AQA GCSE Physics | 8463

SPECIFICATION POINT 4.2.5.2

Electric fields

Past-paper questions

Tier	**Higher**
Question groups	**6**
Available paper years	**2008–2024**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.2.5.2 Electric fields

Question 01

January 2008 | PHY1H | Original Q4 | Legacy

4 (a) A radioactive source emits alpha (α), beta (β) and gamma (γ) radiation.

(i) Which **two** types of radiation will pass through a sheet of card?

.....

(1 mark)

(ii) Which **two** types of radiation would be deflected by an electric field?

.....

(1 mark)

(iii) Which type of radiation has the greatest range in air?

.....

(1 mark)

(b) A student suggests that the radioactive source should be stored in a freezer at –20 °C. The student thinks that this would reduce the radiation emitted from the source.

Suggest why the student is wrong.

.....

.....

(1 mark)

Question 4 continues on the next page

Question 01 · continued

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(c) Phosphorus-32 is a radioactive isotope that emits beta radiation.

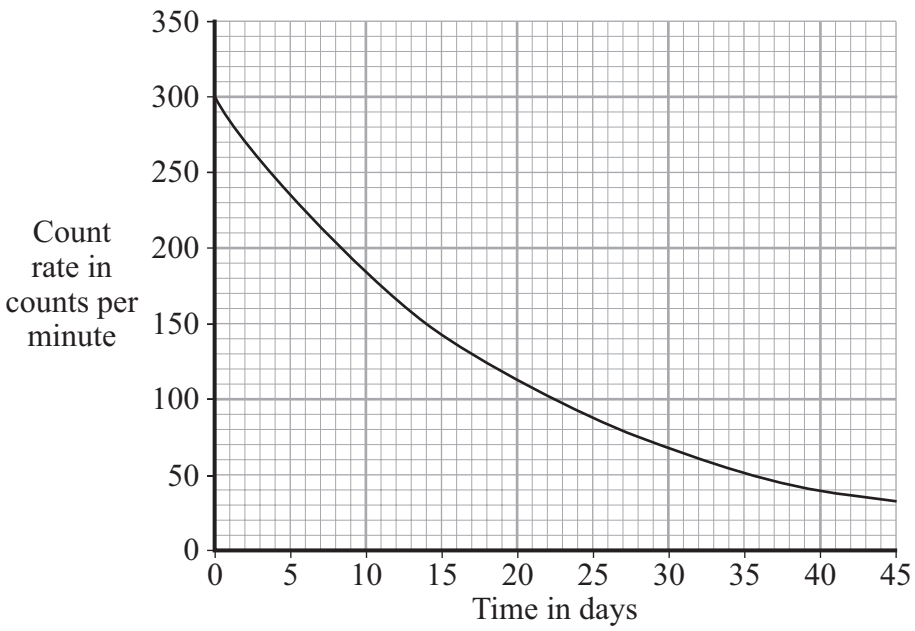
(i) How is an atom of phosphorus-32 different from an atom of the stable isotope phosphorus-31?

.....

.....

(1 mark)

(ii) The graph shows how the count rate of a sample of phosphorus-32 changes with time.



Use the graph to calculate the half-life of phosphorus-32.

Show clearly how you used the graph to obtain your answer.

.....

.....

Half-life = ... days

(2 marks)

4.2.5.2 Electric fields

Question 01 · continued

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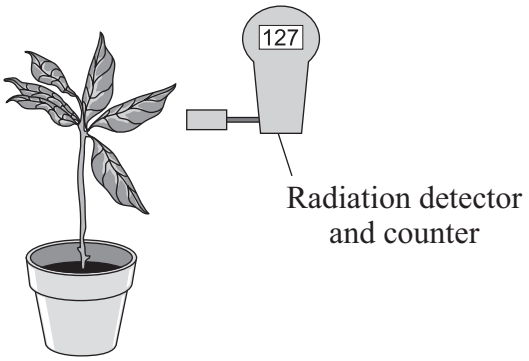
(iii) Plants use phosphorus compounds to grow. Watering the root system of a plant with a solution containing a phosphorus-32 compound can help scientists to understand the growth process.



Explain why phosphorus-32 is suitable for use as a tracer in this situation.

.....

.....

.....

.....

(2 marks)

9

4.2.5.2 Electric fields

Question 02

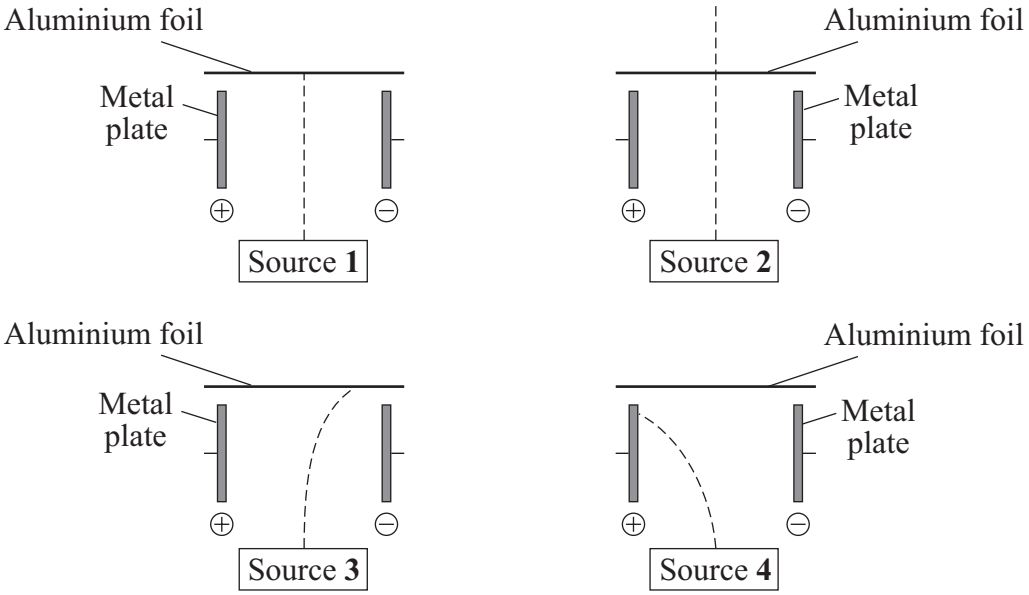
November 2008 | PHY1BP | Original Q1 | Legacy

QUESTION ONE

Radiation from four sources, **1**, **2**, **3** and **4**, is directed into an electric field between two metal plates.

There is a sheet of aluminium foil after the gap between the metal plates.

Light waves are not deflected in electric fields.



In each diagram, the dashed line (----------) shows the path of the radiation.

Match the types of radiation, **A**, **B**, **C** and **D**, with the sources **1–4**.

A alpha radiation

B beta radiation

C gamma radiation

D visible light

4.2.5.2 Electric fields

Question 03

June 2010 | PHY1BP | Original Q7 | Legacy

QUESTION SEVEN

In 1896, Henri Becquerel was doing an experiment with uranium. He first thought that uranium absorbed energy from the Sun and then re-emitted the energy as X-rays. Then, on a cloudy day, he found that the uranium emitted radiation even when the uranium sample was wrapped in black paper.

7A This suggests that . . .

1 his original theory was wrong and further investigation was needed.

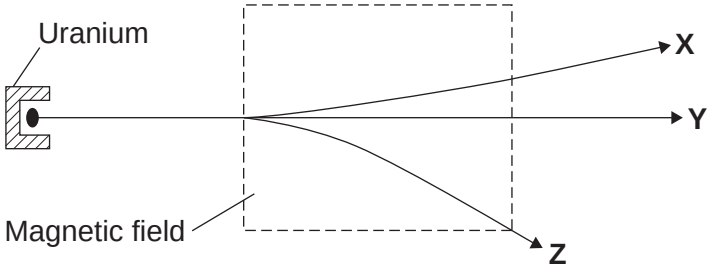
2 his test was fair but more variables needed to be controlled.

3 his original theory was correct and further investigation was needed.

4 his test was not fair and more variables needed to be controlled.

7B Becquerel passed the radiation emitted by uranium through a magnetic field. He found that there were three different types of radiation.

The diagram shows the paths of the three types of radiation, **X**, **Y** and **Z**, in the magnetic field.



Later, Ernest Rutherford called the three types of radiation alpha, beta and gamma.

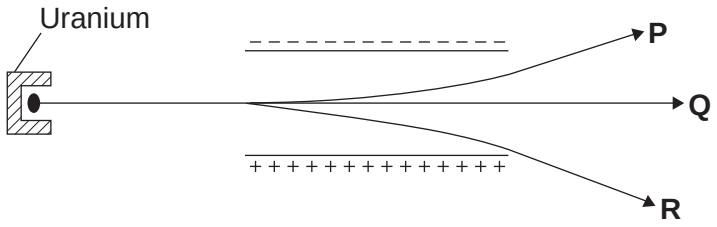
Which is the correct row in the table?

	X	Y	Z
1	alpha	beta	gamma
2	alpha	gamma	beta
3	beta	alpha	gamma
4	beta	gamma	alpha

Question 03 · continued

7C The radiation emitted by uranium can also be deflected in an electric field between two charged plates.

The diagram shows the paths taken by the three types of radiation, **P**, **Q** and **R**, in an electric field.



The explanation for the different paths is that . . .

1 **P** and **R** have the same electric charge and **Q** is uncharged.

2 **P** and **R** are oppositely charged and **P** has a larger mass than **R**.

3 **P** and **R** are oppositely charged and **R** has a larger charge than **P**.

4 **Q** is uncharged and has a larger mass than both **P** and **R**.

7D Rutherford measured the range in air of the three types of radiation.

Which row of the table gives the correct order of range?

	Shortest range → Longest range		
1	alpha	beta	gamma
2	alpha	gamma	beta
3	beta	alpha	gamma
4	beta	gamma	alpha

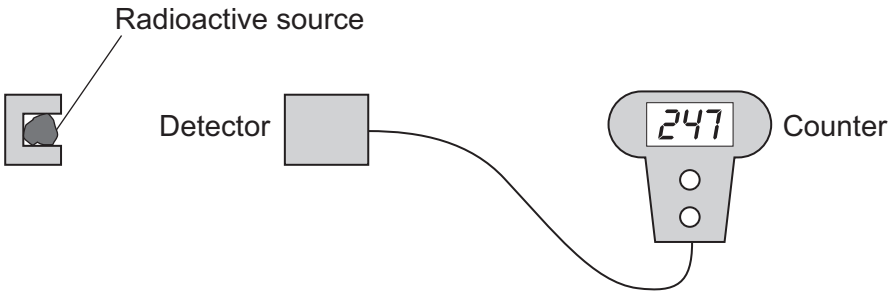
4.2.5.2 Electric fields

Question 04

November 2011 | PHY1BP | Original Q5 | Legacy

QUESTION FIVE

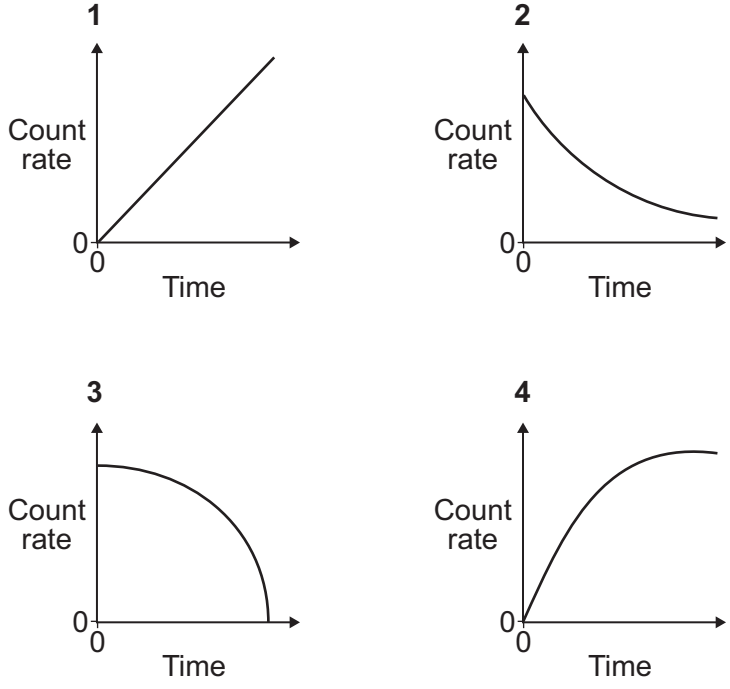
A teacher used the apparatus shown in the diagram to measure the count from a radioactive source.



She put the radioactive source near the detector. She measured the number of counts in 20 seconds. She reset the counter to zero and measured the number of counts in the next 20 seconds. She continued this for 10 minutes.

5A The teacher asked the students to plot a graph of the count rate against time.

Which of the following could be the expected shape of the graph?



4.2.5.2 Electric fields

Question 04 · continued

5B The students can use their graphs to find the half-life of the radioactive source.

What is meant by *half-life*?

1 half the time it takes for the count rate to fall to zero

2 half the time it takes for the number of nuclei in the sample to halve

3 the time it takes for the count rate to halve

4 the time it takes for the number of nuclei in the sample to fall to zero

5C Which of the following will affect the initial count rate in the sample?

1 the pressure in the room

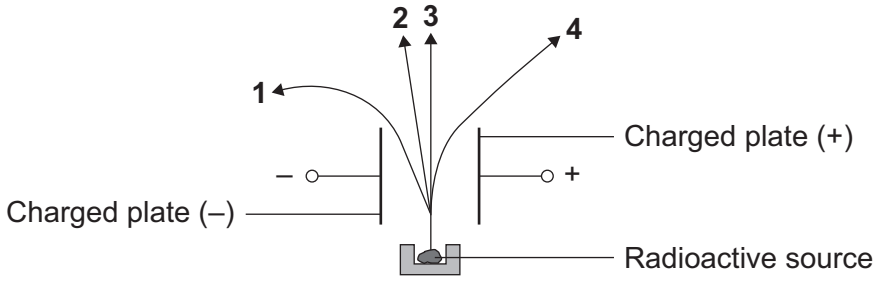
2 the original number of nuclei in the sample

3 the temperature of the room

4 the temperature of the sample

5D A radioactive source is placed close to a pair of charged parallel plates with an electric field between them.

Which of the lines, **1**, **2**, **3** or **4**, on the diagram shows the path of the beta particles emitted by the source?



4.2.5.2 Electric fields

Question 05

June 2018 | 8463/1H | Original Q1

0 1 **Figure 1** shows a student walking on a carpet.

Figure 1



0 1 . 1 The student becomes negatively charged because of the friction between his socks and the carpet.

Explain why the friction causes the student to become charged.

[2 marks]

4.2.5.2 Electric fields

Question 05 · continued

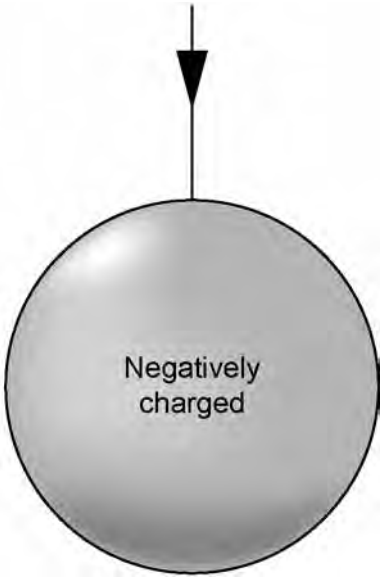
0 1 . 2 The student's head is represented by the sphere in **Figure 2.**

The student is negatively charged. The arrow shows part of the electric field around the student's head.

Draw **three** more arrows on **Figure 2** to complete the electric field pattern.

[1 mark]

Figure 2



0 1 . 3 The negatively charged student touches a metal tap and receives an electric shock.

Explain why.

[3 marks]

4.2.5.2 Electric fields

Question 05 · continued

0 1 . 4 Some carpets have thin copper wires running through them. The student is less likely to receive an electric shock after walking on this type of carpet.

Suggest why.

[2 marks]

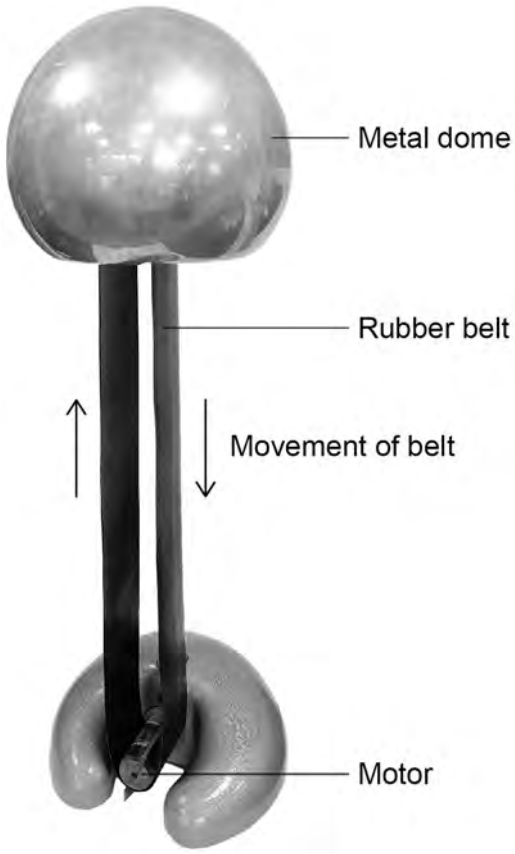
8

4.2.5.2 Electric fields

Question 06

0 4 **Figure 4** shows a static electricity generator.

Figure 4



The rubber belt is turned by a motor.

As the rubber belt moves, charge is transferred from the rubber belt to the metal dome.

Question 4 continues on the next page

4.2.5.2 Electric fields

Question 06 · continued

0 4 . 1 **Figure 5** shows a student touching the metal dome of the static electricity generator.

The dome is negatively charged.

Figure 5



Explain why the student's hair stands up on end.

[3 marks]

4.2.5.2 Electric fields

Question 06 · continued

The charged metal dome creates an electric field.

0 4 . 2 What is an electric field?

[1 mark]

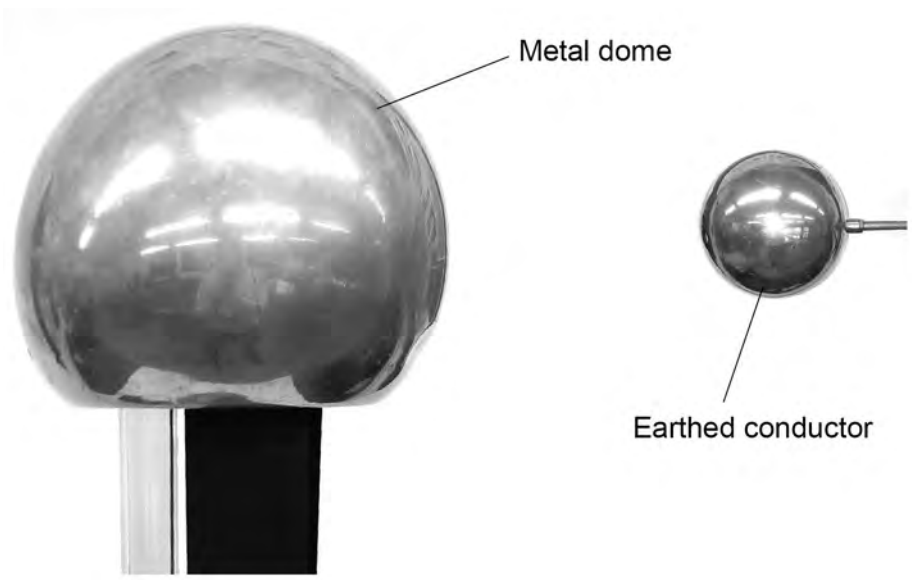
0 4 . 3 How does the electric field strength vary as the distance from the charged metal dome increases?

[1 mark]

Question 4 continues on the next page

Figure 6 shows the negatively charged metal dome and an earthed conductor.

Figure 6



When the earthed conductor is moved towards the metal dome, there is a spark between the dome and the earthed conductor.

0 4 . 4 The spark transfers 0.60 J of energy, and 2.0 μC of charge is transferred from the dome to the earthed conductor.

Calculate the potential difference between the metal dome and the earthed conductor.

Use the Physics Equations Sheet.

[4 marks]

Potential difference = _____ V

4.2.5.2 Electric fields

Question 06 · continued

0 4 . 5 Which of the following changes would increase the distance a spark can jump between the dome and the earthed conductor?

[1 mark]

Tick (✓) **one** box.

Decreased charge on the metal dome ☐

Decreased electric field strength ☐

Decreased electrical resistance of air ☐

Decreased potential difference ☐

10

Turn over for the next question