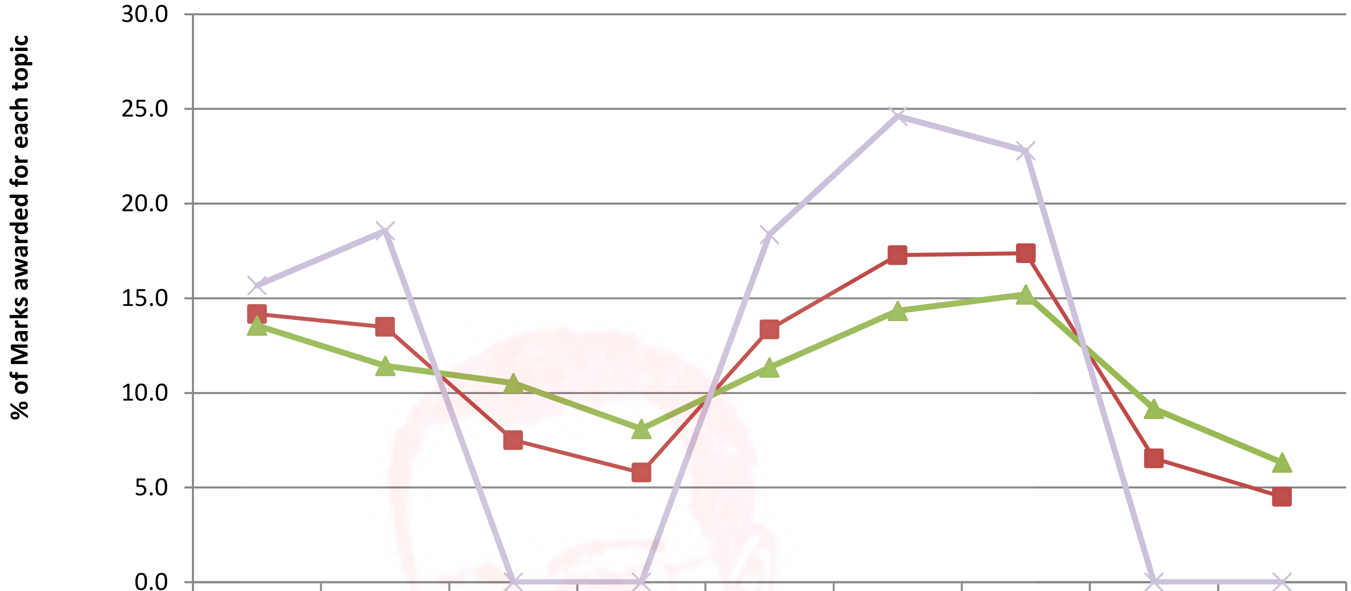
Name

iG Phx 9 EQ 14w to 02w P3 4Students 131marks

For these stats only papers 3 (which after 2016 became paper 4) and paper 6 were used to examine the topics.

iG Phx CIE 0625 PAPERS 3 and 6

Percentage of all WEIGHTED marks awarded for P3 & 6 each topic from s2002 to w2014 (red squares) and % of Paper 3 marks (green triangles) and paper 6 (purple crosses)

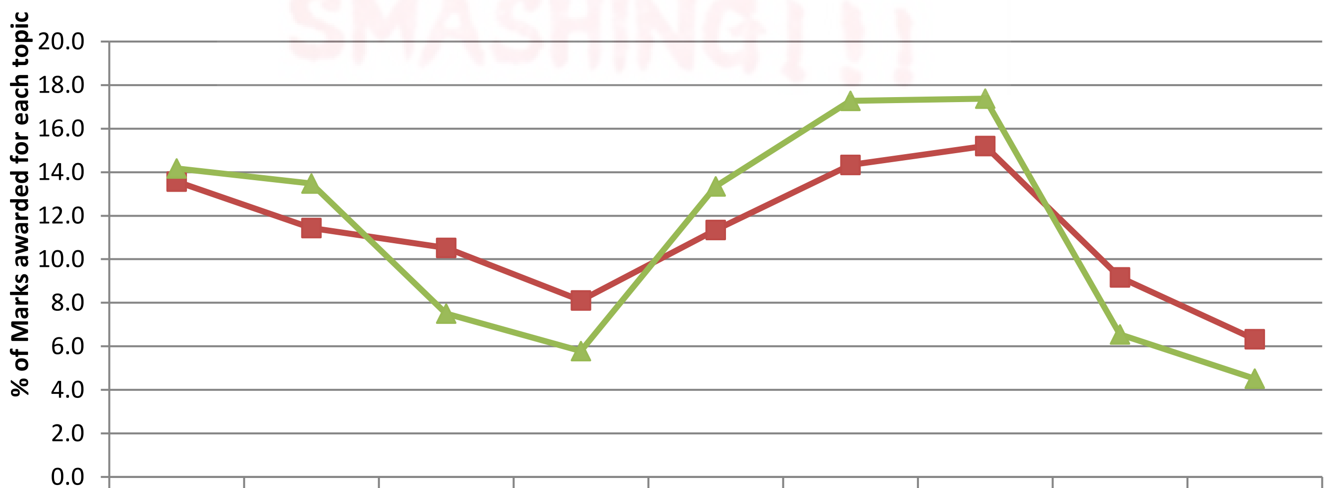


	1	2	3	4	5	6	7	8	9
PhxBoth P3&6	14.2	13.5	7.5	5.8	13.4	17.3	17.4	6.5	4.5
PhxP3	13.6	11.4	10.5	8.1	11.3	14.3	15.2	9.2	6.3
PhxP6	15.7	18.6	0.0	0.0	18.4	24.6	22.8	0.0	0.0

Papers 3 and 6 Topic Number

PAPER 3

Percentage of all marks awarded for each topic from s2002 to w2014 in Paper 3 (red squares) and marks per topic for papers 3 and 6 (green triangles)



	1	2	3	4	5	6	7	8	9
ALL P3 %	13.6	11.4	10.5	8.1	11.3	14.3	15.2	9.2	6.3
P3 & 6	14.2	13.5	7.5	5.8	13.4	17.3	17.4	6.5	4.5

Paper 3 Topic Number

Papers covered in this sample

	1st Paper	Last Paper	Marks/ paper	Theor. All Papers	Actual All Marks	Difference	Difference %	Weight per paper	Weight per mark
Paper 3	2002w	2014w	80	2000	2072	72	3.6	50	0.63
Paper 6	2002s	2015w	40	1120	1040	-80	-7.1	20	0.50

There are a few missing:

Got all Paper 31s (except 2014w Paper 31), and got 2014w 33

So papers in time zones 2 and 3 are not covered.

All topics ranked by frequency of marks in exams (P3 and 6 only)

Topic	PhxBoth P3&6	PhxP3	PhxP6
7	17.4	15.2	22.8
6	17.3	14.3	24.6
1	14.2	13.6	15.7
2	13.5	11.4	18.6
5	13.4	11.3	18.4
3	7.5	10.5	0.0
8	6.5	9.2	0.0
4	5.8	8.1	0.0
9	4.5	6.3	0.0

Other statistics that might be of interest:

	Topics:	1	2	3	4	5	6	7	8	9
P3/4 marks	2072	281	237	218	168	235	297	315	190	131
P3/4 %		13.6	11.4	10.5	8.1	11.3	14.3	15.2	9.2	6.3
P6	1040	163	193	0	0	191	256	237	0	0
P6 %		15.7	18.6	0.0	0.0	18.4	24.6	22.8	0.0	0.0
Total Marks (WIEGHTED)	1815	257	245	136	105	242	314	315	119	82
% of Marks (Weighted)	1815	14.2	13.5	7.5	5.8	13.4	17.3	17.4	6.5	4.5
# of Questions		63	64	35	16	63	74	70	26	20
Average marks per Q		**4.1**	**3.8**	**3.9**	**6.6**	**3.8**	**4.2**	**4.5**	**4.6**	**4.1**

Final note:

My iG and IB chemistry papers were broken down more carefully than these were, so there may be a mark or two in the wrong topic especially in topics 3 to 5, but if you learnt or taught these topics in sequence than you shouldn't have a problem with seeing material from an earlier topic.

Defining the Topics: Why not use the units given in the syllabus?

Artificial topics have been created for the physics syllabus by me so that each topic is roughly the same size. Topics go in syllabus order. I have decided to use the number of marks allocated in previous exams to each syllabus point to determine how many go into each topic.

1. General physics

Topic 1

1.1 Length and time
1.2 Motion
1.3 Mass and weight
1.4 Density

Topic 2

1.5 Forces
1.6 Momentum (Extended candidates only)

Topic 3

1.7 Energy, work and power
1.8 Pressure

2. Thermal physics

Topic 4

2.1 Simple kinetic molecular model of matter

Topic 5

2.2 Thermal properties and temperature
2.3 Thermal processes

3. Properties of waves, including light and sound

Topic 6

3.1 General wave properties
3.2 Light
3.3 Electromagnetic spectrum
3.4 Sound

4. Electricity and magnetism

Topic 7

4.1 Simple phenomena of magnetism
4.2 Electrical quantities
4.3 Electric circuits
4.4 Digital electronics (Extended candidates only)
4.5 Dangers of electricity

Topic 8

4.6 Electromagnetic effects

5. Atomic physics

Topic 9

5.1 The nuclear atom
5.2 Radioactivity

10 A technician sets up a radiation detector in a university laboratory, for use in some experiments. Even before the radioactive source for the experiments is brought into the laboratory, the detector registers a small count rate due to background radiation.

(a) Suggest one source of this background radiation.

....

....[1]

(b) The radioactive source emits γ-rays. It is placed on the laboratory bench close to the detector.

(i) State what γ-rays are.

....

....

....[2]

(ii) A lead sheet of thickness 10 mm is positioned between the detector and the radioactive source.

State and explain what happens to the count rate on the detector.

....

....

....[2]

(c) In a second experiment, γ-rays pass through air to the detector, as shown in Fig. 10.1.

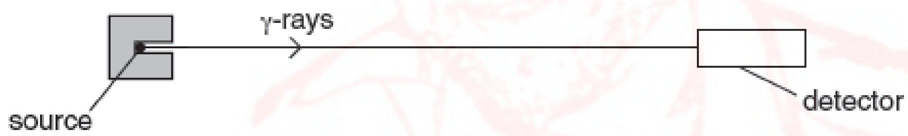


Fig. 10.1

One end of a bar magnet is brought close to the path of the γ-rays.

(i) Tick one box to indicate the effect on the path of the γ-rays. [1]

☐ deflected into the page

☐ deflected out of the page

☐ deflected downwards

☐ deflected upwards

☐ no deflection

(ii) Explain your answer to **(i)**.

....

....[1]

11 (a) Complete the table below for the three types of radiation.

radiation	nature	charge	stopped by
γ	electromagnetic radiation		
β		negative	
α			thick paper

[3]

(b) An isotope of strontium is represented in nuclide notation as $^{90}_{38}Sr$.

For a neutral atom of this isotope, state

(i) the proton number, ...

(ii) the nucleon number, ...

(iii) the number of neutrons, ...

(iv) the number of electrons. ....

[3]

(c) A sample of a radioactive material is placed near a radiation detector. A count-rate of 4800 counts/s is detected from the sample. After 36 hours the count-rate has fallen to 600 counts/s.

Calculate how many more hours must pass for the count-rate to become 150 counts/s.

number of hours = ... [3]

[Total: 9]

11 **(a)** Complete the following statements.

(i) An α-particle consists of ....

(ii) A β-particle consists of ....

[3]

(b) As α-particles and β-particles pass through a gas, molecules of the gas become ionised.

Explain what is meant by the *ionisation* of a gas molecule.

....

....[1]

(c) Fig. 11.1 shows a beam of α-particles and a beam of β-particles in a vacuum. The beams are about to enter a region in which a very strong magnetic field is acting. The direction of the magnetic field is into the page.

Fig. 11.1

(i) Suggest why the paths of the particles in the magnetic field are curved.

....[1]

(ii) Sketch the paths of both types of particle in the magnetic field. [3]

[Total: 8]

11 **(a)** A radioactive source emits α-, β- and γ-radiation.

Which of these radiations

(i) has the shortest range in air, ...

(ii) has a negative charge, ...

(iii) is not deflected in a magnetic field? ....

[2]

(b) In a famous experiment, carried out in a vacuum, a very thin sheet of gold was placed in the path of alpha particles.

It was found that a large number of the alpha particles passed through the sheet with little or no deflection from their original path. A very small number of the alpha particles were reflected back towards the source.

(i) Explain, in terms of the force acting, why the direction of motion of an alpha particle changes when it comes close to the nucleus of a gold atom.

....

....

.... [2]

(ii) State **two** conclusions, about the nuclei of atoms, that were made from the results of this experiment.

1. ....

....

2. ....

....

[2]

[Total: 6]

10 **(a)** Fig. 10.1 shows a wire PQ placed between the poles of a magnet. There is a current in wire PQ.

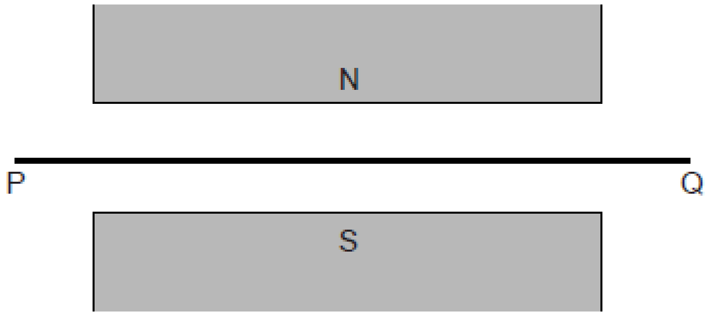


Fig. 10.1

(i) On Fig. 10.1, sketch lines with arrows to show the direction of the magnetic field between the poles of the magnet. [1]

(ii) The force on PQ is into the paper.

Draw an arrow on PQ to show the direction of the current. [1]

(b) The wire PQ in Fig. 10.1 is replaced by a narrow beam of β-particles travelling from left to right.

(i) Suggest a suitable detector for the β-particles.

.... [1]

(ii) State the direction of the force on the β-particles.

.... [1]

(iii) Describe the path of the β-particles in the space between the poles of the magnet.

....

.... [1]

(iv) State what happens to the air molecules along the path of the β-particles.

.... [1]

[Total: 6]

6 **(a)** Six different nuclides have nucleon and proton numbers as follows:

nuclide	nucleon number	proton number
A	214	84
B	214	85
C	211	84
D	211	86
E	210	82
F	210	83

State which two nuclides are isotopes of the same element. .... and .... [1]

(b) Thorium-232 has a half-life of 1.4×10^{10} years.

At a particular instant, the activity of a sample of thorium-232 is 120 Bq.

(i) Calculate the time taken for the activity of this sample to fall to 15 Bq.

time taken ....[1]

(ii) Explain why, when the activity has become 15 Bq, much of the sample will no longer be thorium-232.

....

....

....[1]

(iii) The sample of thorium-232 is used in an experiment in a laboratory.

Explain why its activity may be regarded as constant.

....

....

....[1]

[Total: 4]

10 Emissions from a radioactive source pass through a hole in a lead screen and into a magnetic field, as shown in Fig. 10.1.

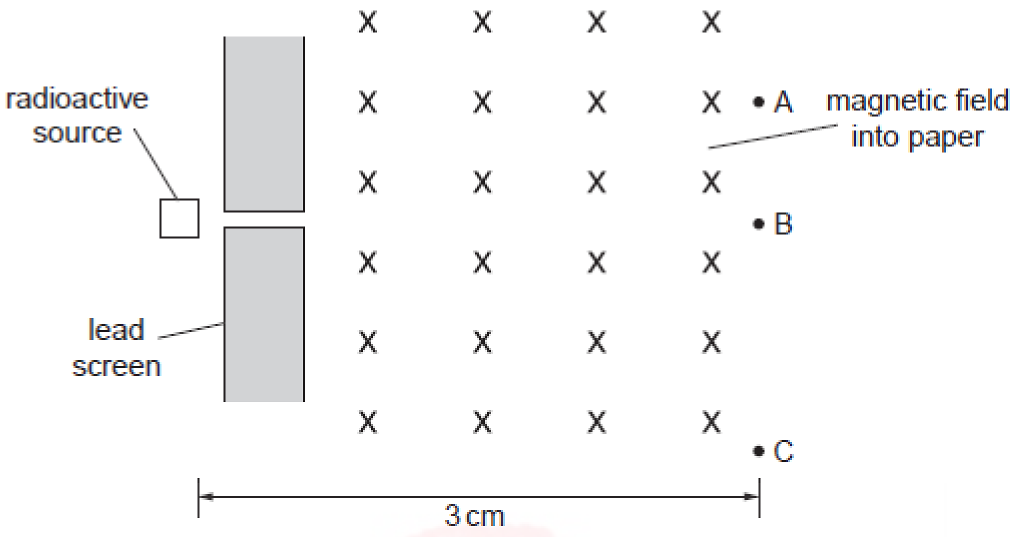


Fig. 10.1

Radiation detectors are placed at A, B and C. They give the following readings:

A	B	C
32 counts/min	543 counts/min	396 counts/min

The radioactive source is then completely removed, and the readings become:

A	B	C
33 counts/min	30 counts/min	31 counts/min

(a) Explain why there are still counts being recorded at A, B and C, even when the radioactive source has been removed, and give the reason for them being slightly different.

....

....

....

.... [2]

(b) From the data given, deduce the type of emission being detected, if any, at A, at B and at C when the radiation source is present.

State the reasons for your answers.

detector at A ....

....

.... [2]

detector at B ....

....

.... [3]

detector at C ....

....

.... [3]

[Total: 10]

Q# 8/_iG Phx/2010/s/Paper 31/ www.SmashingScience.org

10 A certain element is known to exist as two different isotopes.

(a) State one thing that is the same for atoms of both isotopes.

.... [1]

(b) State one thing that is different between atoms of these two isotopes.

.... [1]

(c) An atom of one of these isotopes is unstable and decays into a different element by emitting a β-particle.

(i) State one thing about the atom that remains the same during this decay.

.... [1]

(ii) State one thing about the atom that changes as a result of this decay.

.... [1]

[Total: 4]

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]

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]

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.

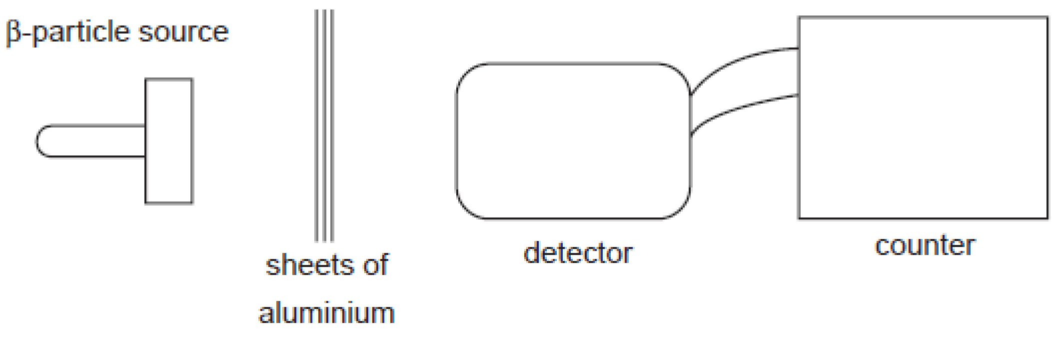


Fig. 11.1

(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]

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

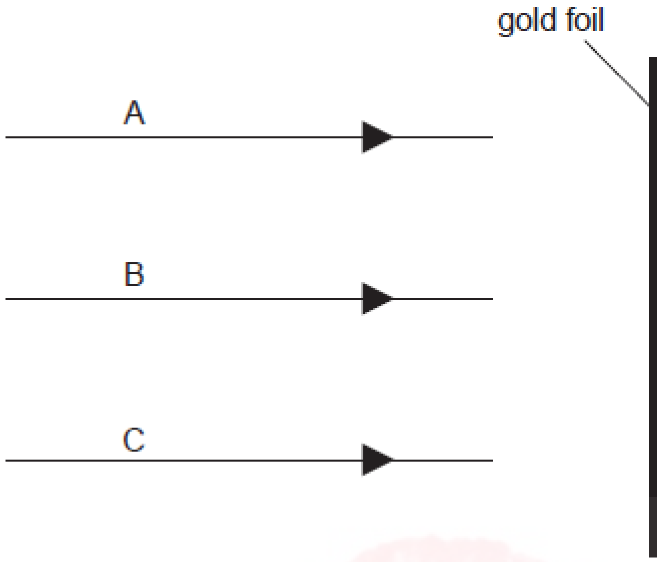


Fig. 11.1

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]

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.

....

....

....

[4]

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.

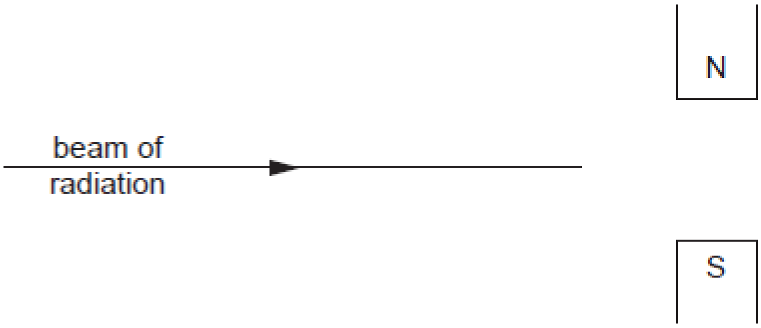


Fig. 11.1

Complete the table below.

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

[6]

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]

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

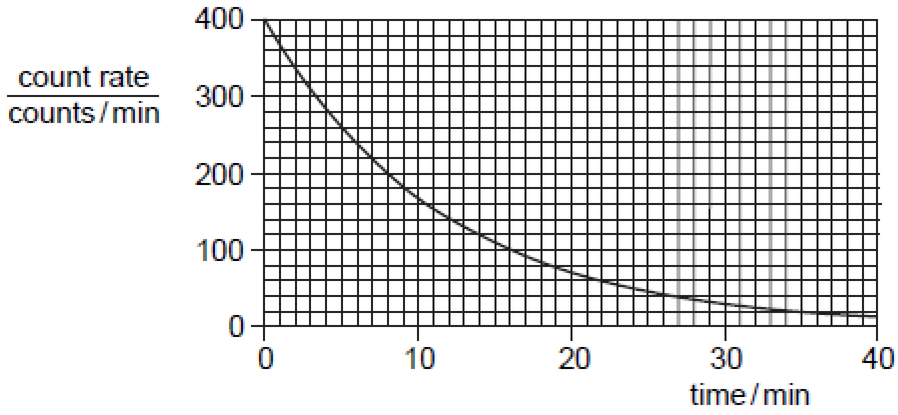


Fig. 10.1

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]

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.

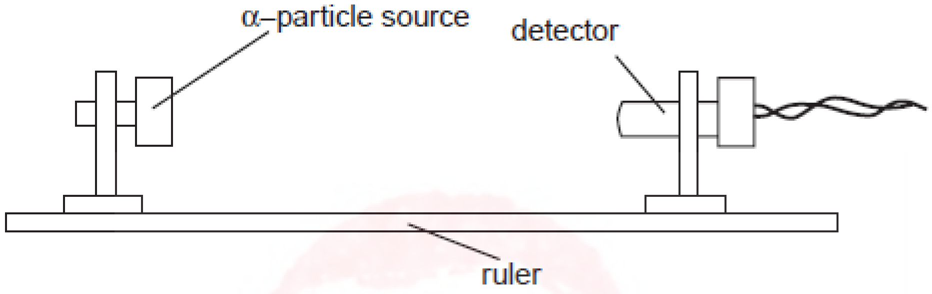


Fig. 11.1

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]

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]

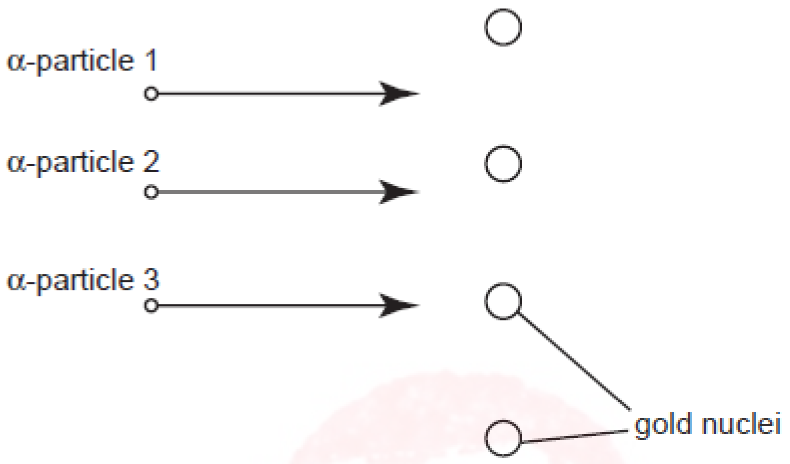


Fig. 11.1

(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]

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.

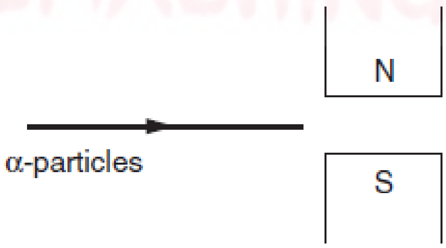


Fig. 11.1

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

....

....

....[3]

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

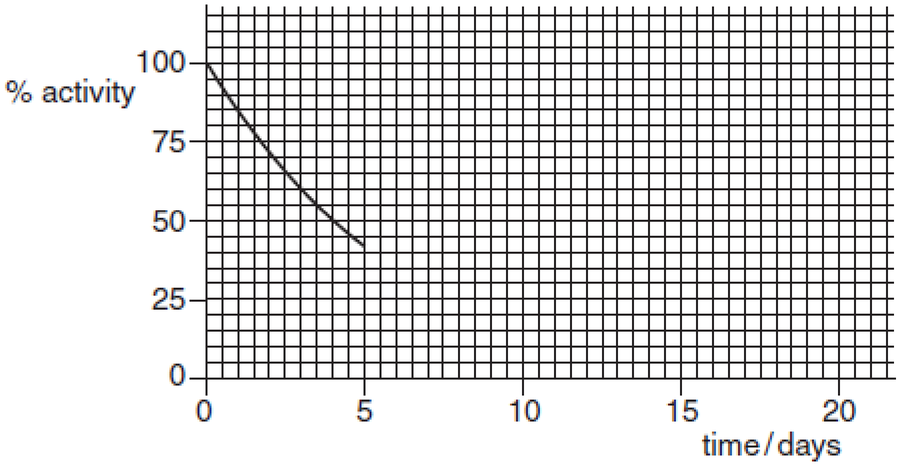


Fig. 10.1

(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.

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

Mark Scheme

Q# 1/ iG Phx/2014/w/Paper 33/ www.SmashingScience.org

10	**(a)**		any one specific source of background radiation e.g. rocks, ground, building materials, radon, radiation from space, Sun, cosmic rays, nuclear waste	B1
	(b)	**(i)**	electromagnetic radiation **OR** photons (very) high frequency **OR** (very) short wavelength **or** high energy	B1 B1
		(ii)	(count rate) decreases	B1
			(count rate decreases but) not completely absorbed (by lead) **OR** only some γ-rays detected	B1
	(c)	**(i)**	no deflection (last / fifth box ticked)	B1
		(ii)	(γ-rays) are uncharged / neutral (**IGNORE** not affected by magnetic fields)	B1
				[Total: 7]

Q# 2/ iG Phx/2014/s/Paper 31/ www.SmashingScience.org

11	**(a)**		γ: none / zero / 0 / neutral AND 2 cm (or more) of lead / thick lead / 50 cm (or more) of concrete	B1
			β: particle / electron AND any named metal / glass / concrete OR 1 m of air	B1
			α: particle / helium nucleus / 2 protons + 2 neutrons / $^4_2$He / $^4_2\alpha$ AND positive OR + OR +2	B1
	(b)	**(i)**	38	
		(ii)	90	
		(iii)	52	
		(iv)	38	B3
	(c)		36 hours = 3 half-lives OR halving in steps from 4800 to 600 seen	C1
			half-life = 12 hours OR 3 half-lives OR 2 / 3 of 36	C1
			(further time to reduce to 150 Bq =) 24 (hours)	A1
				[Total: 9]

Q# 3/ iG Phx/2013/s/Paper 31/ www.SmashingScience.org

11	(a)	(i)	2 protons	B1
			2 neutrons	B1
		(ii)	a (fast moving) electron	B1
	(b)		electron/electrons removed from/gained by the molecule	B1
	(c)	(i)	force because particle is charged OR the force on the particles is perpendicular to their paths OR direction of force changes as direction of motion changes	B1
		(ii)	α-particle <u>curve</u> up the page in at least half of width of field	B1
			β-particle <u>curve</u> opposite to α-particle curve OR down page if α line has no curvature anywhere	B1
			smaller radius of β path clear	B1
				[Total 8]

Q# 4/ iG Phx/2012/w/Paper 31/ www.SmashingScience.org

11	(a)	(i)	alpha or α		
		(ii)	beta or β		
		(iii)	gamma or γ	B2	
			Symbols must be clear 3 correct B2 2 correct B1		
	(b)	(i)	repulsion	B1	
			α particle and (gold) nucleus / protons of (gold) nucleus have positive charges	B1	
		(ii)	Any two of: Nucleus is very small (compared to size of atom) OR Most of atom is empty space		
			Nucleus is positive / contains protons OR Nucleus has (all) the positive charge of the atom		
			Nucleus is heavy OR Nucleus has most / all of the mass of the atom	B2	[6]
			Ignore neutrons		

Q# 5/_iG Phx/2012/s/Paper 31/ www.SmashingScience.org

10	(a)	(i)	Parallel lines perpendicular to pole faces with arrows N to S	B1
		(ii)	Arrow pointing to the right	B1
	(b)	(i)	Geiger (counter) / Geiger (tube) (+ scaler / ratemeter) / photographic plate / scintillation counter / cloud chamber / luminescent or phosphorescent plate	B1
		(ii)	Out of the plane of the paper	B1
		(iii)	(Path is) a curve / circular / arc	B1
		(iv)	(Air molecules are) ionised / lose electrons	B1

[Total: 6]

Q# 6/_iG Phx/2011/s/Paper 31/ www.SmashingScience.org

6	(a)		A and C	B1	
	(b)	(i)	4.2×10^{10} years	B1	
		(ii)	idea of decay OR changes proton/neutron/nucleon number OR change into another nuclide/isotope/element/type of atom OR emits α/β particle (ignore γ / radiation)	B1	
		(iii)	idea of insignificant change in activity during stated time up to 5×10^9 years OR experiment time insignificant c.f. 1.4×10^{10} years OR long half life OR long time to decay	B1	[4]

Q# 7/_iG Phx/2010/w/Paper 31/ www.SmashingScience.org

10	(a)		idea of background radiation	M1
			random/different at different times NOT places	A1
	(b)	A	nothing OR background	M1
			reading doesn't change (when source removed)	A1
		B	gamma OR γ	M1
			gamma undeflected (by magnetic field)	A1
			uncharged/neutral OR electromagnetic radiation	A1
		C	beta OR β	B1
			deflection is big/more deflection than alpha	B1
			low mass/much smaller than alpha	B1
			OR	
			beta OR β	B1
			negative	B1
			deflects according to left-hand rule	B1

[Total: 10]

Q# 8/ iG Phx/2010/s/Paper 31/ www.SmashingScience.org

10 (a) proton number OR atomic number OR (number of) protons / electrons
OR position in periodic table OR chemical properties — B1

(b) mass (number) OR nucleon number OR (number of) neutrons / nucleons
OR (number of) protons plus (number of) neutrons — B1

(c) (i) mass (number) OR nucleon number OR (number of) nucleons
OR (number of) protons plus (number of) neutrons — B1

(ii) proton number OR atomic number OR (number of) neutrons
OR (number of) protons / neutrons / electrons
OR position in periodic table OR chemical properties
OR a neutron changes into a proton — B1 [4]

Q# 9/ iG Phx/2009/s/Paper 31/ www.SmashingScience.org

11 (a) ignore any extra ticks against α

β 3rd and 4th columns ticked

(use ✓ + × = 0 for extras) i.e.

2 correct	2 marks	
1 correct, nothing else	1 mark	
1 correct, 1 wrong	1 mark	
2 correct, 1 wrong	1 mark	
2 correct, 2 or 3 wrong	0 marks	B1 + B1

γ 1st column ticked (use ✓ + × = 0 for extras) — B1

(b) idea of in plane of page OR perpendicular to magnetic field — C1
top to bottom of the page OR opposite direction of deflection of α OR
down the page — A1
Ignore downwards. Ignore references to + or – plates, for both C1 and A1 [5]

Q# 10/ iG Phx/2008/s/Paper 31/ www.SmashingScience.org

11 (a) number of protons 17 and 17 — B1
number of neutrons 18 and 20 — B1
number of electrons 17 and 17 — B1

(b) alpha, beta, gamma words or symbols, any order NOT gamma particles — B1

(c) (mark (i) and (ii) together)

(i) any correct use — M1

(ii) simple correct explanation — A1

[6]

Q# 11/ iG Phx/2007/w/Paper 31/ www.SmashingScience.org

11	**(a)**	detector, no source, no aluminium, take count OR take background	B1
		no aluminium, take count	B1
		aluminium, take count	B1
		subtract background/reading 1 from results	B1
	(b)	count decreases as thickness of aluminium increases	B1
		6-10 sheets/several sheets/few mm,	
		count reduced to background count/β-particles stopped	B1

[Total: 6]

Q# 12/ iG Phx/2007/s/Paper 31/ www.SmashingScience.org

11	**(a)**	A doubles back, either side	B1	
		B carries on, slightly deflected	B1	
		C carries straight on	B1	[3]
	(b)	only (very) few scattered through large angles	B1	
		most pass undeviated so most of atom space	B1	
		scattering/deflection/repulsion due to concentrated mass/charge/charge/nucleus	B1	[3]

[Total: 6]

Q# 13/ iG Phx/2006/w/Paper 31/ www.SmashingScience.org

11	**(a)**	**(i)**	atoms interact with by particle/photon not radiation	B1	
			electron(s) removed to form ions	B1	
		(ii)	much greater mass or size/slower speed/more ion pairs/cm/larger charge	B1	[3]
	(b)	**(i)**	any 2 correct	B2	
		(ii)	e.g. foil thickness described/outline diagram	B1	
			foil too thick less reading/notes on diagram to show method	B1	
			other examples will occur, must have two clear points: e.g. 1. gamma rays aimed at cancer (not just radiation) focused on tumour e.g. 2. fission of heavy nucleus (accept named nuclide) leads to more fissions/chain reaction		[4]

[Total: 7]

Q# 14/ iG Phx/2006/s/Paper 31/ www.SmashingScience.org

11	line1	into paper	B1	
		positive or +2	B1	
	line 2	out of paper or opposite of line 1	B1	
		negative or -1	B1	
	line 3	no deflection	B1	
		no charge	B1	**6**
				[6]

Q# 15/_iG Phx/2005/w/Paper 31/ www.SmashingScience.org

11	(a)	β-source and detector suitably arranged	B1	
		deflecting plates suitably arranged	B1	
		additional detail e.g. slit or collimator, vacuum chamber, circuit connected to deflecting plates	B1	[3]
	(b)	at least 3 readings at right angles beyond & perp. to the plates	M1	[2]
		one near +ve, one near –ve and one in centre	A1	
	(c)	highest reading near +ve plate	B1	[1]
	(d)	electrons negatively charged, attracted to +ve	B1	[1] Total [7]

Q# 16/_iG Phx/2005/s/ www.SmashingScience.org

10	(a)	8 (mins) for value, no working shown	B1	
		8 (mins) for value with suitable working or indication on graph	B1	2
	(b) (i)	source, aluminium and detector, recognisable shapes	B1	
		quality and all labels correct	B1	2
	(ii)	count background	B1	
		source and detector, no absorber, count taken	B1	
		source, absorber and detector, count taken	B1	3 [7]

Q# 17/_iG Phx/2004/w/Paper 3/ www.SmashingScience.org

11	(a)	correct equation i.e. Ra gives Rn + alpha particle or He	1	
		all numbers correct on Rn and He	1	2
	(b) (i)	radiation from surroundings/background radiation	1	
	(ii)	532 to 552 counts/min	1	
	(iii)	5/6 cm	1	
	(iv)	beyond 5/6 cm no alpha, only background radiation	1	4 (6)

Q# 18/_iG Phx/2004/s/ www.SmashingScience.org

11	(a)	Particle 1 carries straight on	B1	
		Particle 2 (slightly) deflected (less than 90°)	B1	
		Particle 3 "turns back" / (deflected more than 90°)	B1	3
	(b)	Nucleus is heavy /dense / all or most of mass in atom in nucleus	B1	
		Most of atom is space or nucleus is (very) small cf. atom	B1	2
	(c)	(mass) 4	B1	1 [6]

Q# 19/ iG Phx/2003/s/ www.SmashingScience.org

11	(a)	(i)	source, detector	B1	
			named absorber/air and labels	B1	
		(ii)	take detector reading with no source (background)	B1	
			detector reading with source, detector and air only	B1	
			detector reading with appropriate named absorber (including distance in air)	B1	
		(iii)	same reading with absorber(including air) as background	B1	
			so all alpha absorbed by cardboard/paper/air, others would get through	B1	max 6
	(b)		curved path stated or drawn	B1	
			path at right angles to magnetic field	B1	
			into paper	B1	3
					[9]

Q# 20/ iG Phx/2002/w/Paper 3/ www.SmashingScience.org

10 a	half-life 4 days*	1	A1	1
b	at least two points worked out		M1*	
	suitable curve completed	2	A1	2
c	by 20 days little radioactivity left, after 1 day about 85% left	1	B1	1
d	$^{A}_{Z}X \rightarrow {}^{0}_{-1}e + {}^{A}_{Z+1}Y$ top line, A1/ bottom line A1	1	A2	2
			QT	6

or ${}^{0}_{-1}\beta$ (not e or β alone)

PAPER TOTAL **80**

$^{A}_{Z}X \rightarrow e/\beta + {}^{A}_{Z+1}Y$ (C1)