Electricity and Magnetism

Ion migration

Introduction- An ionic compound can be split into its respective component ions when it is subjugated to an external electric field. These ions move towards either sides of the terminals through which the external field is being applied. For example, if one ion is negative it will move against the direction of electric field and try to migrate towards the positive terminal (similarly the other way around for the positive ions). This is the phenomenon of induced polarization in ionic compounds.

Summary- In this experiment the ionic compound chosen was Potassium Permanganate. The source of external electric field was an 18V battery made by connected two 9V cells in series. The ions that migrated towards the positive terminal were the $(MnO_4)^{-1}$ ions and the ones that migrated towards the negative electrode were the K+ ions

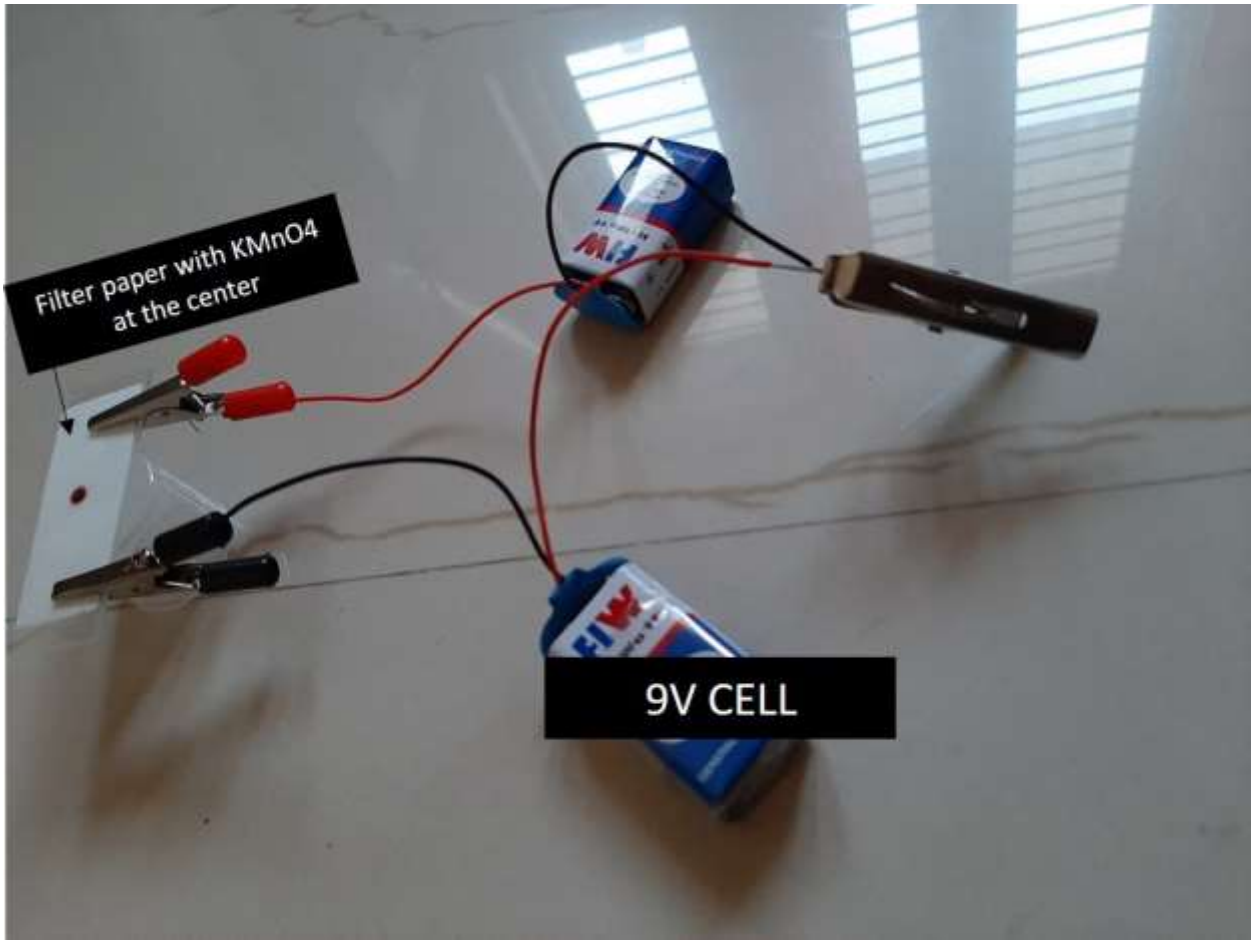
Materials required – Two cells 9V each, $KMnO_4$ crystals and filter paper

Time-lapse/ Experiment data

18V check -

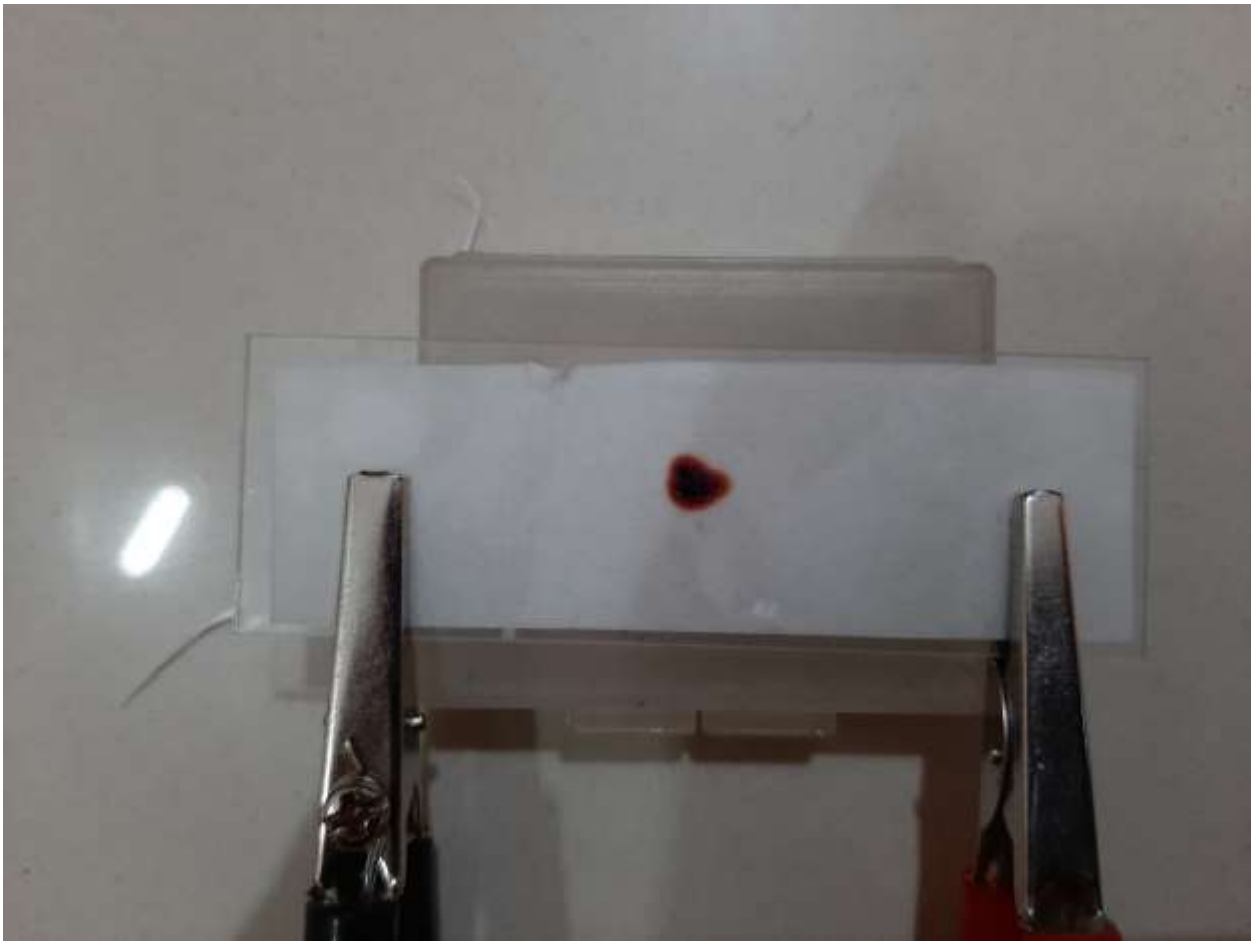
EMF= 19.25V

Setup-

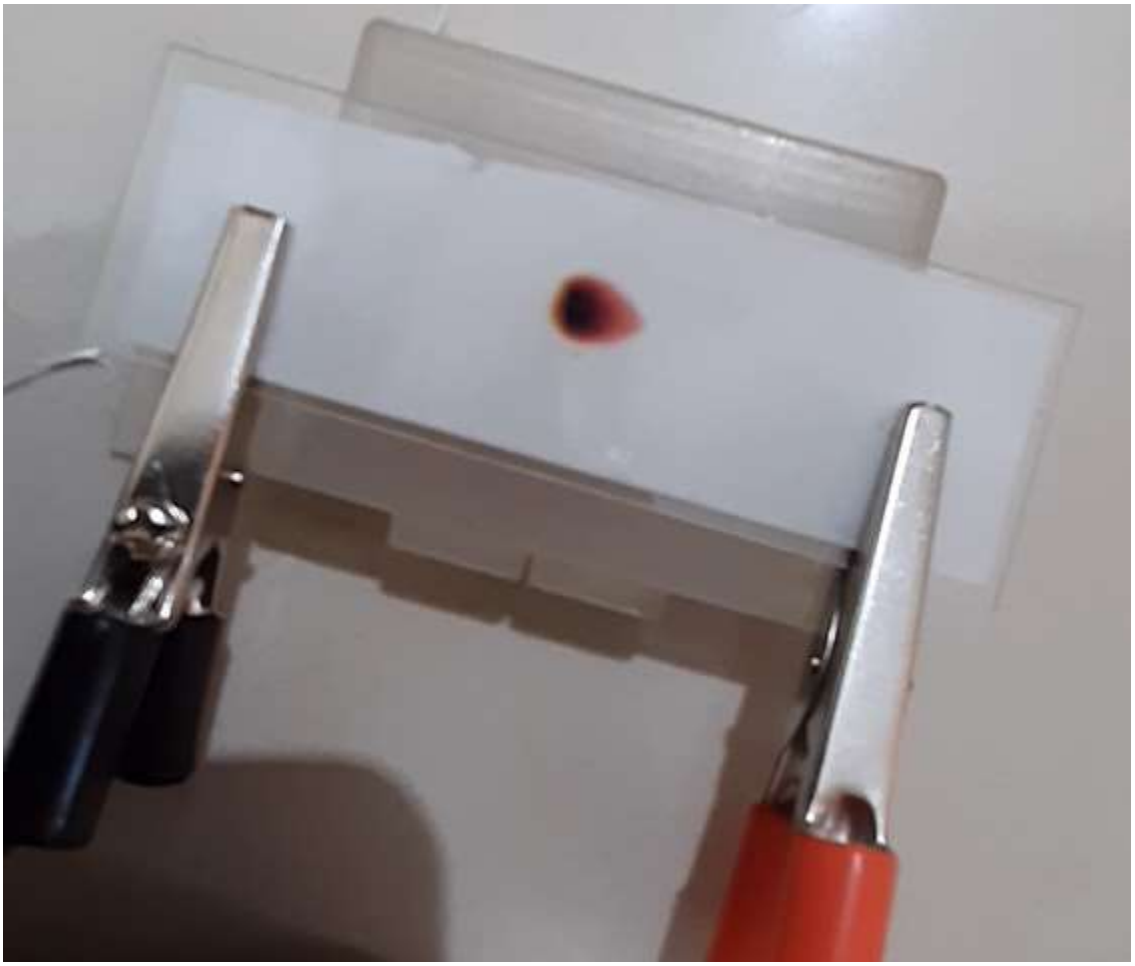


Filter paper snapshot at every 2 min

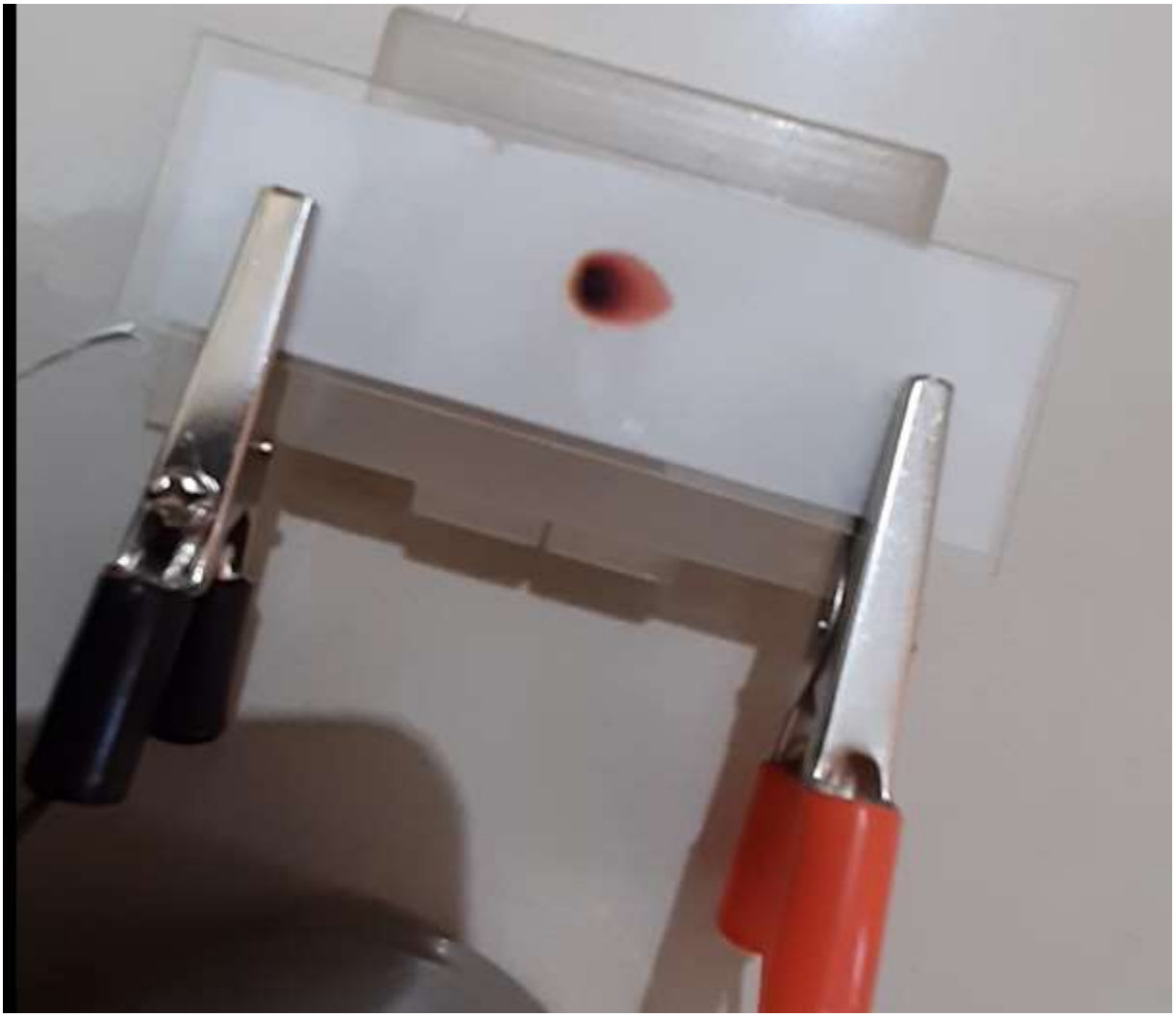
At t= 0min



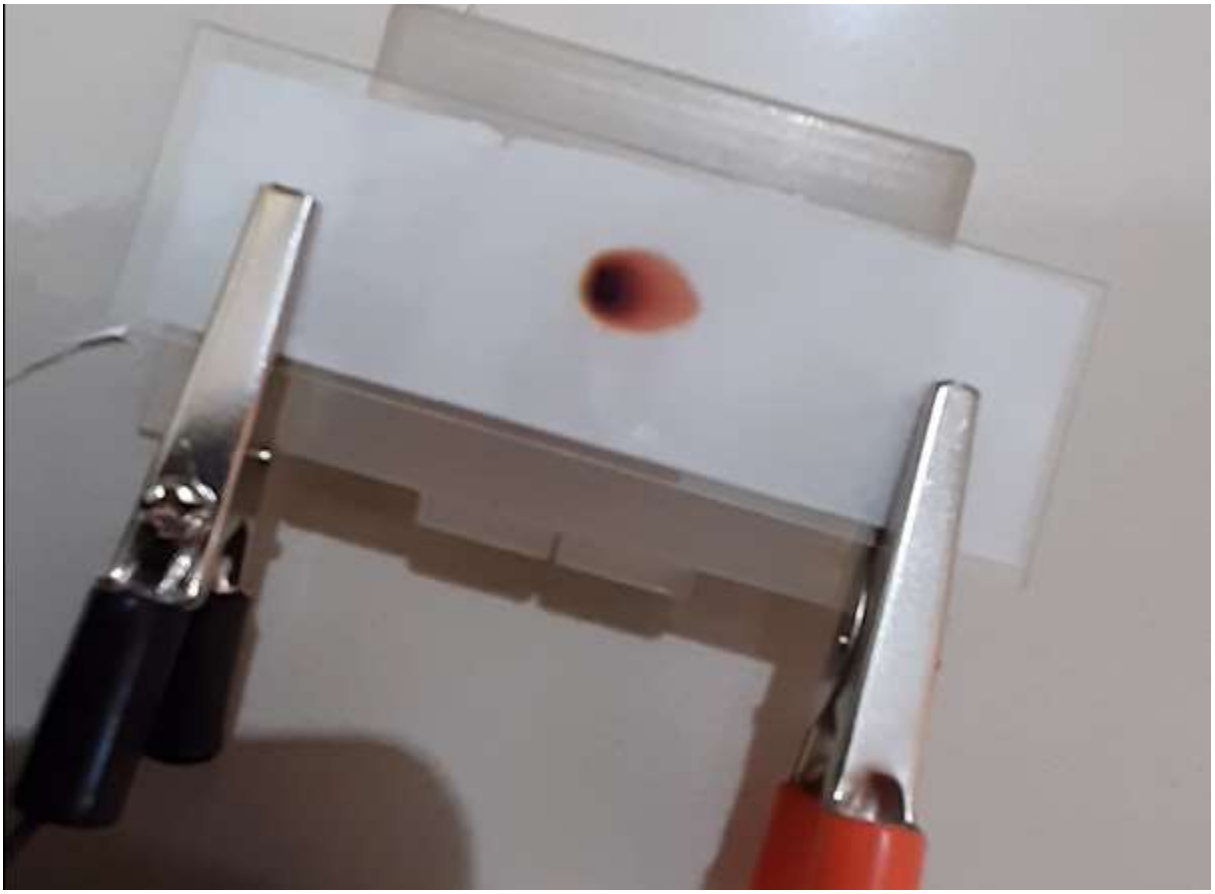
At t = 2min



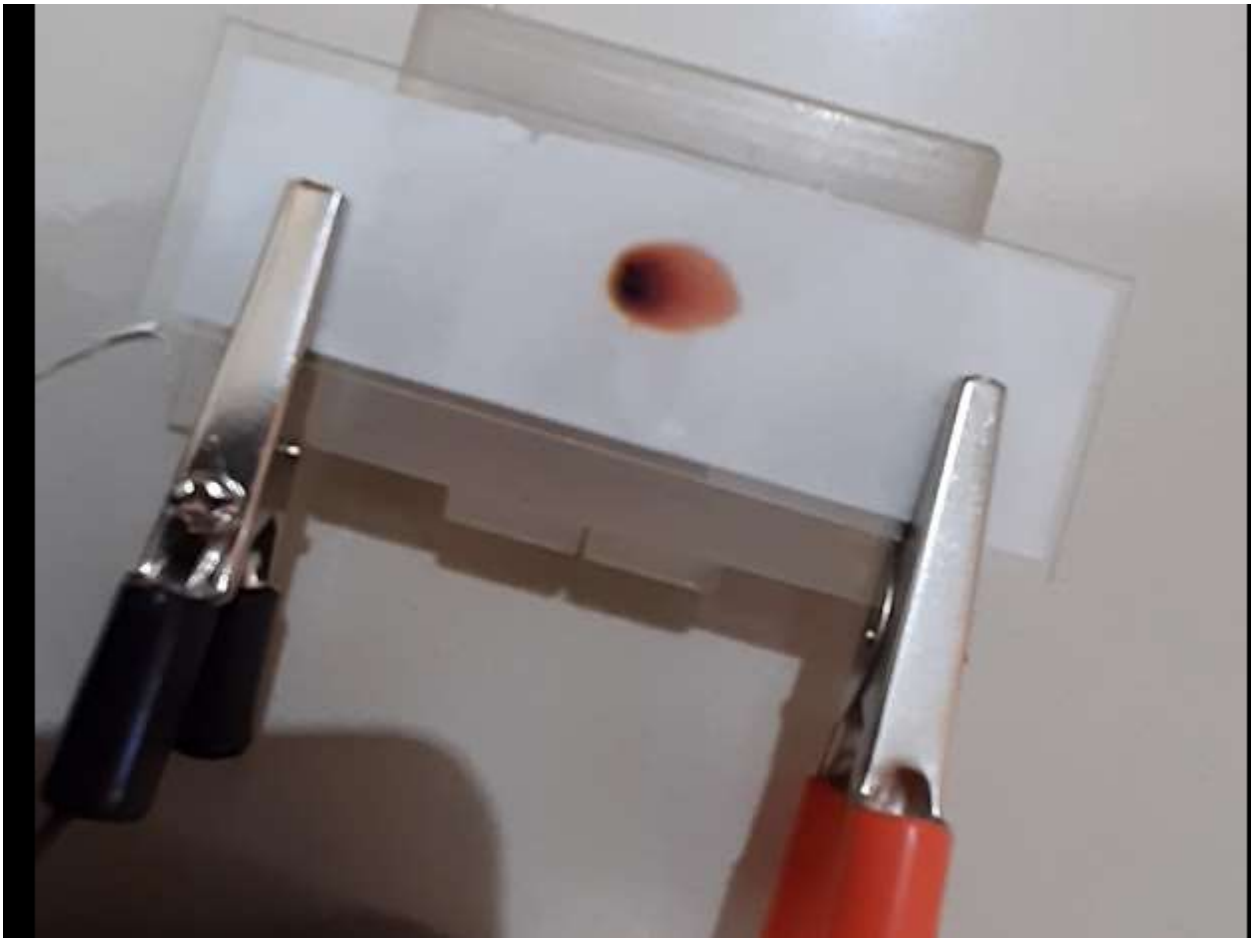
At t=4min



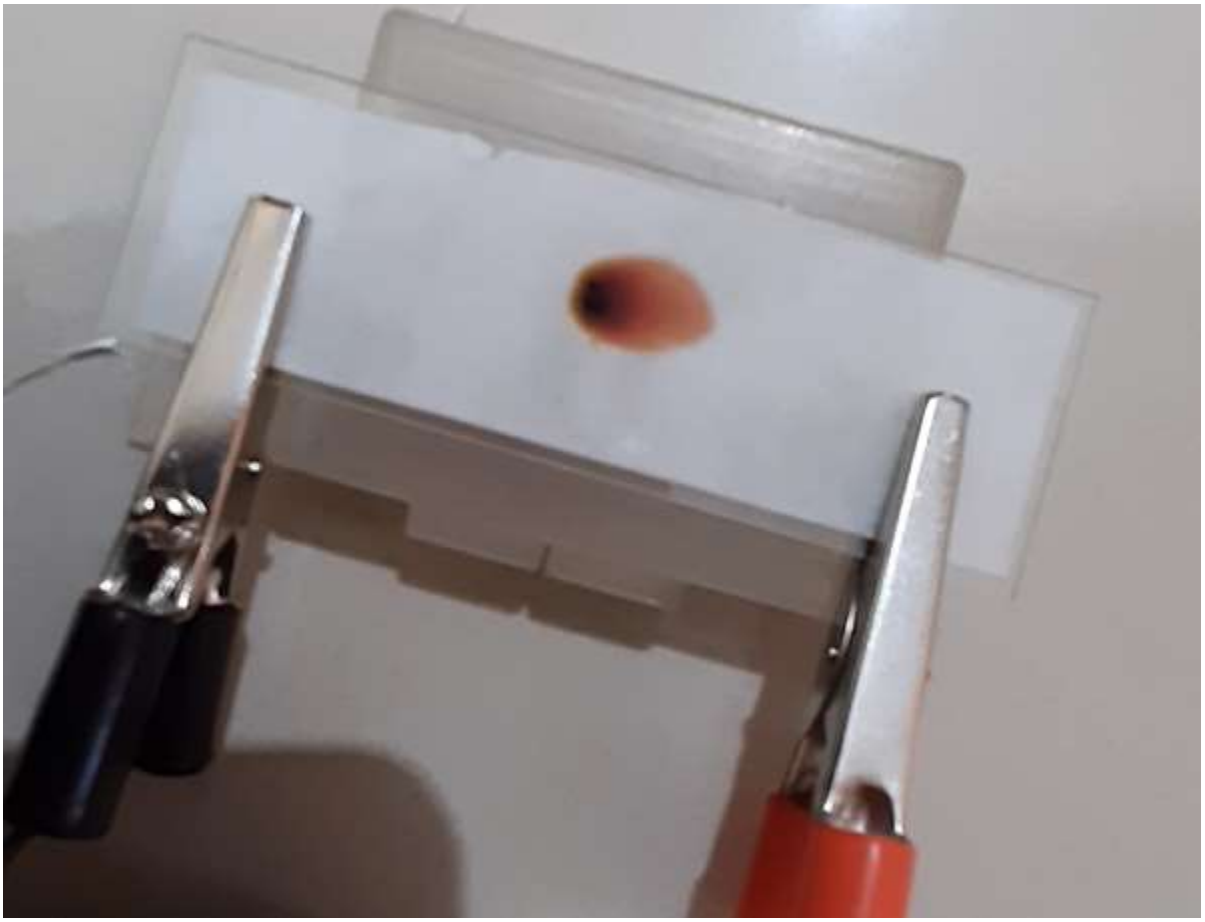
At t = 6min



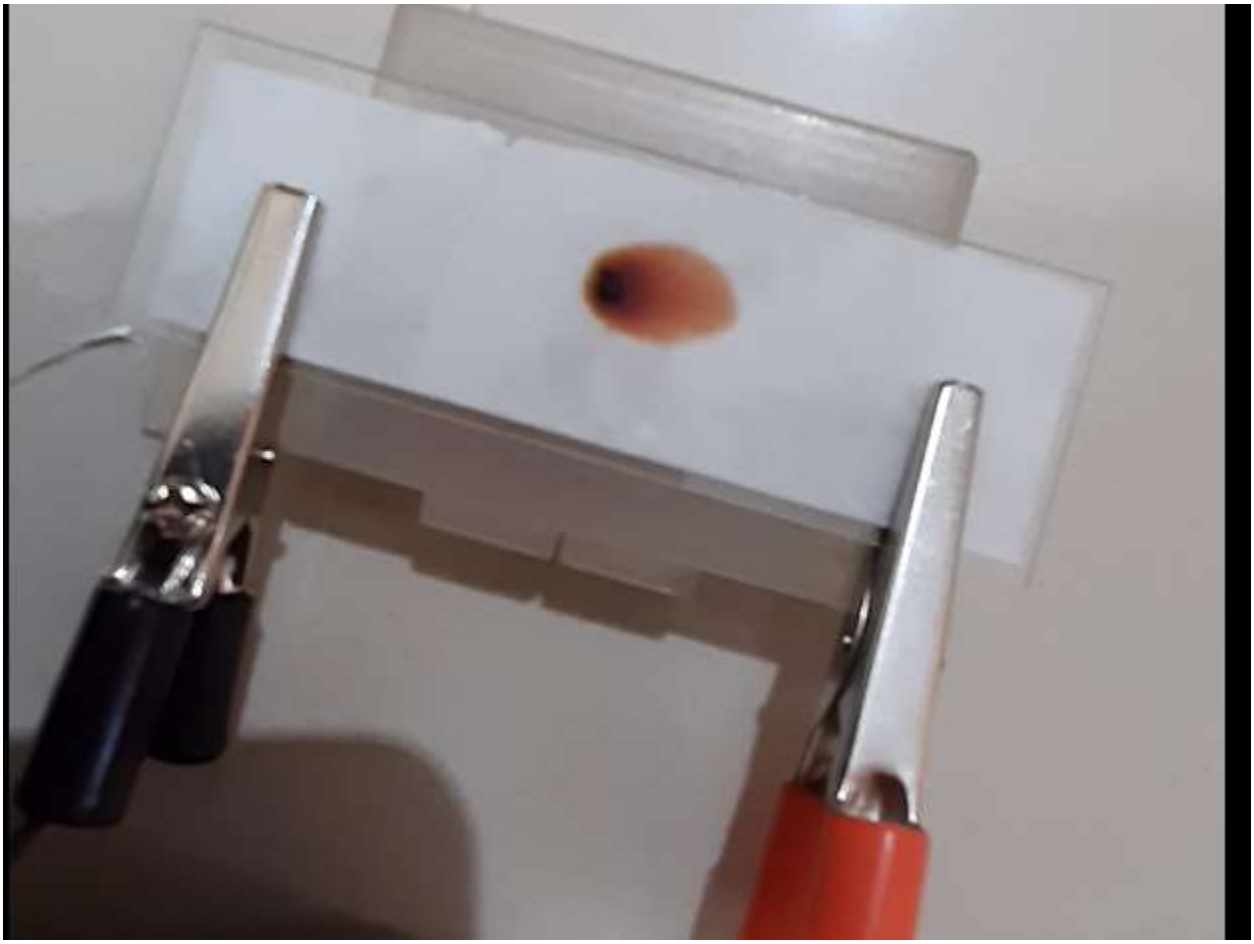
At t= 8min



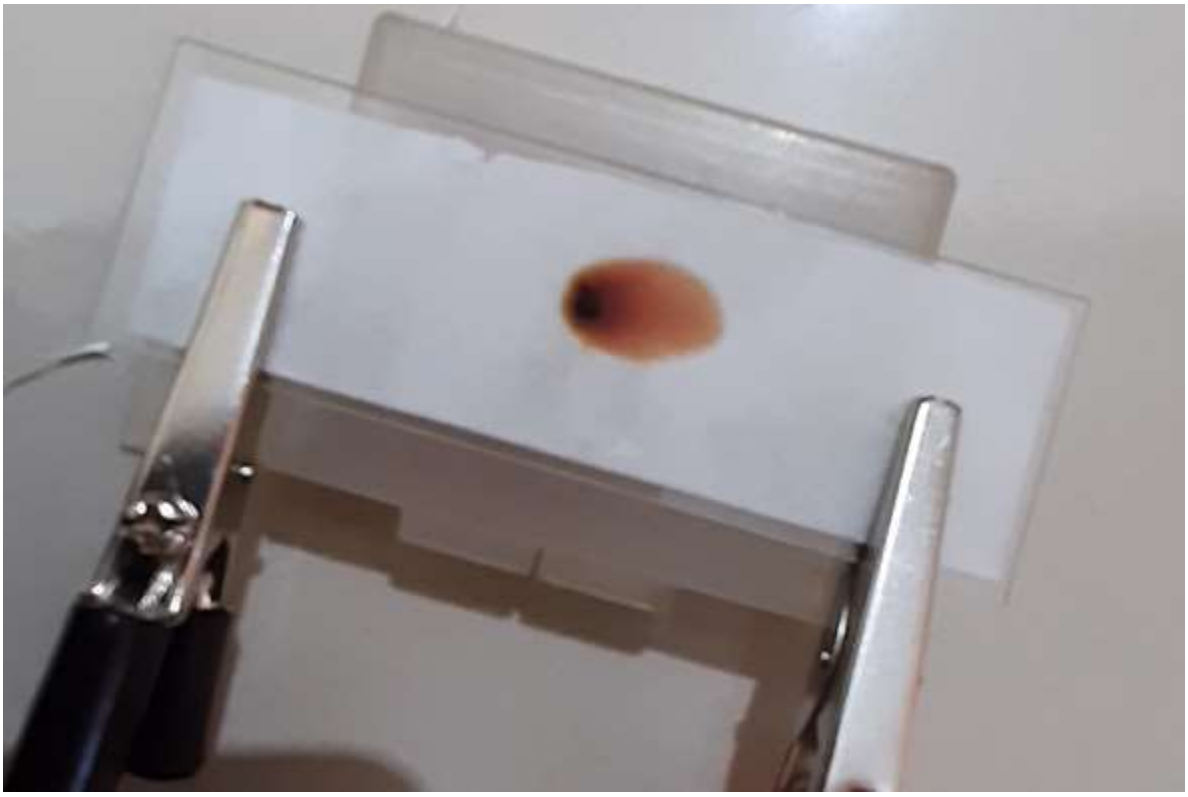
At t = 10 min



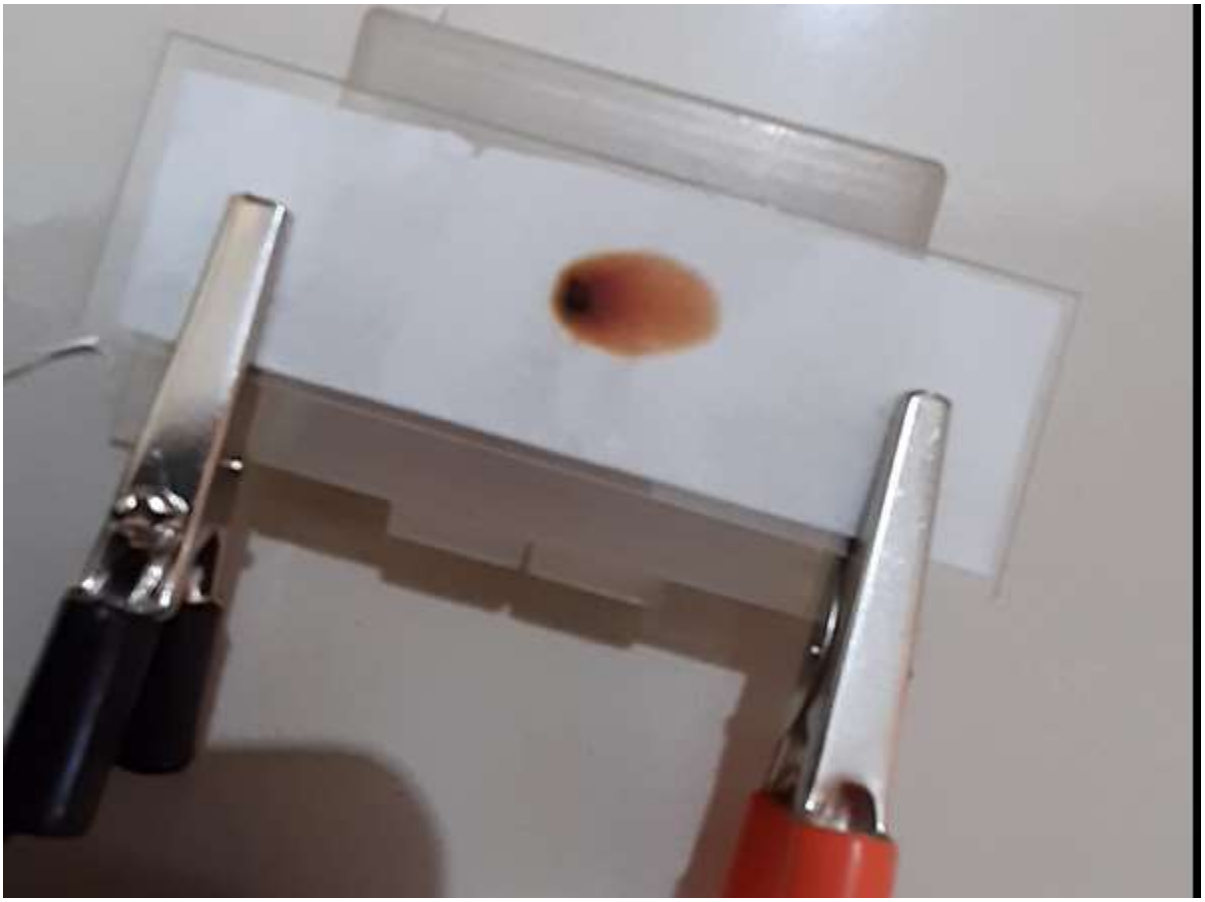
At t = 12min



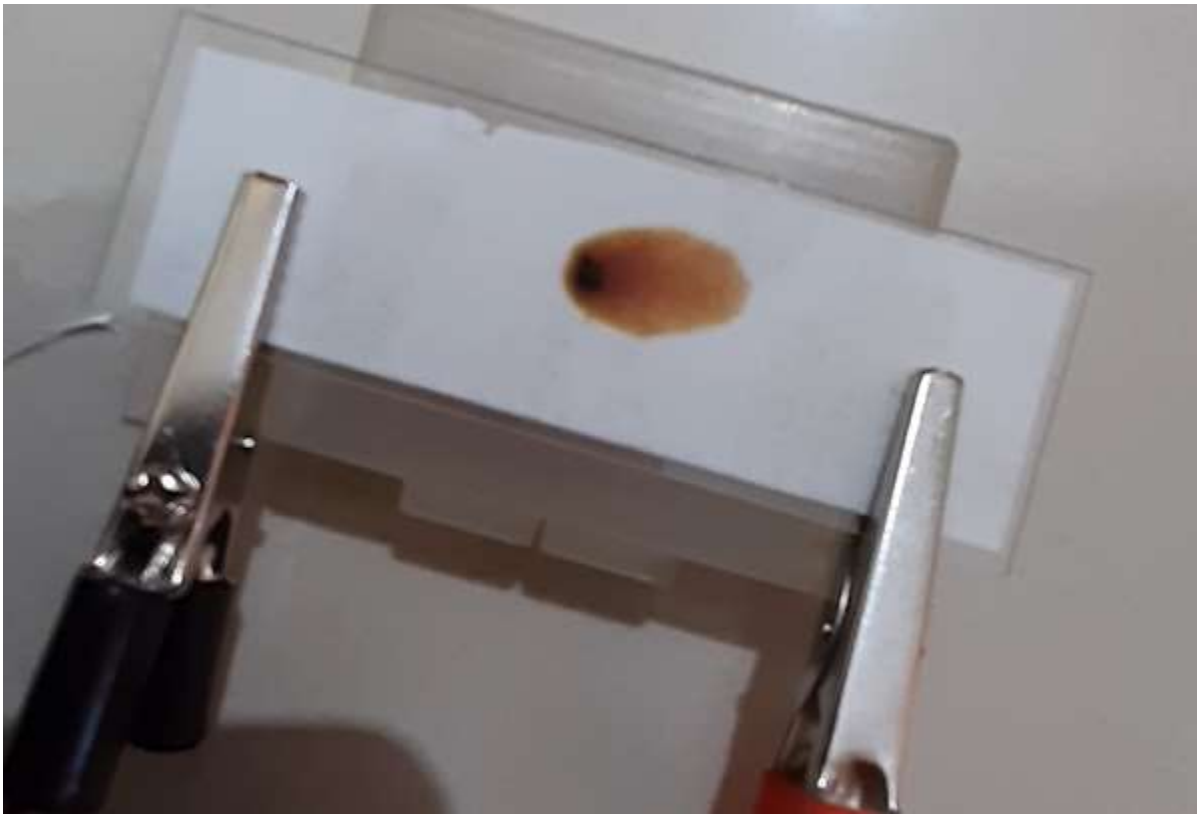
At t= 14min



At t = 16min



At t = 22min



<u>Observation</u> –

The migration of ions was affected by the distance between the two terminals and it was found out that the migration velocity was proportional to the magnitude of the electrical field which in turn was proportional to the distance between the terminals. The colored ions were that of $(MnO_4)^{-1}$ and they migrated towards the positive terminal in the presence of electric field. The charge on Potassium is positive (unit charge) and the one on Manganate ion is negative (unit charge).

<u>Result</u> –

1)The Manganate ion is likely to be the colored ion

2)Charge on ions a) Potassium = (+1)q , where q is the fundamental charge of an electron

b) Manganate ion = (-1)q

Justification – The magnitude of charge comes from the Oxidation States of K and Mn whereas the polarity comes from the fact that in the presence of an external electric field all positive charges move in the direction of the field and all the negative ones move against it. Here as the colored ions moved towards the positive terminal, hence they are likely to be negatively charged (electric field runs from positive to the negative terminal so here the manganate ion moves against it)