	INDIAN SCHOOL AL WADI AL KABIR	
Class: XII	**Department: SCIENCE 2021 – 22** **SUBJECT : PHYSICS**	**Date of submission:** **13.02.22**
Worksheet No:12 **WS WITH ANS.**	**Topic: ATOMS**	**Note:** **A4 FILE FORMAT**
NAME OF THE STUDENT-	**CLASS & SECTION**	**ROLL NO.**

MULTIPLE CHOICE QUESTIONS,

1. When alpha particles are sent through a thin gold foil, most of them go straight through the foil, because
   (a) Alpha particles are positively charged
   (b) Mass of alpha particle is more than mass of electron
   (c) Most of the part of an atom is empty space
   (d) Alpha particles moves with high velocity

Answer : (c) Most of the part of an atom is empty space

2. The radius of an atomic nucleus have an order of,
   (a) 10^{-8}m (b) 10^{-15}m (c) 10^{-12}m (d) 10^{-10}m

Answer : (b) 10^{-15}m

3. In an experiment of scattering of alpha particle showed for the first time that the atom has,
   (a) Electron (b) Proton (c) Neutron (d) Nucleus

Answer : (d) Nucleus

4. The existence of positively charged nucleus was established by,
   (a) Bohr's model of H-atom (b) Positive ray analysis
   (c) α Scattering experiment (d) Thomson's model of atom

Answer: (c) α Scattering experiment

5. What was the order of thickness of gold foil on which beam of alpha particles allowed to fall in Geiger-Marsden Experiment?
   (a) 10^{-3}m (b) 10^{-9}m (c) 10^{-7}m (d) 10^{-5}m

Answer : (c) 10^{-7}m

6. In Geiger Marsden experiment, the expression of distance of closest approach to the nucleus of a alpha particle before it comes to momentarily at rest and reverse its direction is,

a) $\frac{Ze^2}{4\pi\varepsilon_0 K}$ b) $\frac{Ze^2}{2\varepsilon_0 K}$

c) $\frac{Ze^2}{2\pi\varepsilon_0 K}$ d) $\frac{Ze^2}{4\varepsilon_0 K}$

Answer: c) $\frac{Ze^2}{2\pi\varepsilon_0 K}$

7. According to Bohr's postulates, an electrons revolve around the nucleus in _____ orbits.

(a) Dynamic (b) Stationary

(c) Lower (d) First

Ans:- (b) Stable or stationary

8. The angular momentum of the electron in the nth allowed orbit is;

(a) $\frac{ph}{2\pi}$ (b) $\frac{h}{2\pi}$

(c) $\frac{2h}{\pi}$ (d) $\frac{nh}{2\pi}$

Ans:- (d) $\frac{nh}{2\pi}$

9. Which spectral series of hydrogen lie in UV region.

(a) Paschen (b) Lyman

(c) Brackett (d) Balmer

Ans:- (b) Lyman Series

10. In equation $E_n=-\frac{13.6}{n^2}$, what does this negative sign indicates.

(a) Electrons are free to move

(b) Electron is bound with nucleus.

(c) Kinetic energy is equal to potential energy

(d) Atom is radiating energy

Ans:- (b)

(ii) Completion Type Questions

1. The angle of scattering θ for zero value of impact parameter b is _____.

Answer: 180^0.

2. The frequency spectrum of radiation emitted as per Rutherford's model of atom is _____.

Answer: Continuous.

3. The scattering angle will decreases with the _____ in impact parameter.

Answer: Increase

4. An alpha particle contains _____ protons and _____neutrons.

Answer: Two, two.

5. According the Rutherford's model of an atom, the most of space in atom is _____

Answer: Empty.

6. The radius of an atom is about _____m and that of nucleus is _____m.

Answer: 10^{-10} m and 10^{-15} m.

7. The Rutherford's model of an atom cannot explain the characteristics _____ spectrum emitted by H-atom.

Answer: Line

8. The force responsible for scattering of alpha particle with target nucleus is _____.

Answer: Electrostatic force

9. The SI unit of impact parameter is _____.

Answer: Meter.

10. If the size of first orbit of hydrogen atom is 0.5 Å, the size of 2^{nd} orbit of hydrogen atom would be _____.

Ans. 2 $\mathring{A}$ $\{r \propto n^2\}$

SHORT ANSWER TYPE QUESTIONS;

[1] It is found experimentally that,13.6eV energy is required to separate a hydrogen atom into a proton and electron. Compute the orbital radius and the velocity of electron in a hydrogen atom?

E = - 13.6 eV = -13.6 x 1.6 x 10^{-19} J & n=1, e = 1.6 x 10-19C, m = 9.1 x 10^{-31} kg, k = 9 x 10^9

T.E of electron $= -K.E = -\frac{e^2}{8\pi\varepsilon or}$ or $-13.6 \times 1.6 \times 10^{-19} = -\frac{e^2}{2\,x\,4\pi\varepsilon o\,r}$ or $r = 5.3 \times 10^{-11}$ m

K.E = ½ $mv^2 = -\frac{e^2}{8\pi\varepsilon or}$

v = $\frac{e}{\sqrt{4\pi\varepsilon omr}} = 2.2 \times 10^6$m/s

[2] Using the Rydberg formula, calculate the wave lengths of the first four spectral lines in the Lyman series of the Hydrogen spectrum. [R = 1.03×10^7/m & c = 3×10^8m/s]

$\frac{1}{\lambda} = R\left[\frac{1}{nf^2} - \frac{1}{ni^2}\right]$

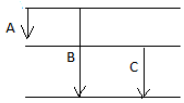
[n_i = 2,3,4 ---] to lower energy level [$n_f = 1$] , we get

$\lambda_1 = 1218A^0$, $\lambda_2 = 1028\ A^0$, $\lambda_2 = 974.3\ A^0$, $\lambda_4 = 951.4\ A^0$

[3] Obtain the ratio of nuclei radii of gold isotope $_{79}AU^{197}$ & silver isotope $_{47}Ag^{107}$.what is the approximate ratio of the nuclear mass density. $R = R_o A^{1/3}$ [A1= 197,A2 = 107]

$\frac{Rau}{Rag} = \frac{Ro[197]^{1/3}}{Ro[107]^{1/3}} = 1.23$[ii]1:1,as the mass density doesnot depend upon the mass no.

[4] The energy level diagram of an element is given alongside. Identify by doing necessary calculations, which transition corresponds to the emission of a spectral line of wavelength



102.7nm

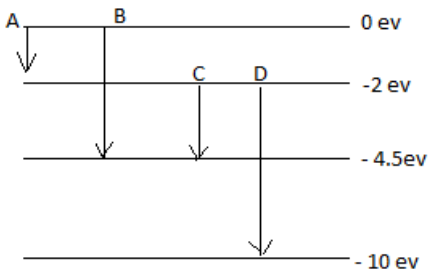
E = $\frac{hc}{\lambda} = \frac{6.6\,x10^{-34}\ x3x10^8}{102.7\,x\,10^{-9}}$ J and in ev ,E = 12.04 ev

E = E2- E1

= -1.51[n =3] - -13.6[n =1] = 12.04 ev

Hence transition is from 3 to 1

[5] The energy levels of an atom are shown below. Which of them will result in the transition of a photon of wavelength 275nm? [b] Which transition corresponds to emission of radiation of maximum wave length?



[a] E = $\frac{hc}{\lambda} = \frac{6.6\,x10^{-34}\ x3x10^8}{275\,x\,10^{-9}}$ =4.5ev.Hence B

[b] **The radiation of maximum wavelength is emitted when the change in energy is minimum.** Transition A has the minimum change of energy and therefore transition A emits the maximum wave length.

[6]Find the wave length of the hydrogen line in the Pfund [n= 4] series that has the largest wavelength.

The largest wavelength corresponds to the smallest frequency. This, in turn ,means a transition involving minimum energy. Clearly ,the transition from n=5 states to n =4 is what is required[R = 1.097 x $10^7 m^{-1}$]

$\frac{1}{\lambda} = R\left[\frac{1}{nf^2} - \frac{1}{ni^2}\right]$ or $\frac{1}{\lambda} = R\left[\frac{1}{4^2} - \frac{1}{5^2}\right]$ or $\lambda = 4.05 \times 10^{-6}$ m

[7]Why is a very thin gold foil is used in the α scattering expts.?

It is to minimize the multiple scattering due to more than one gold atom

LONG ANSWER TYPE QUESTION;

[1] (a) Using Bohr's second postulate of quantization of orbital angular momentum show that the circumference of the electron in the n^{th} 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 ?

[2] Using Bohr's postulates, obtain the expression for the total energy of the electron in the stationary states of the hydrogen atom. Hence draw the energy level diagram showing how the line spectra corresponding to Balmer series occur due to transition between energy levels.

[3] Using Bohr's postulates, obtain the expression for the total energy of the electron in the stationary states of the hydrogen atom. Hence draw the energy level diagram showing how the line spectra corresponding to Balmer series occur due to transition between energy levels.

[4] (a) State the first two postulates of Bohr's theory of hydrogen atom. Also explain briefly the necessity for invoking these postulates to describe the structure of the atom.

(b) Using Bohr's third postulate, write the Rydberg formula for the spectrum of the hydrogen atom. With the help of this formula, calculate the wavelength of the first member of the spectral line in the Lyman series of the hydrogen spectrum.

(Take the value of Rydberg constant R = $1{\cdot}03 \times 10^7\ m^{-1}$)

[5] Using Rutherford model of the atom, derive the expression to find the total energy of the electron in hydrogen atom. What is the significance of total negative energy possessed by the electron?

PREPARED BY: MR. WILLIAM D	CHECKED BY: HOD - SCIENCE