Name.....MARKING SCHEME.....Adm No.....Class.....

KISII SCHOOL
FORM 4G PHYSICS RAT 10
TERM ONE 2020
Time: 30 minutes

RADIOACTIVITY

1. (a) Explain what is meant by the term *radioactivity*. (1 mark)

This is the spontaneous random emission of particles from the nucleus of an unstable nuclide. ✓

(b) State the meaning of the following terms as used in radioactivity.

(i) Atomic number. (1 mark)

This is the number of protons in the nucleus an atom. ✓
(It is also called the proton number and it is equal to the number of electrons in a neutral atom).

(ii) Mass number. (1 mark)

This is the sum of number of protons and neutrons in the nucleus an atom. ✓
(It is also called the nucleus number).

(iii) Half-life. (1 mark)

This is the time taken for half the number of nuclides initially present in a radioactive sample to decay. ✓

2. During radioactive decay, the nuclide can emit an alpha particle, a beta particle or gamma rays. State which radiation is equivalent to:

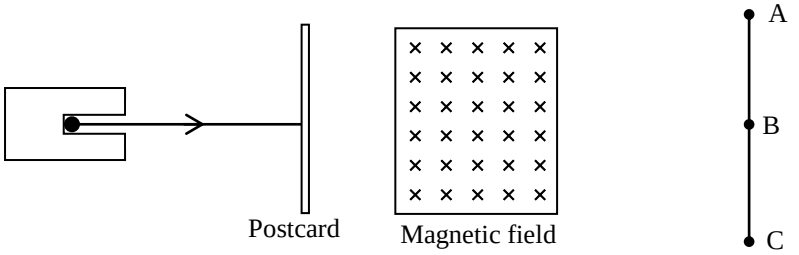
(i) An electron. (1 mark)

Beta particle. ✓

(ii) the nucleus of helium atom. (1 mark)

Alpha particle. ✓

3. The figure shows a narrow beam of radiation from a radioactive source, incident to a postcard. The emergent radiation passes through a magnetic field which is perpendicular to the plane of the paper, and into the paper.

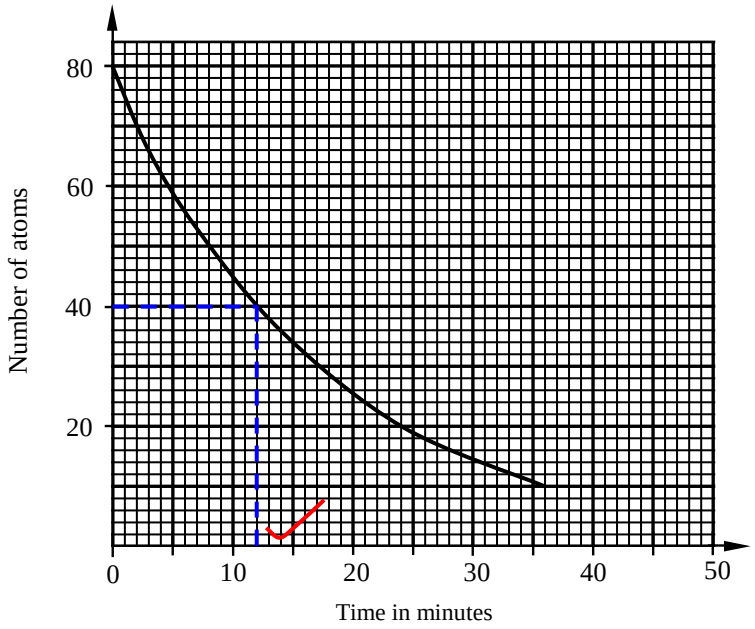


A detector moved along line **AC** detects radiations only at points **B** and **C**. State the types of radiations detected at points **B** and **C**. (2 marks)

B – Gamma rays or gamma radiation ✓

C – Beta particle ✓

4. The figure shows a graph of the variation of the number of atoms of a certain radioactive material with time.



Determine half-life of the material. (2 marks)

Half life = 12 minutes ✓

5. (a) When radiation from a radioactive source enters a **G.M tube**, pulse current flows.

(i) State the effect of the radiation on the gas inside the tube. (1 mark)

The radiation ionizes the gas inside the tube. ✓

(ii) Explain how the pulse current that flows is created. (2 marks)

— When the radiation enters the tube, it ionizes argon gas inside the tube. ✓

— The negative ions move towards the central anode wire, while the positive ions move towards the wall (cathode) of the G.M. tube causing pulse current to flow. ✓

(b) When the radiation from the radioactive source enters a diffusion cloud chamber, some white traces are observed. Explain how these traces are formed. (2 marks)

— When the radiation enters the diffusion cloud chamber, it ionizes air particles along its path. ✓

— The saturated alcohol vapour condenses around the air ions forming white traces. ✓

6. The following is a nuclear equation for a fission process resulting from the reaction of a neutron with a Uranium nucleus.

$$ {}^{1}_{0}n + {}^{235}_{92}U \longrightarrow {}^{141}_{56}A + {}^{x}_{y}Q + 3\left({}^{1}_{0}n\right) + \text{Energy} $$

Determine the values of x and y and state the source of the energy released. (2 marks)

141 + x + 3(1) = 235 + 1 | 56 + y + 3(0) = 92 + 0

x = 92 ✓ | y = 36 ✓

7. The initial mass of a radioactive substance is **20 g**. The substance has a half-life of **5 years**. Determine the mass remaining after **20 years**. (3 marks)

The number of half lives = $\frac{20}{5}$ = 4 ✓

20 $\xrightarrow{5\text{yrs}}$ 10 $\xrightarrow{5\text{yrs}}$ 5 $\xrightarrow{5\text{yrs}}$ 2.5 $\xrightarrow{5\text{yrs}}$ 1.25 ✓

Mass remaining = 1.25 g ✓

ALTERNATIVE

$N = N_o\left(\frac{1}{2}\right)^{\frac{T}{t}}$

$N = 20\left(\frac{1}{2}\right)^{\frac{20}{5}}$

$= 1.25$ g