# CLASS XII ATOMS WORK SHEET

1.A particle of energy $1/2\ mv^2$ bombards a heavy target nucleus of charge Ze. Then the distance of closest approach will be proportional to

A. $v^2$ B. $1/v^4$

C. $1/m$ D. $1/Ze$

2.When hydrogen atom is raised from the ground state to an excited state

A. $P.E$ decreases and $K,E$ increases

B. $P.E$ increases and $K.E$ decreases

C. Both $P.E$ and $K.E$ increases

D. Both $P.E$ and $K.E$ decreases

3.The largest wavelength in ultraviolet region of hydrogen spectrum is $122\ nm$. The smallest wavelength in the infrared region of the hydrogen spectrum is

A. $802\ nm$ B. $823\ nm$

C. $1882\ nm$ D. $1648\ nm$

4.The transition from the state $n = 4$ to $n = 3$ in hydrogen like atom results in ultra violet radiation. Infra red radiation will be obtained in the transition from:

A. $2 \rightarrow 1$ B. $3 \rightarrow 2$

C. $4 \rightarrow 2$ D. $5 \rightarrow 4$

5) The *plum pudding model* of the atom is proposed by

A. JJ Thomson B.Rutehrford C. Bohr D. Johann Jakob Balmer

6.When the α particle rebounds back then the impact parameter is

A.zero B.180 C.90 D.45

7.The correct expression for the distance of closest approach when an α particle having KE is approaching gold nucleus is .

A) $\frac{2*79*e^2}{4\pi\varepsilon_0 KE}$ B. $\frac{2*79*e}{4\pi\varepsilon_0 KE}$ C. $\frac{2*79*e^2}{4\pi\varepsilon_0}*KE$ D. $\frac{79*e^2}{4\pi\varepsilon_0 KE}$

8.The value of Rydberg's constant is

A) $1.097*10^7\ cm^{-1}$ B) $1.097*10^7\ m^{-1}$ C) $1.097*10^{-7}\ cm^{-1}$ D) $1.097*10^{-7}\ cm^{-1}$

9.The relation between the orbit radius and the electron velocity is

A. $r = \frac{e^2}{4\pi\varepsilon_0 mv^2}$ B. $r = \frac{e^2}{4\pi\varepsilon_0 mv}$ C. $r = \frac{e^2}{4\pi\varepsilon_0 * \frac{1}{2}mv^2}$ D. $r = \frac{e^2}{4\pi\varepsilon_0 * v^2}$

10.The total energy of the electron in the ground state is -13.6eV.The PE of the electron in ground state is

A) +13.6eV B) -13.6eV C)-27.2eV D)+27.2eV

11.The KE of electron in the second excited state of hydrogen atom is

A) +1.51eV B)-1.51eV C) -3.4eV D) +3.4Ev

12.The longest wave length in Balmer series in hydrogen spectrum is

A) 656.3 nmB) 900 nm C) 1020nm D) 434.1 nm

13.The emitted light of photon corresponds to Lyman series lies in

A) UV region B)Visible region C) Infra red region D) X ray region

14.Which one of the following statement is not correct?

A) Atom will always emit line spectra

B) The energy of an accelerating electron should remains the same

C) According to the classical electromagnetic theory, the frequency of the electromagnetic waves emitted by the revolving electrons is not equal to the frequency of revolution.

D) The electron would spiral inward and eventually fall into the nucleus and such an atom can not be stable

15.The radius of the third excited stationary orbit is

A) 2.12 $A^0$ B) 8.48 $A^0$ C) 4.77 $A^0$ D) 1.59 $A^0$

16.The correct expression for the radius of the n th orbit is

A) $\frac{n^2h^2\varepsilon_0}{\pi me^2}$ B) $\frac{nh^2\varepsilon_0}{\pi me^2}$ C) $\frac{h^2\varepsilon_0}{\pi mn^2e^2}$ D) $\frac{n^2h^2\varepsilon_0}{\pi m^2e^2}$

17.The correct expression for the energy of the electron in the nth orbit is

A) $\frac{-2.18*10^{-18}}{n^2}J$ B) $\frac{-2.18*10^{-18}}{n^2}eV$ C) $\frac{-13.6}{n^2}J$ D) $\frac{-2.18*10^{-18}}{n}eV$

18.The correct expression for the Rydberg's constant is

A) $R=\frac{me^4}{8\varepsilon_0{}^2Ch^3}$ B) $R=\frac{me^3}{8\varepsilon_0{}^2Ch^3}$ C) $R=\frac{me^4}{8\varepsilon_0{}^2h^3}$ D) $R=\frac{me^4}{8\varepsilon_0{}^2Ch^2}$

19.An electron jumps from fourth excited state. How many transition of electron is possible?

A) 9 B) 1 C)12 D)15

FILL IN THE BLANKS

1.The negative sign in the expression of total energy of electron indicates -----

2.Rutherford scattering therefore, is a powerful way to determine an --------

3.These dark lines found in the emission line spectrum of the gas is called as --------

4.The line with the wavelength, 434.1 nm in the red is called ------

5.The relation between potential energy and kE of electron in n th orbit is ----

6.Relation between orbital time period of electron and principal quantum number is ---

7.The ionization potential of the electron of energy in the ground state of hydrogen atom is ---

8.Alpha-particles emitted by a $^{214}Bi_{83}$radioactive source were collimated into a narrow beam by their passage through -----

9.The scattered alpha-particles were observed through a rotatable detector consisting of ----and ----------

REASONING QUESTIONS

1.Why very small number of α particle retrace its path in α scattering experiment?

2.why most alpha particles go right through a thin metal foil without deflection in α scattering experiment?

3.In gold foil experiment why do you prefer gold foil?

4.In gold foil experiment why do you prefer thin goldfoil?

5.The energy supplied to an electron in the ground state of hydrogen atom is 13.056eV. In which excited state the electron goes from ground state?

6.An electron jumps from third excited level. How many photons are emitted which lies in visible region?

7.In Rutherford α scattering experiment, the size of the gold nucleus was calculated it was found that the answer obtained is much greater than actual value why?

8. What does it mean by the total energy of the electron of hydrogen atom is -3.4eV?

## NUMERICALS

1.The ground state energy of hydrogen atom is -13.6eV. If an electron makes a transition from an energy level -0.85eV to -3.4eV, calculate the wavelength of the spectral line emitted. To which series of hydrogen spectrum, does this wavelength belong?

2.The ground state energy of hydrogen atom is -13.6eV. (i) What are the potential energy and kinetic energy of an electron in the $3^{rd}$ excited state? (ii)If the electron jumps to the ground state from the third excited state, calculate the frequency of photon emitted.

3.In Geiger-Marsden experiment, calculate the distance of closest approach to the nucleus of Z=80, when an α particle of 8MeV energy impinges on it before it comes momentarily to rest and reverses its direction.

4.Calculate the shortest and longest wavelengths of Lyman series.($R=1.097x10^{7}m^{-1)}$

5.The period of revolution of the electron in the third orbit in a hydrogen atom is

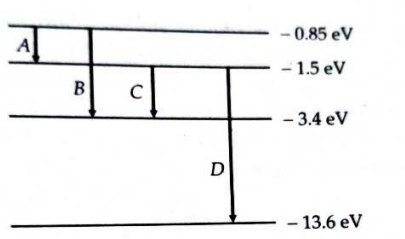
$4.132x10^{-15}$s. Hence find the period in the $5^{th}$ Bohr orbit.

6. The kinetic energy of α particle incident on gold foil is doubled. How does the distance of closest approach change?

7.(a)Using Bohr's second postulate of quantization of orbital angular momentum show that the circumference of the electron in the nth orbital state in hydrogen atom is n times the de-Broglie wavelength associated with it.

(b)The electron in hydrogen atom is initially in the third excited state. What is the maximum number of spectral lines which can be emitted when it finally moves to the ground state?

8.The energy level diagram of an element is given below. Identify by doing necessary calculations which transition corresponds to the emission of a spectral line of wavelength 102.7nm.




9. Calculate the impact parameter of 5MeV particle scattered by $90^{o}$ when it approaches a gold nucleus.

10.In the ground state of hydrogen atom its Bohr radius is given as $5.6 \times 10^{-11}$m. The atom is excited such that the radius becomes $21.2 \times 10^{-11}$m. Find (i) the value of the principal quantum number and (ii) the total energy of the atom in this excited state.