Atomic Physics

(IGCSE Physics Year 2002 Oct/Nov Paper 3-Set 1)

10 Fig. 10.1 is part of the decay curve for a sample of a β-emitting isotope.

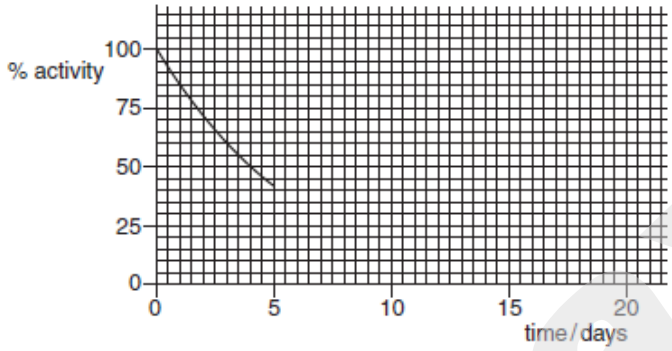

Fig. 10.1

(a) Use Fig. 10.1 to find the half-life of the isotope.

half-life = ... [1]

(b) Complete Fig. 10.1 as far as time = 20 days, by working out the values of a number of points and plotting them. Show your working. [2]

(c) The decay product of the β-emitting isotope is not radioactive.
Explain why the sample of the radioactive isotope will be safer after 20 days than after 1 day. Support your answer by reference to the graph.

.....

.....[1]

(d) The isotope used for this decay curve may be represented by the symbol ${}^{A}_{Z}X$.
Write down an equation, by filling in the gaps below, to show the β-decay of this isotope to a decay product that has the symbol Y.

${}^{A}_{Z}X \rightarrow$ + Y [2]

ChemPraxis

(IGCSE Physics Year 2003 May/June Paper 3-Set 1)

11 **(a)** A radioactive isotope emits only α-particles.

(i) In the space below, draw a labelled diagram of the apparatus you would use to prove that no β-particles or γ-radiation are emitted from the isotope.

(ii) Describe the test you would carry out.

.....

.....

.....

.....

(iii) Explain how your results would show that only α-particles are emitted.

.....

.....

.....

[6]

(b) Fig. 11.1 shows a stream of α-particles about to enter the space between the poles of a very strong magnet.

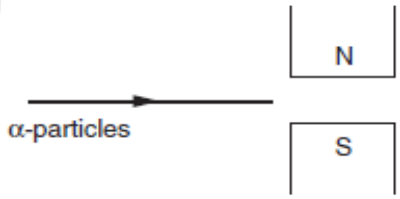

Fig. 11.1

Describe the path of the α-particles in the space between the magnetic poles.

.....

.....

.....[3]

ChemPraxis

(IGCSE Physics Year 2003 Oct/Nov Paper 3-Set 1)

11 **(a)** A sodium nucleus decays by the emission of a β-particle to form magnesium.

(i) Complete the decay equation below.

$$^{24}_{11}Na \longrightarrow \quad Mg \; +$$

(ii) Fig. 11.1 shows β-particles from sodium nuclei moving into the space between the poles of a magnet.

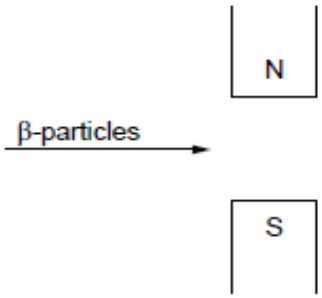

Fig. 11.1

Describe the path of the β-particles between the magnetic poles.

.....

.....

.....

[5]

(b) Very small quantities of a radioactive isotope are used to check the circulation of blood by injecting the isotope into the bloodstream.

(i) Describe how the results are obtained.

.....

.....

.....

.....

(ii) Explain why a γ-emitting isotope is used for this purpose rather than one that emits either α-particles or β-particles.

.....

.....

.....

[4]

ChemPraxis

(IGCSE Physics Year 2004 May/June Paper 3-Set 1)

11 (a) α-particles can be scattered by thin gold foils.

Fig. 11.1 shows part of the paths of three α-particles.
Complete the paths of the three α-particles. [3]

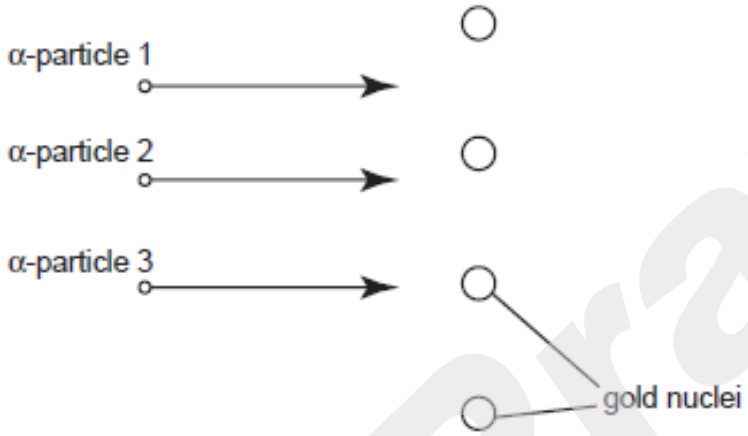

Fig. 11.1

(b) What does the scattering of α-particles show about atomic structure?

.....

.....

.....[2]

(c) State the nucleon number (mass number) of an α-particle.

nucleon number = ...[1]

ChemPraxis

(IGCSE Physics Year 2004 Oct/Nov Paper 3-Set 1)

11 **(a)** The decay of a nucleus of radium $^{226}_{88}Ra$ leads to the emission of an α-particle and leaves behind a nucleus of radon (Rn).
In the space below, write an equation to show this decay. [2]

(b) In an experiment to find the range of α-particles in air, the apparatus in Fig. 11.1 was used.

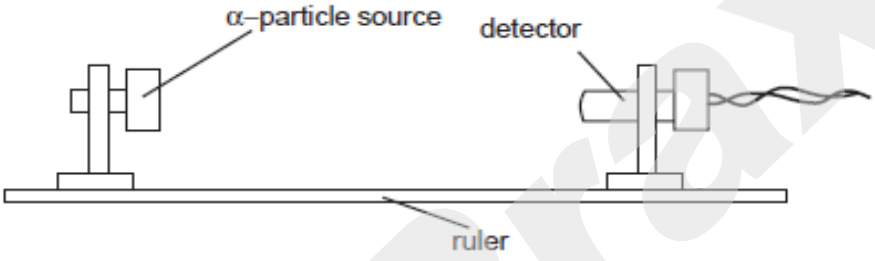

Fig. 11.1

The results of this experiment are shown below.

count rate / (counts/minute)	681	562	441	382	317	20	19	21	19
distance from source to detector/cm	1	2	3	4	5	6	7	8	9

(i) State what causes the count rate 9 cm from the source.

.....

(ii) Estimate the count rate that is due to the source at a distance of 2 cm.

.....

(iii) Suggest a value for the maximum distance that α-particles can travel from the source.

.....

(iv) Justify your answer to **(iii)**.

.....

.....

[4]

ChemPraxis

(IGCSE Physics Year 2005 May/June Paper 3-Set 1)

10 (a) Fig. 10.1 is the decay curve for a radioactive isotope that emits only β-particles.

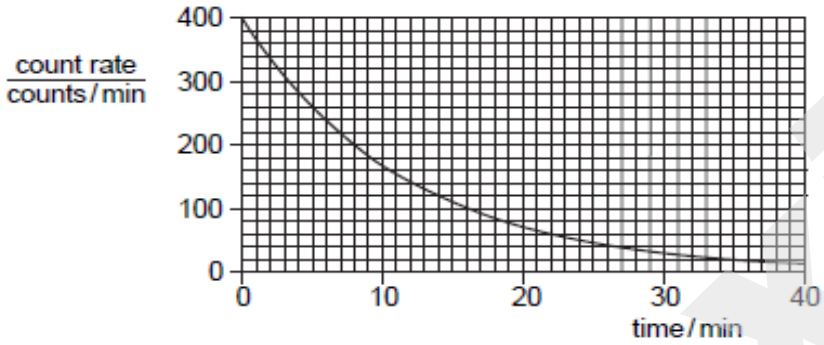

Fig. 10.1

Use the graph to find the value of the half-life of the isotope.

Indicate, on the graph, how you arrived at your value.

half-life ..... [2]

(b) A student determines the percentage of β-particles absorbed by a thick aluminium sheet. He uses a source that is emitting only β-particles and that has a long half-life.

(i) In the space below, draw a labelled diagram of the apparatus required, set up to make the determination.

[2]

(ii) List the readings that the student needs to take.

.....

.....

.....

..... [3]

(IGCSE Physics Year 2005 Oct/Nov Paper 3-Set 1)

11 A radioactive source emits only β-particles.

(a) A scientist wishes to investigate the deflection of β-particles by an electric field. Draw a labelled diagram to suggest a suitable experimental arrangement.

[3]

(b) State how the apparatus would be used to show the deflection of the β-particles by the electric field.

.....

.....

..... [2]

(c) State how the results would show the deflection of the β-particles.

.....

..... [1]

(d) Explain the direction of the deflection obtained.

.....

..... [1]

ChemPraxis

(IGCSE Physics Year 2006 May/June Paper 3-Set 1)

11 Fig. 11.1 shows a beam of radiation that contains α-particles, β-particles and γ-rays. The beam enters a very strong magnetic field shown in symbol form by N and S poles.

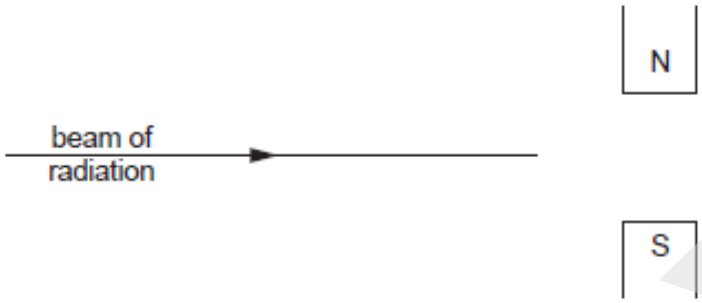

Fig. 11.1

Complete the table below.

radiation	direction of deflection, if any	charge carried by radiation, if any
α-particles		
β-particles		
γ-rays		

[6]

ChemPraxis

(IGCSE Physics Year 2006 Oct/Nov Paper 3-Set 1)

11 **(a)** α-particles, β-particles and γ-rays are known as ionising radiations.

(i) Describe what happens when gases are ionised by ionising radiations.

.....

.....

.....

(ii) Suggest why α-particles are considered better ionisers of gas than β-particles.

.....

.....

[3]

(b) **(i)** Suggest two practical applications of radioactive isotopes.

1. .....

2. .....

(ii) For one of the applications that you have suggested, describe how it works, or draw a labelled diagram to illustrate it in use.

.....

.....

.....

ChemPraxis

(IGCSE Physics Year 2007 May/June Paper 3-Set 1)

11 Fig. 11.1 shows the paths of three α-particles moving towards a thin gold foil.

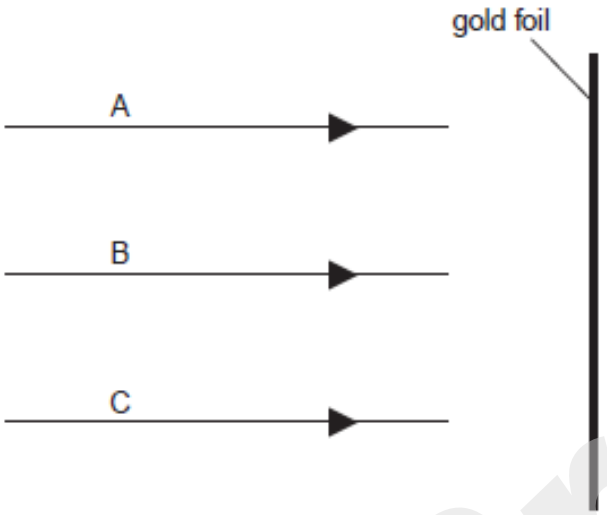

Fig. 11.1

Particle A is moving directly towards a gold nucleus.
Particle B is moving along a line which passes close to a gold nucleus.
Particle C is moving along a line which does not pass close to a gold nucleus.

(a) On Fig. 11.1, complete the paths of the α-particles A, B and C. [3]

(b) State how the results of such an experiment, using large numbers of α-particles, provides evidence for the existence of nuclei in gold atoms.

.....

.....

.....

..... [3]

[Total: 12]

ChemPraxis

(IGCSE Physics Year 2007 Oct/Nov Paper 3-Set 1)

11 Fig. 11.1 shows an experiment to test the absorption of β-particles by thin sheets of aluminium. Ten sheets are available, each 0.5 mm thick.

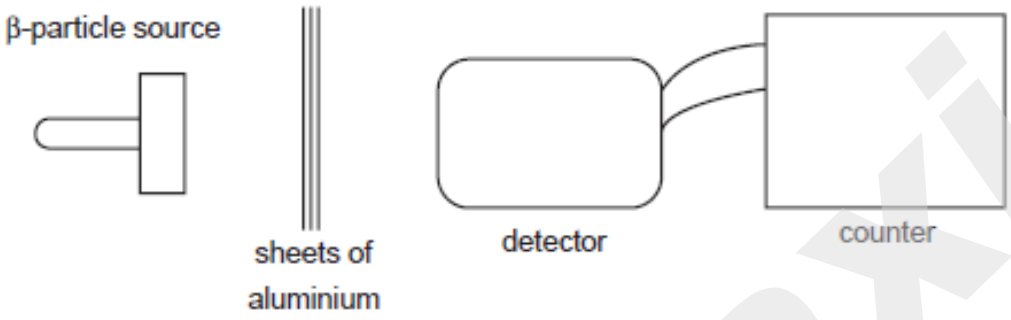

Fig. 11.1

(a) Describe how the experiment is carried out, stating the readings that should be taken.

.....

.....

.....

.....

..... [4]

(b) State the results that you would expect to obtain.

.....

.....

.....

..... [2]

[Total: 6]

(IGCSE Physics Year 2008 May/June Paper 3-Set 1)

11 **(a)** Chlorine has two isotopes, one of nucleon number 35 and one of nucleon number 37. The proton number of chlorine is 17.

Table 11.1 refers to neutral atoms of chlorine.

Complete Table 11.1.

	nucleon number 35	nucleon number 37
number of protons		
number of neutrons		
number of electrons		

[3]

Table 11.1

(b) Some isotopes are radioactive.

State the three types of radiation that may be emitted from radioactive isotopes.

1. .....

2. .....

3. ..... [1]

(c) **(i)** State one practical use of a radioactive isotope.

.....

..... [1]

(ii) Outline how it is used.

.....

.....

.....

.....

..... [1]

[Total: 6]

ChemPraxis

(IGCSE Physics Year 2008 May/June Paper 3-Set 2)

11 **(a)** Chlorine has two isotopes, one of nucleon number 35 and one of nucleon number 37. The proton number of chlorine is 17.

Table 11.1 refers to neutral atoms of chlorine.

Complete Table 11.1.

	nucleon number 35	nucleon number 37
number of protons		
number of neutrons		
number of electrons		

[3]

Table 11.1

(b) Some isotopes are radioactive.

State the three types of radiation that may be emitted from radioactive isotopes.

1. .....

2. .....

3. ..... [1]

(c) **(i)** State one practical use of a radioactive isotope.

.....

..... [1]

(ii) Outline how it is used.

.....

.....

.....

.....

..... [1]

[Total: 6]

ChemPraxis

(IGCSE Physics Year 2008 Oct/Nov Paper 3-Set 1)

NA

(IGCSE Physics Year 2008 Oct/Nov Paper 3-Set 2)

NA

ChemPraxis

(IGCSE Physics Year 2009 May/June Paper 3-Set 1)

11 A beam of ionising radiation, containing α-particles, β-particles and γ-rays, is travelling left to right across the page. A magnetic field acts perpendicularly into the page.

(a) In the table below, tick the boxes that describe the deflection of each of the types of radiation as it passes through the magnetic field. One line has been completed, to help you.

	not deflected	deflected towards top of page	deflected towards bottom of page	large deflection	small deflection
α-particles		✓			✓
β-particles					
γ-rays					

[3]

(b) An electric field is now applied, in the same region as the magnetic field and at the same time as the magnetic field.

What is the direction of the electric field in order to cancel out the deflection of the α-particles?

..... [2]

[Total: 5]

ChemPraxis

(IGCSE Physics Year 2009 May/June Paper 3-Set 2)

11 A beam of ionising radiation, containing α-particles, β-particles and γ-rays, is travelling left to right across the page. A magnetic field acts perpendicularly into the page.

(a) In the table below, tick the boxes which describe the deflection of each of the types of radiation as it passes through the magnetic field. One line has been completed, to help you.

	not deflected	deflected towards top of page	deflected towards bottom of page	large deflection	small deflection
α-particles		✓			✓
β-particles					
γ-rays					

[3]

(b) An electric field is now applied, in the same region as the magnetic field, and at the same time as the magnetic field.

What is the direction of the electric field, in order to cancel out the deflection of the α-particles?

..... [2]

[Total: 5]

ChemPraxis

(IGCSE Physics Year 2009 Oct/Nov Paper 3-Set 1)

NA

(IGCSE Physics Year 2009 Oct/Nov Paper 3-Set 2)

NA

ChemPraxis