

# Assignment WK-5

## Chemistry

DATE: \_\_\_\_\_

### Question no. 1

1. (B) The nature of residual gas
2. (D) All of above
3. (A) Independent of its wavelength
4. (C) It does not account for the stability of atom
5. (C) 1.673 mg

### Question no. 2

(ii)

### Reasons

The hydrogen atom contains only two fundamental particles i.e. one proton and one electron.

When hydrogen gas is used in the discharge tube, the positive rays particles are just proton and cathode rays particles are electrons, since a proton is 1836 times heavier than an electron, therefore  $e/m$  value for positive ray obtained from hydrogen is 1836 time lesser than that of cathode rays.



## Reason:

At normal pressure, the gas molecules are congested in discharge tube. When the pressure inside the tube is reduced, to decrease the number of gas molecules so that hindrance in the way of movement of electrons of cathode rays become minimized. At a pressure of 0.01 torr, the molecules are very isolated and apart from each other. This creates a conducting medium for the passage of cathode rays.

## Frequency

- The number of waves passing through a point per second.
- Its symbol is  $\nu$ .
- Its units are hertz, cycle/sec, revolution/sec.

## Wave Number

- Number of waves per unit length
- It is denoted by  $\bar{\nu}$ .
- Its units are  $\text{cm}^{-1}$ ,  $\text{m}^{-1}$  etc.

# Question no. 3



# Measurement of Charge on Electron

In 1909, Robert Andrews Millikan discovered the oil drop method to determine the charge of an electron.

## Instrumentation

### (i) Metallic Chamber -

The apparatus consists of a metallic chamber. It has two parts. The chamber is filled with air, the pressure of which can be adjusted by a vacuum pump.

### (ii) Two Electrodes:-

There are two electrodes A and A'. These electrodes are used to generate an electrical field in the space between the electrodes. The upper electrode is connected to a positive terminal of the battery. It has holes in it. The lower electrode is connected to negative terminal of the battery.

### (iii) Atomizer

A fine spray of oil droplets is created by an atomizer (a device which changes a liquid into small droplets by forcing it out through a small hole). A few droplets pass through the hole in the top plate and into the region between the charged plates.

### (iv) Microscope:- One of the droplets is



observed through a microscope. This droplet when illuminated perpendicularly to the direction of view, appears in the microscope, as a bright speck against a dark background.

## Working:-

### (a) In absence of electric field:-

The droplets falls under the force of gravity without applying the electric field. The velocity of the droplets is determined. The velocity of the droplet ( $v_1$ ) depends upon its weight,  $mg$

$$v_1 \propto mg \dots (i)$$

$m$  = mass

$g$  = gravity acceleration.

### (b) In presence of electric field:-

- After that the air between the electrodes is ionized by X-rays.
- The droplets under observation takes up an electron and become negatively charged. Now connect A and A' to a battery which generates an electric field having a strength  $E$ .
- The droplet moves upward against the action of gravity with a velocity.

$$v_2 \propto Ee - mg \text{ (ii)}$$

Where ' $e$ ' is the charge on the electron and  $Ee$  is the upward driving force on the droplet due to applied electric field. Now dividing eq. (i) by (ii)



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$$\frac{v_1}{v_2} = \frac{mg}{Ee - mg}$$

- The value of  $v_1$  and  $v_2$  are recorded with the help of microscope
- The factor like  $q$  and  $E$  are also known. Mass of the droplet can be determined by varying the electric field in such a way that the droplet is suspended in the chamber.