

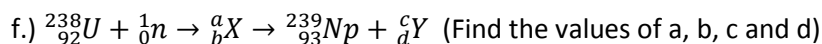
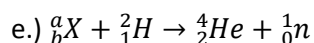
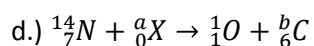
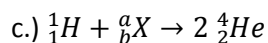
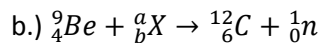
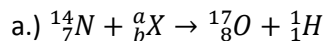
TUTORIAL QUESTIONS NUCLEAR PHYSICS

Question 1

What is the number of nucleons in the nucleus of the atom ${}_{17}^{35}\text{Cl}$?

Question 2

Find the values of a & b.



Question 3

A certain alpha particle track in a cloud chamber has a length of 37 mm. The average energy needed to produce an ion pair in air is 5.2×10^{-18} J. Alpha particles in air produce an average of 5000 such pairs per mm of the track. Find the initial energy of the alpha particle.

Question 4

The deviation of alpha particles by thin metal foils through angles that range from 0° to 180° can be explained by

- a.) Scattering from free electrons.
- b.) Scattering from bound electrons.
- c.) Scattering from small but heavy regions of positive charge.
- d.) diffraction from the crystal lattice.

Question 5

Explain why you would expect beta-particles to travel further through air than alpha particles.

Explain why you would expect beta-particles to travel further through air than through metal.

Question 6

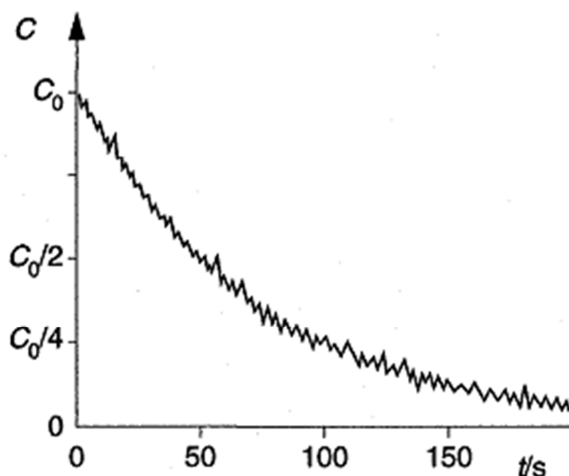
Explain why the most strongly ionizing radiation (alpha particles) is the least penetrating, while the least ionizing (gamma rays) is the most penetrating.

Question 7

- a.) When the results of the alpha particle scattering experiment is being analyzed, what conclusions were drawn about the distribution of mass and charge in the atom?
- b.) Describe and explain the experimental observations that led to these conclusions.

Question 8

The graph below shows how randomness affects count rate. State and explain what happens if the experiment is performed using the same amount of radioactive material but at a higher temperature.



Question 9

Approximate values for the radius of a gold atom and the radius of a gold nucleus are 10^{-10} and 10^{-15} m respectively.

- Estimate the ratio of the volume of a gold atom to the volume of a gold nucleus.
- The density of gold is 19000 kgm^{-3} . Estimate the density of a gold nucleus, stating any assumptions that you make in your answer.

Question 10

Which one of the following combinations of radioactive decay results in the formation of an isotope of the original nucleus?

- a.) α and four β b.) α and two β b.) α and β d.) two α and β

Question 11

Which one of the following statements is true of both α -particles and X-rays?

- They cause ionization of the air when they pass through it.
- They can be detected after passing through a few millimetres of aluminium.
- they can be deflected by electric and magnetic fields.
- They are used industrially for the photographic detection of flaws in metal casings.

Question 12

When it disintegrates, a certain radioactive nuclide P emits γ -radiation and a single α -particles, forming a daughter product Q. Which one of the following statements is true?

- P and Q are isotope of the same element.
- The nucleon number of P is one more than that of Q.
- P has more protons in its nucleus than Q.
- The proton number of P is less than that of Q.