

India's Number 1 Education App

CHEMISTRY

BOOKS - PEARSON IIT JEE FOUNDATION

ATOMIC STRUCTURE



1. Write different isotopes of oxygen , carbon and chlorine.



3. (i) What are A,B,C,D and E in the given figure?

(ii) What is the purpose of C?

(iii) Explain the role , of D in the phenomenone

taking place in the discharge tube.



4. An atom of element is represented as $._Z C^A$

. After the emission of a β -particle , another element Y is formed. Represent Y with atomic

number and mass number.





5. Calculate the specific charges (e/m) of the following particles and then arrange the particles in the asceding order of their specific charges.

(a) Electron

(b) Proton

(c) α -particle.



6. Calculate the mass of a charged particle in CGS units if its charge is x coulomb and specific charge is y coulomb/g.



7. The isotopes of an element have mass numbers, A, A + 1, A + 2. The ratio of abundance of these isotopes is 3:2:4. Calcualte the average atomic mass of the element.



8. Following conclusions are drawn by observing α -ray scattering experiment. Write the respecitve observations based on which these conclusions are drawn.

(i) Non-uniform distribution of positive charge.

(ii) Presence of positively -charged core or nucleus.

(iii) Presence of large empty space in an atom.

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9. Thomson's Model OF Atom || Rutherford's Model OF Atom Vatch Video Solution

10. The wavelength of particular radiation is $700 \text{ nm}(1 \text{ nm} - 10^{-9} \text{m})$.Find its frequency (v).

11. An element has protons whose mass is equal to 23, 881, times that of an electron. Identify the element and write its electronic configuration.

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12. Write the electronic configuration and the atomic number of the atom which becomes stable by gaining 3 electrons in fifth shell.

13. What is ratio of the amount of energy required to remove an electron from hydrogen and He^+ ion ?



14. Comple the following table :



Note: Core electrons are inner electrons which

exclude valence electorns.



2. The value of the Plank's constant 'h' in erg -s

is _____





4. Name the three fundamental particles in an atom. Write the values of their mass numbers and atomic numbers.

5. The equation for the calcualtion of energy of nth orbit if hydrogen atom derived by Bohr

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is ____.

6. Who discovered protons? Based on what experiment was he able to discover these protons ?

7. Neutrons were discovered by bombarding

beryllium with _____ particles.

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8. What name did Max Planck give to energy

packages?



9. What is Heisenberg's uncertainty principle ?



10. Accroding to _____, the charges in an atom are arranged like the pulp and seeds of a watermelon.

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11. Which theory supported the particle nature

of an electron ?

12. Give the value of Planck's constant in

(1) erg-s

(2) joule-s



13. What happens when an electron jumps

from a lower energy level to a higher energy

level?





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Short Answer Type

 According to Rutherford's atomic model, where are the protons and electrons located in an atom ?

2. The wavelength of particular radiation is $700 \text{ nm}(1 \text{ nm} - 10^{-9} \text{m})$.Find its frequency (v).



Level 1 Concept Application

1.
$$\cdot_8 (O)^{16}$$
 and $\cdot_8 (O)^{18}$ are isotpes while $\cdot_{20} (Ca)^{40}$ and $\cdot_{18} (Ca)^{40}$ are isobars.



2. Energy is absorbed when the electron jumps

from K to L energy sheels.



3. Anode rays are deflected towards the negative plate in the presence of an electric field because they consist of _____particles.

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7. Which among the following pairs are having

different number of valence electrons ?

A.
$$Na^+, Al^{+3}$$

B.
$$P^{-3}, Ar$$

C.
$$Mg^{\,+\,2},\,Ar$$

D.
$$O^{-2}, ar{F}$$

Answer:



8. Which among the following are isobars ?

A.
$$_{b}\left(X
ight)^{a} ext{ and } _{b}\left(Y
ight)^{a}+1$$

 $\mathsf{B..}_{b}\left(X
ight)^{a} ext{ and } \cdot_{c}\left(Y
ight)^{b}$

 $\mathsf{C..}_{b}\left(X
ight)^{a} ext{ and } ext{.}_{b+1}\left(Y
ight)^{a}$

D. none

Answer:

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9. Which of these pairs has almost similar masses ?

A. proton-electron

B. neutron-electron

C. electron.
$$_{-1}\left(H
ight) ^{1}$$

D. nuetron . $_{-1}$ $\left(H
ight) ^{1}$

Answer:

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10. The energy of an electron revolving in the $3^r d$ orbit of Be^{+3} ion is _____ev

A.-10.2

B. - 13.6

C. - 24.2

D. - 18.1

Answer:

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11. Which of the following concepts , was not considered in Rutherford's atomic model ?

A. the electrical neutrality of atom

- B. the quantisation of energy
- C. electrons revolve around nucleus at very

high speeds

D. existence of nuclear forces of attraction

on the electrons.

Answer: B



12. $._7 (X)^{15}, ._7 (X)^{11}$ are two naturally occuring isotopes of an element X. what is the percentage of each isotope of X if the average atomic mass is 14 ?

A. 95,5

B. 80,20

C. 25,75

D. 16,84

Answer:





13. A trinegative ion of an element has 8 electrons in its M shell. The atomic number of the element is

A. 15

B. 18

C. 20

D. 16

Answer:



14. Arrange the following statements given by

various scientists in chronological order :

A. 4 3 12

B. 42 31

C. 2431

D. 4321

Answer:

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15. What is the ratio of radii of the first successive odd orbits of hydrogen atom?

A. 9:1

B.1:9

C. 1: 3

D. 3:1

Answer:

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16. An electron revolves round the nucleus in the 3rd orbit and jumped to a higher orbit X showing a difference in angular momentum equal to $\frac{h}{\pi}$. The value of 'X' could be.

A. 4

B. 6

C. 5

D. 7

Answer:



17. Ruterford's α -particle scattering experiment eventually led to the conclusion that

A. mass and energy are related

B. the point of impact with matter can be

precisely determined

C. neutrons are buried deep in the nucleus

D. electrons are disturbed in a large speace

around the nucleus.

Answer:



18. Arrange the following steps which are carreid out in μ -ray experiment in the correct sequence:

(i) Passage of μ - particles thorugh a slit.

(ii) bombardment of μ -partilces with a gold foil

(iii) deflection of μ -particles

(iv) production of μ -particles

A. 4123

B. 4132

C. 1432

D. 1423

Answer:



19. Which among the following pairs are having different number of toatl electrons ?

A. Na^+ and Al^{+3}

B. P^{-3} and Ar

 $\mathsf{C}.Mg^{+2}$ and Ar

D. O^{-2} and F^{-}

Answer:



20. The postulates of Bohr's atomic model are given below. Arrange them in the correct sequence :

(1) As long the electron revolves in a particular orbit, the electron does not lose its energy. Therefore, these orbits are called stationary orbits and the electrons are said to be in stationary energy states.

(2) Electrons revolve round the nucleus in specified circualr paths called orbits or shells.(3) The energy associated with a certain energy level increases with the increase of its distance from the nucleus.

(4) An electron jumps form a lower energy level to a higher energy level by absorbing energy. But when it jumps from a higher to lower energy level, energy is emitted in the form of electromagnetic radiation.

(5) Each orbit or sheel is associated with a definite amount of energy. Hence, these are also called energy levels and are designated as K,L,M and N, respectively.

A. 13452

B. 23514

C. 25314

D. 21435



21. The ratio of atomic number of two elements A and B is 1:2 The numebr of electrons present in the valence sheel $(3^r d)$ of A is equal to the difference in the number of electrons present in the other two shells. Steps involved for the calculation of ratio of number of electrons present in a penultimate sheel to anti-penultimate sheel of B are given below:

Arrange them in the correct sequence :

(1) calculation of atomic number of B

(2) calcualtion of valence electrons present inA.

(3) calacualtion of atomic number of A.

(4) calacualtion of number of electrons present in the penultimate and antipenultimate shells of B.

(5) writing electronic configuration of B.

A. 23415

B. 23154

C. 45231

D. 42135

Answer:

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22. The equation given by Bohr to calculate radius of $n^t h$ orbit of hydrogen atom is

A.
$$r_n=rac{n^2h^2}{4\pi^2me}$$

B. $r_n=rac{n^2h^2}{4\pi^2me}$
C. $r_n=rac{nh^2}{4\pi^2me}$

D.
$$r_n=rac{n^2h^2}{4\pi^2m^2e}$$

Answer:

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23. The number of electrons present int the valence shell of an atom with atomic number 38 is

A. 2

B. 10

C. 1

D. 8

Answer:



24. The mass number of an atom whose unipositive ion has 10 electrons and 12 neutrons is B. 23

C. 21

D. 20

Answer:

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Level 2 Concept Application

1. When the same isotopic gas is taken in two discharge tubes, the angle of deflection is

found to be different though the strength of the external electric field applied is the same. Explain.

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2. In a canal ray experiment, different gases were found to produce canal rays with the same specific charge. Explain.

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3. Whne canal rays experiment is conducted with hydrogen gas, scientists were found to give particles with different $\frac{e}{m}$ values. Justify.



4. Energy of the electron in the atom is negative. Explain.



5. Electronic spectra can distinbuish isobars

but not isotopes. Justify.

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6. If the energy difference between the orbits when an electron in H atom excited to higher energy orbit from its ground state is 12.1eV/ atom , calcualte the frequency of radiation emitted $(1eV = 1.602 \times 10^{-19J})$ when electron comes back to second energy level.



7. Is the energy difference between successive orbits the same for all orbits? Justify your answer.

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8. Though there is only one electron in a hydrogen atom, the spectrum of hydrogne contains a number of lines, How do you explain this?



9. What is the ratio of radius of the 1^st orbit

to $2^n d$ orbit, if the velocity of the electron in

the $1^{s}t$ orbit is twice that of the $2^{n}d$ orbit.



10. A particular atom has the 4th shell as its valenced sheel. if the difference between the number of electrons between K and N shells

and L and M shells is zero, find the atomic number of the element and electronic congfiguration of its stable ion.

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11. A stable unipositive ion of an element contains three fully filled orbits.What is the atomic number of the element ?

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12. Explain why a blackened plantinum strip when placed the radius of curvature red hot, only when the cathode taken has concave shape.

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13. The average atimic mass of two isopoes with mass numbers A and A + 2 is A + 0.25. Calculate the percentage abundance of the isotopes.



14. Spectral line given by an atom is a kind of signature of the respective atom. Commnet of

this statement.

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15. Why was a spherical sulphide screen used

in α -ray scattering experiment ?

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16. Why is the source of α -particles kept inside

the lead block?

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17. If Thomson's model is considered to be correct, what would be the obervation of Ruterford's α -ray scattering experiment?



18. The ratio of the atomic numbers of two elements A and B is 2:3 A is an intery gas the first 3 orbits completely filled. Identify A and B and write their electronic configurations.

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19. A stable dipositive ion and a dinnegative ion are isoelectrnic with an octet configuaration in the second shell of their atoms. Identify of the preceding and succeeding elements and write their electronic

configurations.



20. Predict the possible atomic number (s) of an atom in which the third sheel is completely filled and maximum 3 more electrons can be added in that shell.

21. The radius of n^{th} orbit of a single electron

species is $0.132 n^2 A^\circ$. Identify the element.

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22. What is the frequency of light emitted when an electron in a hydrogen atom jumps from the 3^{rd} orbit to the 2^nd orbit ?



23. An electron having an angular momentum of 1.05×10^{-34} joules jumps to another orbit such that it has an angular momentum of 4.20×10^{-34} joules. Explain the possible transitions.

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24. The mass number of a particular element which has equal number of protons and

neutrons is 32. What is the electronic

configuration of the atom and its stable ion ?



Level 3 Concept Application

1. In Millikan's oil drop experiment, the distance between the metal plates, A and B to which an electric potential is applied such that A is positive and B is negative is 5 mm. An oil drop is found to be suspended at a distance of

2 mm from B. Predict the change in the position of the oil drop when there is a sudden drop or rise in potential. Justify.

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 Different gases in the discharge tube produce different colours under suitable conditions of pressure and voltage. Explain.

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3. Is the velocity of an electron in all orbits the same for an atom of a particular element ? How does it very for different single electron specites ? Give reasons in support of your answer.

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4. What is the ratio of distance between successive orbits of 1 and 2 to 2 and 3 of hydrogen atom ?



5. If $\overset{y}{\cdot} A^{+1}$ or $\overset{y-1}{\cdot} B^{+1}$ were to be used instead of α -particles in Rutherford's experiment, which would be better and why? **View Text Solution**

6. Draw a comparison between the potential energy and kinetic energy of electrons in the 1^st orbits of hydrogen and He^+ ion. Also comment on the total energy of the electrons

in the above cases.



7. Though the kinetic energy of electrons decreases with an increase in the distance from the nucleus, the potential energy of the electron increases. How do you account for this ?



8. Why is high voltage and low pressure maintained in the discharge tube ?



9. If canal ray experiments are conducted with different isotopes of hydrogen gas, do the canal rays produced show that same deflection under the external eletric field? Give reasons to support your answer.





if the given schematic diagrom represents, Thomson's experiment and the corresponding observation, what would be his atomic model ?

