RADIOACTIVITY

1. 1995 Q32 P1

A radioactive carbon 14 decay to Nitrogen by beta emission as below

$$\begin{array}{ccccc} 14 & & x & & 0 \\ C & \longrightarrow & N & + & e \\ 6 & & 7 & & y \end{array}$$

Determine the values of x and y in the equation (2 marks)

2. 1997 Q34, 35 P1

34. A lithium atom has 3 protons in its nucleus. Complete the diagram in **Figure 14** by marking X in the appropriate shells show the electron distribution when the atom is not excited

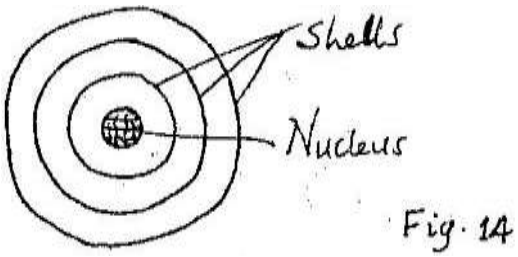


Fig. 14

35. In a sample there are 5.12×10^{-20} atoms of krypton – 92 initially. If the half of krypton; 92 is 3.0s determine the number of atoms that will have decayed after 6s.

3. 1998 Q12 P1

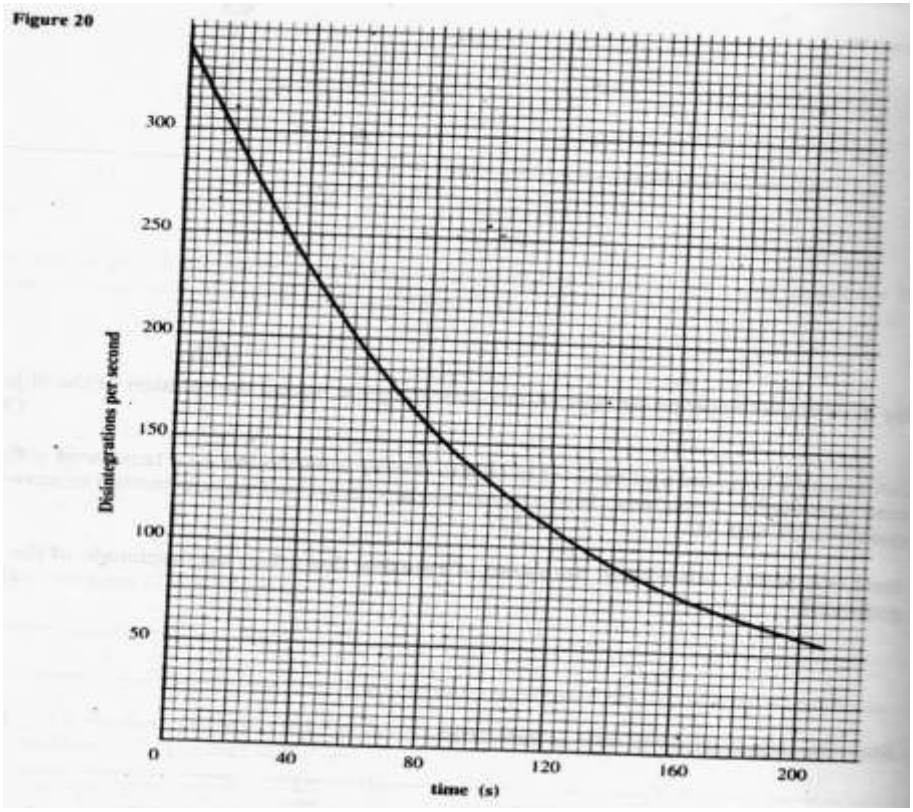
The activity of a radioactive substance, initially at 400 counts per second reduces to 50 counts per second in 72 minutes. Determine the half – life of the substance.

4. 1999 Q35 P1

A radioactive nuclide of atomic number z emits a beta particle and gamma rays. State the atomic number of the new nuclide.

5. 2000 Q36 P1

The graph in **Fig 20** shows the disintegration per second versus time in seconds, s for a sample of radioactive material; determine the half – life of the sample.



6. 2001 Q34 P1

The following reaction is part of a radioactive series:

$$^{120}_{83}X \longrightarrow {}^{Y}_{84}210 \longrightarrow {}^{c}_{b}$$

Identify the radiation r and determine the values of b and c.

7. 2002 Q27 P1

Cobalt 60 is a radio isotope that has a half – life of 5.25 years. What fraction of the original atoms in a sample will remain after 21 years?

8. 2002 Q31 P1

A nucleus is represents by $^{107}_{42}x$. State the number of neutrons in the nucleus.

9. 2002 Q2 P2

Fig. 3. Shows the path of radiation form a radioactive source after entering a magnetic field. The magnetic field is directed into the paper and is perpendicular to the plane of the paper as shown in the figure.

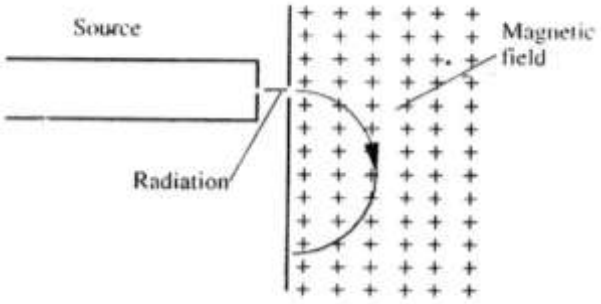


Figure 2

Identify the radiation and give a reason

……

b) Below is a nuclear reaction

$$\frac{232}{90}A \xrightarrow{K} \frac{228}{88} \xrightarrow{y\ gamma} \frac{Y}{X}$$

i) Identify radiation K ……

ii) Determine the values of X and Y.

(c) **Fig 3** shows a device for producing metal foils of constant thickness. Any change in thickness can be detected by the Geiger tube and recorded by the Geiger. The pressure adjusted by the roller is then adjusted to keep the thickness constant.

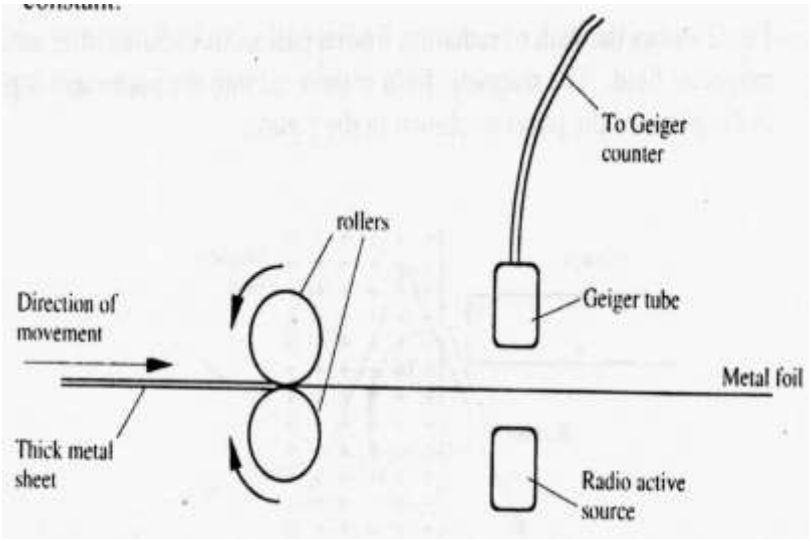


Figure 3

(i) State the change in the metal foil that will lead to a decrease in the Geiger counter reading

……

……

(ii) Give a reason for your answer in c(i) above

(iii) State the change in the roller pressure that should be made as a result of this decrease in the Geiger counter reading.

(iv) Give a reason for your in (c) (iii) above

(v) Explain why a source emitting α (alpha) particles only would not be suitable for this device.

(vi) Explain why a radioactive source of a half-life of 1600 years is more suitable for use in the device than one of a half-life of 8 minutes.

10. 2003 Q18 P1

The following equation shows part of a radioactive decay process.

$$^{234}_{90}\mathbf{T} \xrightarrow{x} {}^{234}_{91}\mathbf{Pa}$$

Name the radiation x.

11. 2004 Q3 P2

Figure 4 shows the cross-section of a diffusion cloud chamber used to detect radiation from radioactive sources.

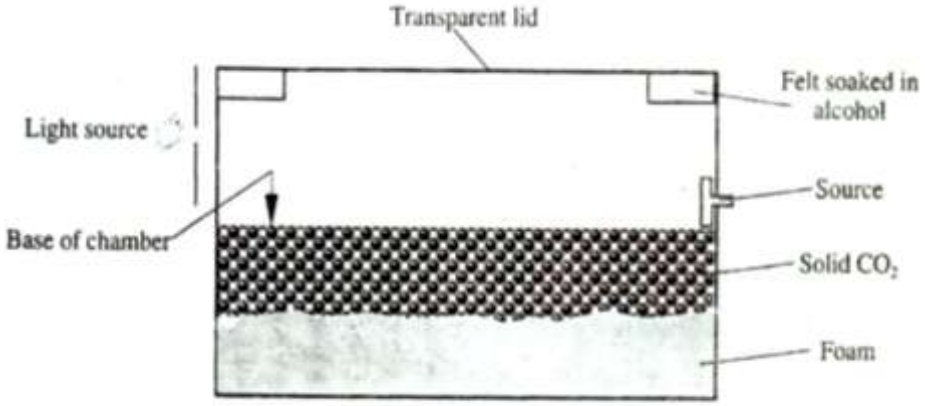


Figure 4

a) i) State one function of each of the following:

Alcohol

……

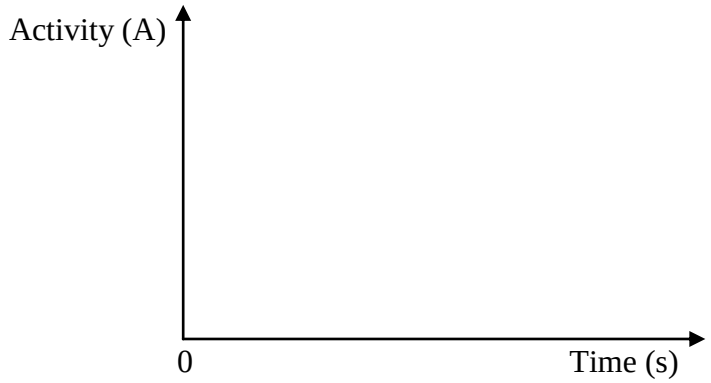
solid CO_2

……

ii) When radiation from the source enters the chamber, some white traces are observed. Explain how these traces are formed and state how the radiation is identified.

iii) A leaf electroscope can also be used as a detector of radiation. State two advantages of the diffusion cloud chamber over the leaf electroscope as a detector.

) i) Two samples of the same radioactive material have initial masses M and 2M respectively. On the axes provided, sketch the graph of activity versus time for each sample. Label the graph for each sample.



ii) A radioactive sample of half-life 130 days initially has 1.0 x 10^{2c} radioactive atoms. Determine the number of radioactive atoms that have decayed after 390 days.

12. 2005 Q36 P1

The following represents a nuclear reaction involving the nuclide polonium Po

$$^{218}_{84}Po \xrightarrow{m} {}^{214}_{82}Pb \xrightarrow{n} {}^{214}_{83}Bi \longrightarrow {}^{214}_{84}X$$

Identify m, n and X (3marks)

13. 2005 Q7 P2

(a) What is meant by radioactivity (1 mark)

(b) With an aid of a labeled diagram explain the working of Geiger Muller tube as a detector of radiation (5 marks)

(c) In an experiment to determine the half life of a certain radioactivity substance, the activity in disintegrations per minute was measured for some time. **Table 1** shows the results obtained

Time in Minutes	0	10	20	30	40	50	60	70	80
Activity in disintegrations	152	115	87	66	50	38	20	12	6

On the grid plot a suitable graph and sue it to determine the half life t ½ of the substance (7 marks)

(d) At time t = 40 minutes, the activity of a sample of a certain radioactive isotope with a half life 12 minutes if found to be 480 disintegration per minute. Determine the time which activity was 3840 disintegrations per minute (2 marks)

14. 2007 Q13 P2

The following is part of radioactive decay series

$$^{234}_{83}Bi \xrightarrow{ß} {}^{a}_{84}X \longrightarrow {}^{230}_{b}Y$$

Determine the values of a and b (2 marks)

a = …….

b= ……

15. 2008 Q14 P2

A radioactive isotope of copper decays to form an isotope of Zinc as shown below

$$^{69}_{29}Cu \longrightarrow {}^{69}_{30}Zn + \text{radiation}$$

(2marks)

Name the radiation emitted and give a reason for your answer

Radiation……

Reason……

16. 2009 Q17 P2

(a) **figure 11** shows the path of radiation from a radioactive source.The field is perpendicular to the paper and directed out of paper.

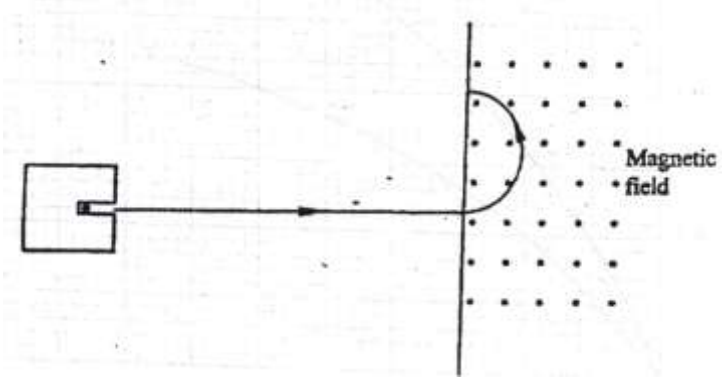


Figure 11

Identify the radiation (1mark)

(b)Radiation from a radioactive source enters a G.M tube

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

(ii)Explain how the large discharge current is created. (2marks)

(c) The following is a nuclear equation for fission process resulting from the reaction of a neutron with a uranium nucleus

$$^{1}_{0}n + {}^{235}_{92}U \longrightarrow {}^{141}_{56}A + {}^{y}_{x}Q + 3\,{}^{1}_{0}n$$

(i)determine the values of x and y. (2marks)

(ii)State the source of the energy released (1mark)

(iii)Explain how this reaction is made continuous in a nuclear reactor. (2marks)

17. 2010 Q9 P2

The initial mass of a radioactive substance is 20g. The substance has a half-life of 5 years. Determine the mass remaining after 20 years.

18. 2011 Q19a, b P2

(a) When a radiation was released into a diffusion cloud chamber, short thick tracks were observed. State with a reason the type of radiation that was detected. (2marks)

(b) The half-life of an element X is 3.83 days. A sample of this element is found to have an active rate of 1.6×10^3 disintegrations per second at a particular time.

Determine its activity rate after 19.15 days. (2marks)

19. 2012 Q6 P2

Figure 6, 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.

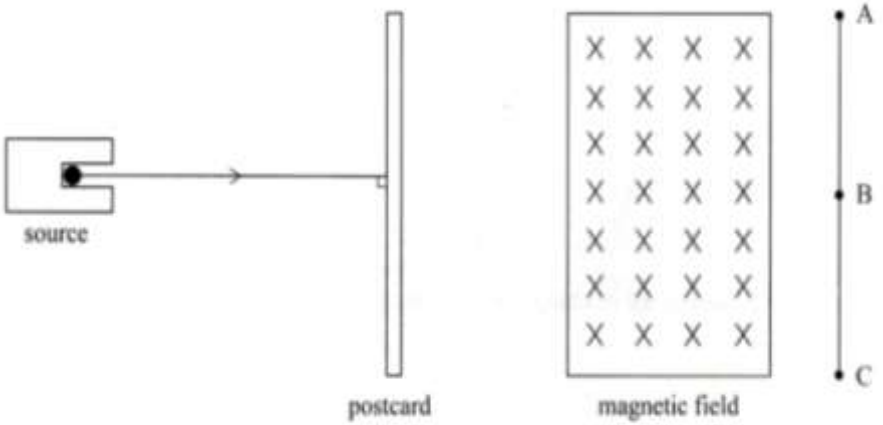


Figure 6

A detector moved along line AC detects radiations only at points B and C. state the two types of radiations detected (1mark)