

Tutorial 4- Radioactivity and the Discovery of the Nucleus

- Based on experimental observations given below what can you say about the cathode rays.

Observation	Explanation
Cathode rays produce a fluorescent glow when strike with fluorescent materials	
Cathode rays produce sharp images of sharp objects	
Cathode rays can be deflected by a magnetic field	
Cathode rays are attracted towards the positive pole of an electric field.	
Cathode rays can rotate a light peddle wheel placed in their path	

- Explain the following observation
 - The charge to mass ratio of cathode rays is the same regardless of the metal used for the cathode and the gas present inside the cathode ray tube.
 - Cathode rays cannot be detected when the gas pressure of the tube is high.
 - Canal rays (positive rays) are more difficult to deflect by a magnetic field, but cathode rays can be easily deflected by a magnetic field.
- Where do the cathode rays eliminate from in the cathode ray tube?
 - How do cathode rays produce in the cathode ray tube?
 - What is the difference between cathode rays and what are canal rays with respect to the charge?
 - Do the e/m ratio of the canal ray particles identical when different gases are present in the Crooke's tube?
 - What modifications to the normal Crook's tube were done to observe canal rays?
 - Which gas gives the canal rays with the highest e/m ratio?

TEST WHAT YOU KNOW!!!!

4. What is radioactivity and what are the three common types of radiation produced by the radioactivity? Who discovered radioactivity?

5.

- Sketch the set-up of the Rutherford's experiment, which helped him determine the presence of a nucleus in an atom.
- List three main observations made and explain them by drawing a structure of the atom.
- Do the results of Rutherford's experiment match with Thomson's Plum Pudding model of the atom? If not explain why so?
Describe the Rutherford's model of atom.

6. Compare and contrast the 2 subatomic particles you have learned so far using the given table.

Subatomic particle	Relative Mass	Relative Charge	Location in the atom

7. Name the scientist who discovered the nucleus of the atom and briefly explain how.

8. An atom of phosphorus has an atomic number of 15 and a mass number of 31. How many neutrons does it contain?

9. What is the specific name given for the atoms that have the same number of protons but different number of neutrons? Give 3 such examples in hydrogen.

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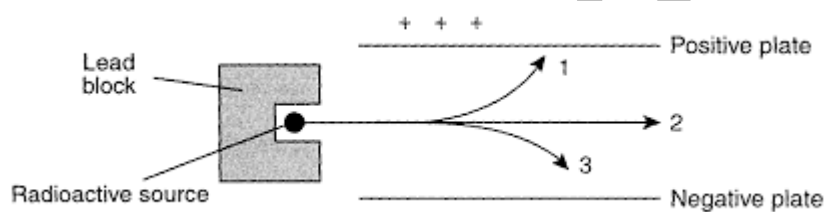
10. Give the atomic symbol for each of the following elements using the format, A_ZX .

(1) Sodium with 12 neutrons

(2) Argon with 21 neutrons

(3) Lead with 126 neutrons

11. The diagram below represents radioactive emanations passing through an electric field. What are the types of particles emitted as represented by the arrows labelled 1, 2 and 3?



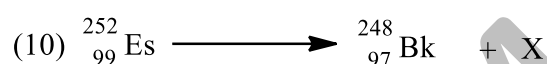
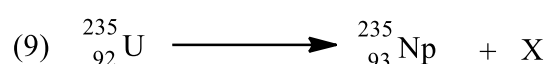
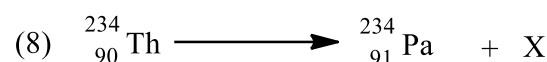
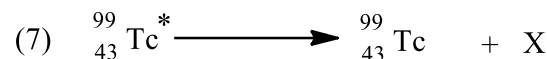
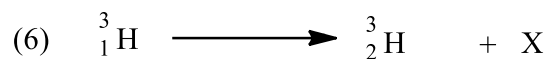
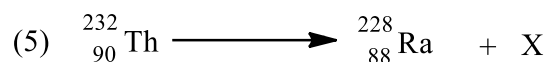
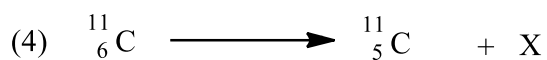
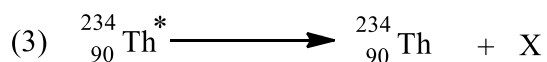
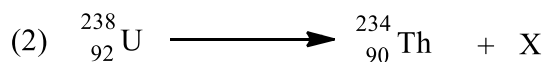
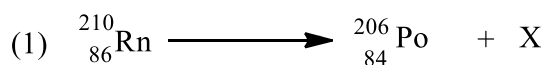
12. When unstable nuclei undergo radioactive decay, they emit three types of radioactive particles. List them out and compare their charge, mass, penetrating power, and ionizing power. Use words : highest, moderate, low and none.

Particle/Radiation	Relative Charge	Relative Mass	Penetrating power	Ionizing power

13. $\frac{e}{m}$ for an unknown charged particle was found to be $+1.614 \times 10^{10} \text{ C kg}^{-1}$. If the charge of the particle is twice that of an electron and charge of an electron is $-1.602 \times 10^{-19} \text{ C}$. What is the type of the charge for this particle (positive or negative)? Calculate the mass of the particle in kg.

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14. Complete the following nuclear reactions by determining the missing particles donated as “X”.



15. Write short answers.

- a) Who discovered the electron?
- b) Who discovered the proton and gave its name?
- c) Who named the electron?
- d) Give evidence for the electrical nature of matter.
- e) Who measured the $\frac{e}{m}$ ratio of the electron?
- f) Which scientist determined the charge of the electron? What was his experiment named as?
- g) Who initiated the experiment based of a perforated cathode in a gas discharge tube?
- h) What did Henry Becquerel discover?