_8O^{16} \right]$

A. 2 1 3 4

B. 3 1 4 2

C. 2 4 3 1

D. 3 4 2 1

Answer: C

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17. Arrange the following statements in a sequence which involves the calculation of the atomic number and mass number for an atom of an element with 15 electrons and 16 neutrons.

(1) A = Number of protons + Number of neutrons

A = Z + Number of neutrons

A = 15 + 16 = 31

(2) Number of protons and number of electrons are equal in a neutral atom. Hence,

the atomic number Z is equal to 15.

(3) Mass number is equal to the total number of protons and neutrons.

(4) Atomic number is 15 and mass number is 31.

A. 2 4 3 1

B. 2 3 1 4

C. 3 2 1 4

D. 3 2 4 1

Answer: B

18. Many theories and experiments carried out for the study of atom eventually led to the development of its structure. Arrange the given theories or models of atom proposed by different scientists in chronological order.

(1) planetary model

(2) watermelon model

(3) Bohr.s atomic model

(4) Dalton.s atomic theory

A. 3 2 1 4

B. 4 1 2 3

C. 2 1 4 3

D. 4 2 1 3

Answer: D

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19. Rutherford.s α-ray scattering experiment led to the discovery of the nucleus and to the conclusion that an atom consists of large empty space. Arrange the following steps in a

sequence which explains the experiment and also the above mentioned conclusions.

(1) To make out the observations a spherical ZnS screen was placed surrounding the gold foil.

(2) The substance which acts as a source of α-particles is taken in a lead container and made to pass through a slit between like charged positive plates.

(3) It was observed that most of the particles passed straight through the gold foil, few were deflected through small angles and very few through large angles. However, very few

completely rebounded.

(4) A norrow , condensed beam consisting of α - particles is made to bombard on a thin gold foil.

    A. 1 3 2 4

    B. 2 3 1 4

    C. 4 2 1 3

    D. 2 4 1 3

Answer: D

20. The mass of which of the following fundamental particles is negligible ?

A. electrons

B. protons

C. neutrons

D. Both (a) and (c)

Answer:

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21. Identify the electronic configuration of manganese (Z=25)

    A. 2 , 8 , 13 ,2
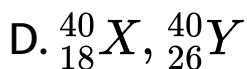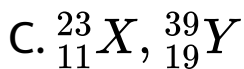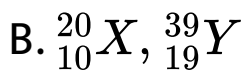
    B. 2,8,8,7

    C. 2,8,15

    D. 2,8,10,5

Answer:

22. Which among the following set of elements contain same number of valence electrons?

A. $^{23}_{11}X$, $^{40}_{20}Y$

B. $^{20}_{10}X$, $^{39}_{19}Y$

C. $^{23}_{11}X$, $^{39}_{19}Y$

D. $^{40}_{18}X$, $^{40}_{26}Y$
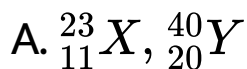
Answer:

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23. The atoms of the same element may differ in the number of _____

    A. electrons only

    B. protons only

    C. neutrons only

    D. both electrons and protons

Answer:

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24. Assertion (A): Electrons present in ground states of different single electron species (H, He^+, Li^{++}) possess different amount of energy.

Reason (R) : Distances of electrons from the nuclei of different single electron are equal.

    A. Both A and R are correct and R is the

        correct explanation of A.

    B. Both A and R are correct and R is not the

        correct explanation of A.

C. A is correct and R is wrong.

D. A is wrong and R is correct.

Answer:

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25. Identify the atomic number corresponding to least number of valence electrons

A. 19

B. 15

C. 35

D. 34

Answer:

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26. An atom of an element has mass number 31. It has 16 neutrons. The valence shell and the number of valence electrons, respectively, could be

A. M-shell and 6 electrons

B. M-shell and 5 electrons

C. N-shell and 5 electrons

D. L-shell and 6 electrons

Answer:

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27. The number of electrons present in each α-particle is

A. 2

B. 3

C. 0

D. 1

Answer:

28. An atom of an element has two electrons

in the valence shell and two consecutive inner

shells have 8 electrons each. Calculate the atomic number of the element.

A. 19

B. 20

C. 30

D. 18

Answer:

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29. Rutherford's theory assumed which of the following paths for the electron ?

A. spherical

B. circular

C. spiral

D. not defined

Answer:

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30. If an electron jumps from orbit A to orbit B it loses energy while it jumps from C to B it gains energy. Arrange the orbits in the increasing order of distance from the nucleus.

    A. $A < B < C$

    B. $C < A < B$

    C. $C < B < A$

    D. $A < C < B$

Answer:

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1. A neutral atom of an element has a nucleus with nuclear charge 12 times and mass 24 times that of hydrogen. Calculate the number of electrons, protons and neutrons in its stable positively charged ion.

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2. Mass number of two isotopes of an element differ by 2 unit (A and A + 2) . Average atomic mass is 0.5 more than the lower mass number. What could be the ratio of the two isotopes.

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3. A stable neutral atom of a element contains three fully filled orbits. Find the atomic number of the element.

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4. The percentage abundance of two isotopes of boron in a natural sample are 80 and 20. The first isotope has 6 neutrons in the nucleus. If the actual atomic mass of boron is 11.01, calculate the mass numbers of the 2nd isotopes.

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5. A di-positive ion has an electronic arrangement 2,8,8 . Find out the number of

electrons, protons and neutrons in that element if its mass number is 40.

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6. Atoms of two element P and Q have 5 electrons in 2nd shell and 3rd shell respectively . What could be the geometrical representations of P and Q ? What will the atomic numbers of these elements be ?

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7. Anode rays are also produced along with cathode rays in the discharge tube under low pressure. Justify

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8. Cathode rays are deflected in electric and magnetic fields. But they are made to pass straight in Thomson.s experiment. How do you account for this?

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9. If the maximum permissible orbits of elements in nature are limited to n = 4, what are the number of possible elements?

10. A metallic element forms an ion with unit charge. The ion has 10 electrons and 12 neutrons . What is the number of electrons, protons and neutrons in its neutral atom ?

Represent the atom with atomic number and mass number.

11. Nuclear charge of an element B is twice that of A. If A has two completely filled orbits and L shell is its outermost orbit, find out atomic numbers of A and B.

12. The number of electrons in a di-positive ion of an element X is 18. If the mass number of X is 4 units more than twice the number of electrons of its ion, calculate of protons , electron and neutrons in X.

13. Rutherford's α-ray scattering experiment was conducted in order to test the validity of

Thomsom's model. What results were expected from this experiment ?

14. If the average atomic mass fo chlorine is 35.5 then find the percentage abundance of the two isotopes of chlorine which have the mass number 35 and 37.

15. The electronic configuration of an atom A is a,a+b, a+2b , a and that of B a, a + b , 3a+2b, b.

(a) Write the electronic configuration of A and B.

(b) Calculate their atomic numbers,

(c) If the number of neutrons in A is 5b and that in B is 22.5a, calculate their mass number.

16. Compare and contrast and angle of deflection of α-rays in α-ray scattering experiment carried out by taking aluminium foil and gold foil. Justify.

17. Why did Thomson assume that electrons are embedded in a positive mass but not the other way round ?

18. The ratio of the number of neutrons present in the two element X and Y is 5:7 and the ratio of mass numbers is 10:13 . Element X attains stable octet configuration by losing two electrons from the fourth shell. Calculate the number of protons , electrons and neutrons present in X and Y.

19. The di-positive and di-negative ions of different elements possesses octet configuration in their third shell. Find out the atomic number and number of valence electrons in their neutral atoms .

20. From the following table, identify isotopes and isobars.

Atoms	Number of protons	Number of neutrons
A	X	Z + 2
B	X + 1	Z
C	X − 2	Z + 4
D	X + 1	Z + 1
E	X	Z + 1

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21. Based on the information given in the

below three statements, answer the following

questions.

(i) Element X has two valence electrons in the

M-shell.

(ii) In element Y, the electrons are distributed in the first three shells. It has eight electrons in the M-shell.

(iii) Element Z has eight electrons in the penultimate shell, i.e., M.

(a) Give the electronic configuration of X.

(b) Which element is stable among X, Y and Z and why?

(c) In which atom of an element is the number of electrons distributed in all the four shells?

(d) What is the atomic number of Z in which the number of electrons in the first and the last shell are not the same?

(e) What are the number of electrons and protons present in Y?

22. In an α-ray scattering experiment what would happen if (a) protons are used instead of α particles.

23. An atom of an element has one electron in the valence shell and the two consecutive inner shells have 8 electrons each. Find the atomic number of that element. Write the electronic configruation of preceding and succeding elements.

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Concept Application Level 3

1. Discharge doesn't take place at normal atmospheric pressure inside the cathode ray tube . Justify

2. The e/m ratio of cathode rays does not change by changing the gas in cathode ray discharge tube. But the e/m ratio of anode rays changes by changing the gas in the discharge tube. Justify this statement.

3. When the canal ray experiment was conducted by taking helium gas in the discharge tube, e/m value of the particles was found to be less under low voltage and it was found to be more under high voltage . How do you explain this ?

4. Different gases can produced colours in discharge tube. Explain with reason.

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5. Anode rays produced by isotopes and isobars possess same charge when taken in different discharge tubes. Which among the two sets of anode rays show different deflections in the presence of electric field ?

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6. If $^{y}_{x}A^{+1}$ or $^{y-2}_{x-1}B^{+1}$ were to be used instead of α particles in Rutherford's experiment , which would be better and why ?

7. According to Bohr's theory , the electrons revolve round the nucleus in definite paths called orbits . Do the electrons revolve round with same speed in all orbits? Justify.

8. M shell of two elements A and B have 18 electrons each. The difference in the number of electrons present in N shell of A and B is 8. M shell is the penultimate shell in B. Predict the range of probable atomic numbers of A and B.

9. Which postulate of Rutherford's theory is not derived from the results of α-ray scattering experiment ?

On what basis Rutherford's could assume that ?

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10. Predict the possible atomic number(s) of an atom in which the third shell is incompletely filled and maximum 4 more

electrons can be added to that shell of the atom.

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