EXPERIMENTS THAT LEAD TO A MODEL OF THE ATOM: Worksheet: how physics experiments led to an understanding of electrons and a model of the atom

A. To the right is a representation of a Cathode Ray Tube used in several physics experiments. A key factor in the construction of the tube was to add different gases and to create low pressure inside the tube. Watch the demonstration of the Cathode Ray Tube.

i. Draw what you observe in the cathode ray tube diagram.

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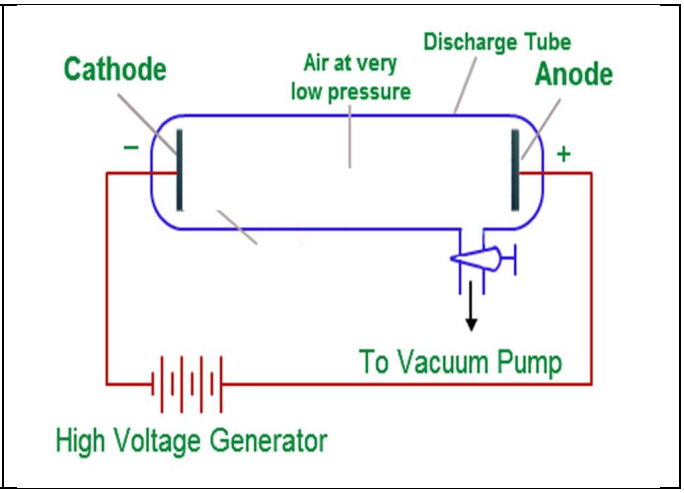
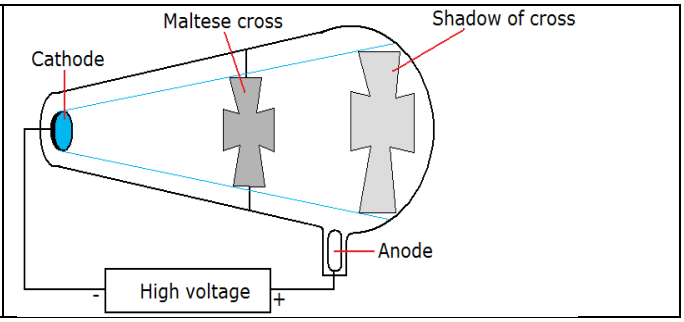


B. Observe the diagram of what some scientists did to attempt to identify the direction of the rays (right to left or left to right) in the cathode ray tube.

ii. Based on your observation indicate the direction of the cathode rays in the diagram on the right.

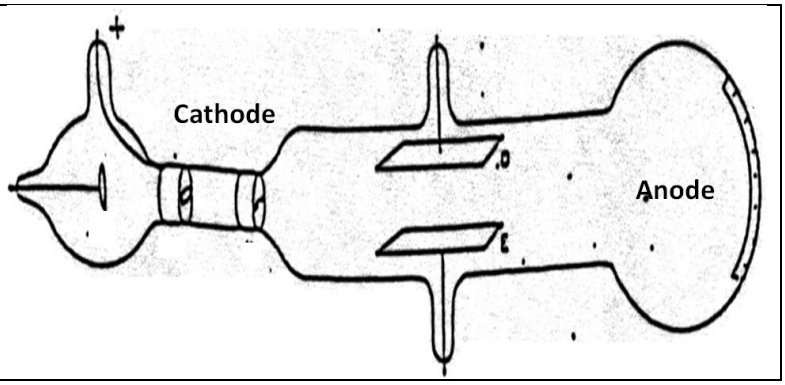
iii. Return to the diagram on top and indicate the direction of the cathode rays.



iv. Describe a series of experiments scientists might carry out to show the cathode rays existed in "all" matter.

C. J.J Thompson and co-workers modified the cathode ray tube to include parallel capacitor plates, two metal plates, inside the tube. Thompson wanted to investigate what effect an Electric Field had on the cathode rays.

v. Observe the demonstration. The demonstrator will tell you the charge on plate "D" and plate "E". Draw what you observe.



vi. "D" is a _____ charged plate and "E" is a _____ charged plate. Put the charges on the plates in the diagram. On the diagram above, draw a long arrow starting from the cathode indicating what happens to the rays as they pass through the electric field. Based on the results of this experiment, what charge does this beam of cathode rays have? Explain.

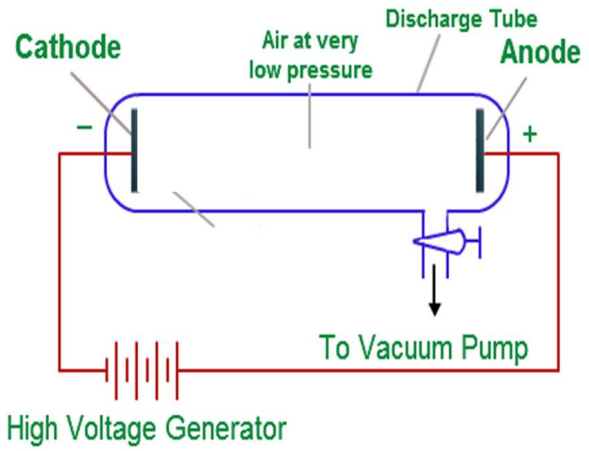
D. Scientists were interested in observe what effect a magnetic field would have on the cathode rays. It was known that charged particles are deflected by a magnetic field.

E. Observe the next demonstration. Draw a magnet in the diagram on the right. Indicate the poles of the magnet (north and south).

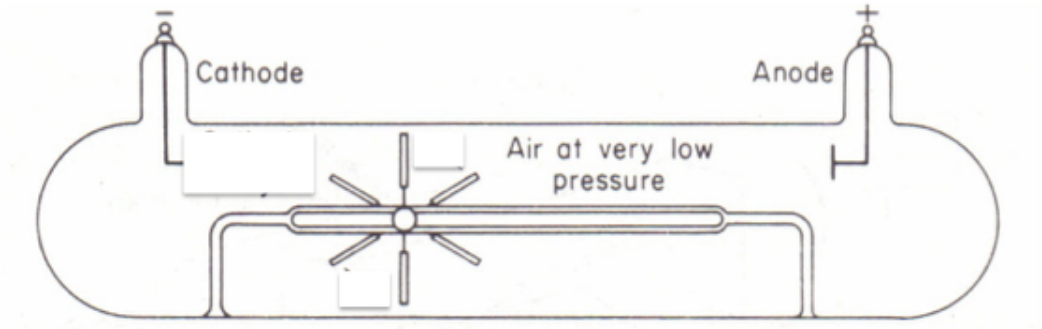
vii. What happens to the rays as a north end of magnet is brought near the rays, draw a long arrow starting from the cathode indicate the direction of flight of the rays in a magnetic field.

viii. Based on the results of this experiment, what charge does this beam of rays have? Explain.

ix. Draw a separate diagram of the CRT with capacitor plates.



F. In a third experiment a paddle wheel is added to the cathode ray tube. Based on the results of this experiment, draw a picture to describe what is observed. Show the direction of the cathode rays and show the direction of spin of the paddle wheel. What did scientist conclude about cathode rays from this experiment?



G. J.J Thompson and co-workers modified the cathode ray tube experiment again to include parallel capacitor plates and magnets. Thompson wanted to investigate what effect combing an Electric Field and a Magnetic Field had on the cathode rays. By doing this they hoped to obtain the charge to mass ratio of the cathode rays. What is the charge to mass ratio?