Name:

IGCSE Physics: **w25 11**

1 Which description of the structure of an atom is correct?

A negatively charged electrons surrounding an uncharged nucleus

B negatively charged electrons surrounding a positively charged nucleus

C positively charged electrons surrounding an uncharged nucleus

D positively charged electrons surrounding a negatively charged nucleus

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2 An isotope of carbon has the nuclide notation $^{14}_{6}C$.

What does the nucleus of one atom of this isotope contain?

	number of protons	number of neutrons
A	6	6
B	6	8
C	8	6
D	8	8

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3 A teacher writes the nuclide equation for a fusion reaction.

$$^{2}_{1}H + ^{X}_{1}H \rightarrow ^{4}_{2}Q + ^{1}_{0}n$$

What is the missing number X and the missing element Q?

	X	Q
A	2	H
B	2	He
C	3	H
D	3	He

4 **(a)** Table 9.1 shows information about particles in an atom.

Complete the table.

Table 9.1

particle	charge on particle	location of particle
	positive	
neutron		in the nucleus
	negative	

[3]

(b) Fig. 9.1 represents three types of emission P, Q and R from a radioactive nucleus. The diagram shows whether each emission can penetrate paper and aluminium.

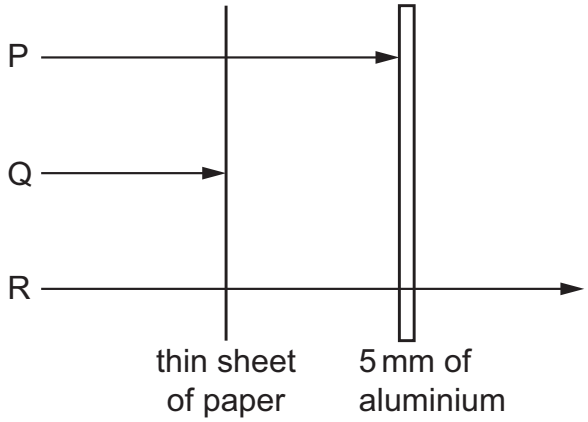


Fig. 9.1

Identify the types of emission labelled P, Q and R.

Type P is .....

Type Q is .....

Type R is .....

[3]

(c) State **two** precautions for storing radioactive materials safely.

1 .....

2 .....

[2]

[Total: 8]

5 **(a)** Radon-222 is a radioactive gas that emits alpha (α) particles.

The nuclide notation for radon-222 is $^{222}_{86}Rn$.

(i) State the number of protons in **one** nucleus of radon-222.

number of protons = ... [1]

(ii) Determine the number of neutrons in **one** nucleus of radon-222.

number of neutrons = ... [1]

(b) A sample containing 60 mg of radon-222 decays to 7.5 mg in 11.5 days.

Calculate the half-life of radon-222.

half-life = ... days [3]

(c) Radon gas is one source of background radiation.

Name **two** other sources that make a significant contribution to background radiation.

1 .....

2 .....

[2]

[Total: 7]

6 **(a)** Table 10.1 describes four nuclides.

Table 10.1

	americium-241	plutonium-239	plutonium-241	uranium-238
nuclide notation	$^{241}_{95}Am$	$^{239}_{94}Pu$	$^{241}_{94}Pu$	$^{238}_{92}U$

(i) Determine which **two** nuclides have the same number of nucleons.

..... [1]

(ii) Determine which nuclide has the largest number of neutrons.

..... [2]

(b) Plutonium-241 has a half-life of 14 years.

A sample of radioactive material contains 72 mg of plutonium-241.

Calculate the mass of plutonium-241 remaining in the sample after 42 years.

mass of plutonium-241 remaining = ... mg [3]

[Total: 6]

7 **(a)** An isotope of americium has 95 protons and 146 neutrons in its nucleus.

Write the nuclide notation for the nucleus of this isotope. The chemical symbol for americium is Am.

[2]

(b) Fig. 11.1 shows how the count rate of a sample of americium changes with time.

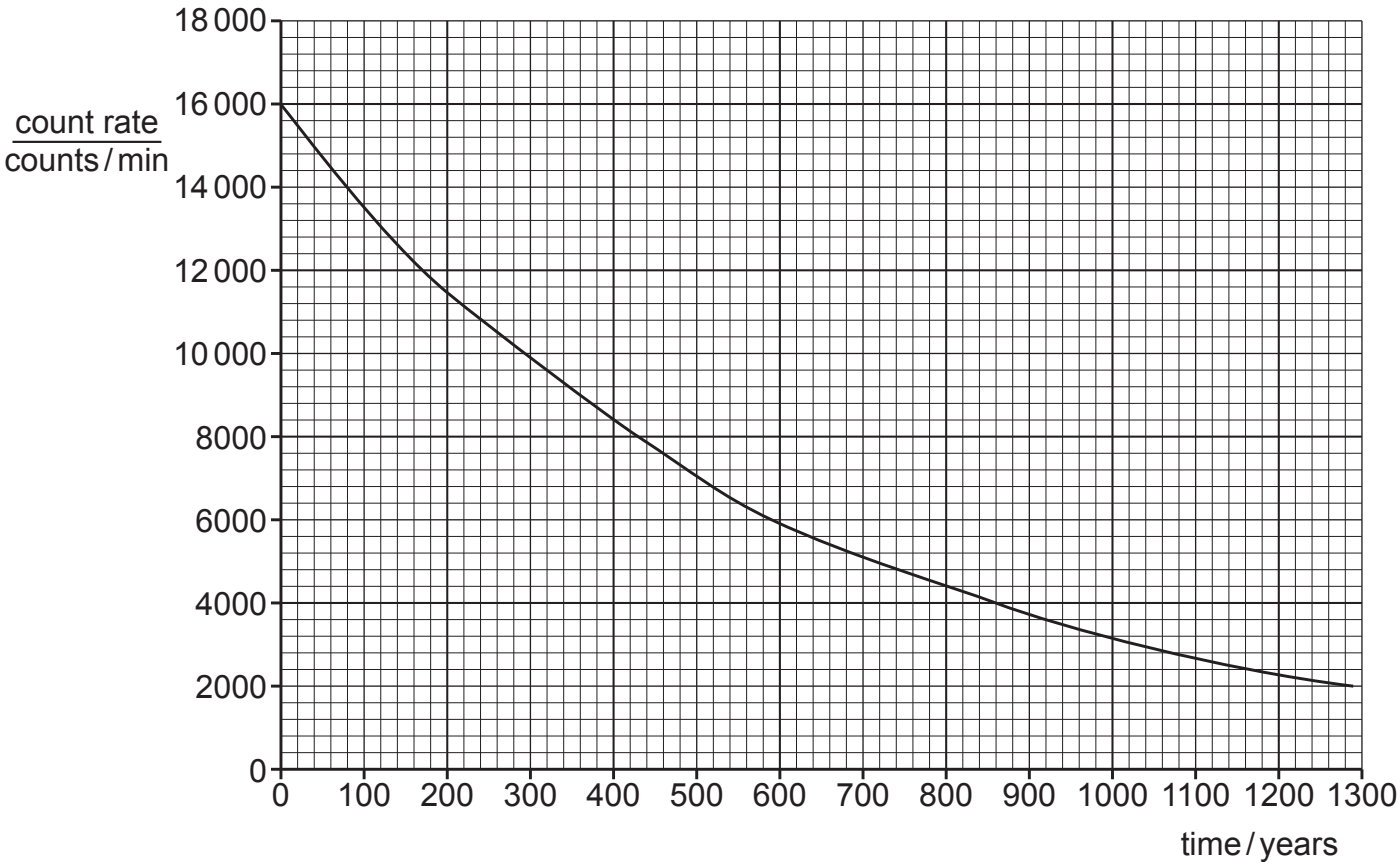


Fig. 11.1

Determine the half-life of the americium in the sample. Use information from Fig. 11.1.

half-life = ... years [2]

[Total: 4]

8 **(a)** Alpha (α) particles are directed at a very thin sheet of gold foil.

The following observations provide evidence for the nuclear model of the atom.

State what conclusions may be made about the model of the atom from these observations.

(i) Observation: most of the particles pass straight through the foil.

conclusion .....

.....

..... [1]

(ii) Observation: a few particles bounce back or are deflected through large angles.

conclusion .....

.....

..... [1]

(b) Fig. 8.1 shows three beams of ionising radiation, alpha, beta and gamma, passing between two parallel plates. The plates are charged and there is a uniform electric field between them.

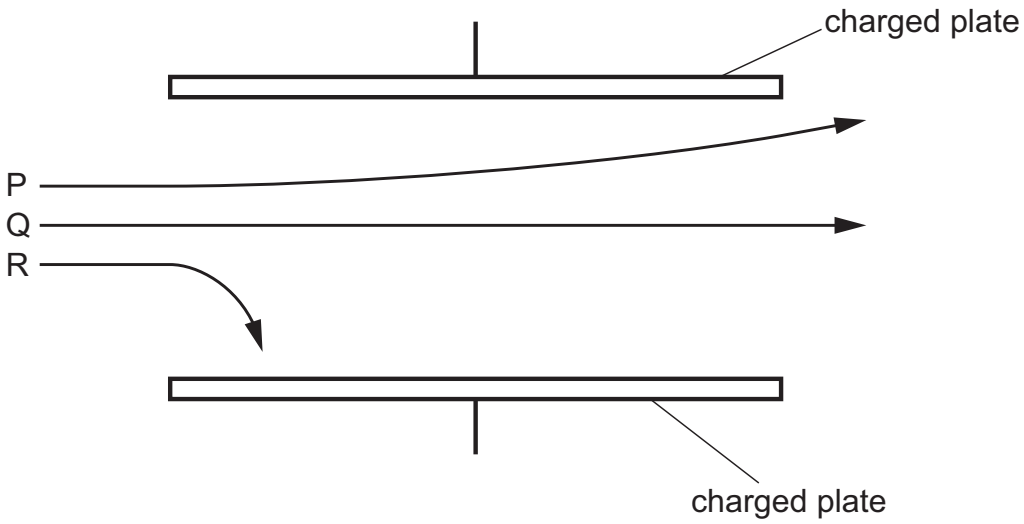


Fig. 8.1

(i) State and explain which path P, Q or R shows a beam of alpha particles.

path .....

explanation .....

.....

.....

[2]

(ii) State and explain the direction of the electric field between the plates.

direction .....

explanation .....

.....

.....

[1]

(c) Curium-242 is a radioactive isotope. It emits alpha particles. It has a half-life of 160 days.

After 480 days, the mass of curium-242 in a sample is 2.4×10^{-3} g.

Calculate the initial mass of curium-242 in the sample.

initial mass of curium-242 = ... [2]

[Total: 7]

9 **(a)** Fig. 9.1 shows a beam of radiation in a vacuum. The beam contains α-particles, β-particles and γ-radiation.

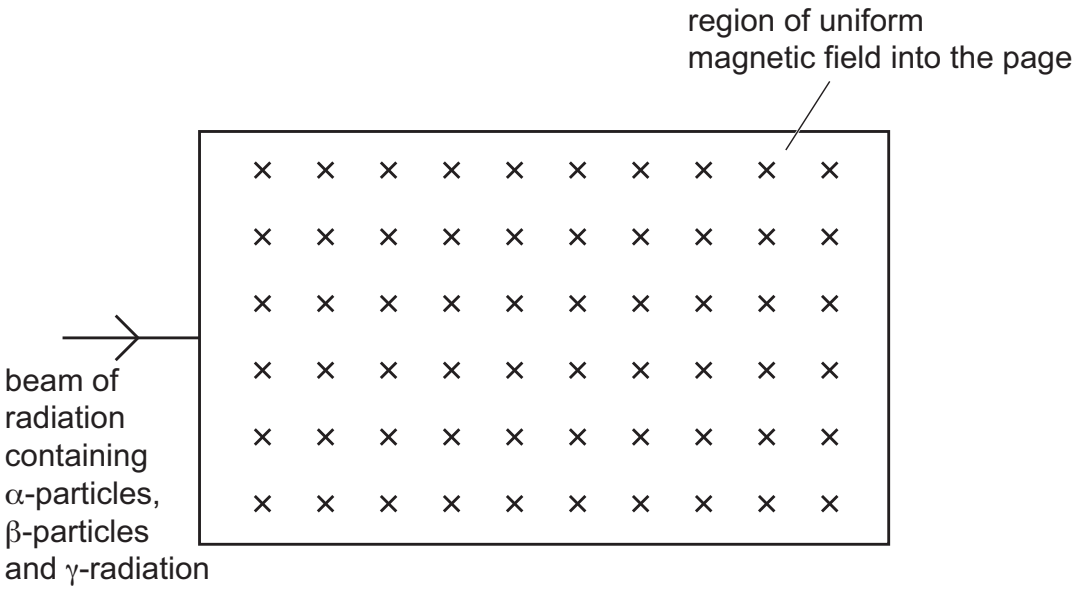


Fig. 9.1

The beam enters a region where there is a strong, uniform magnetic field. The direction of the magnetic field is into the page.

On Fig. 9.1 draw and label the paths within the magnetic field of:

(i) α-particles (label this path α) [1]

(ii) β-particles (label this path β) [2]

(iii) γ-radiation (label this path γ) [1]

(b) Table 9.1 shows five radioactive sources, the main type of radiation emitted by each source and the half-life of each source.

Table 9.1

radioactive source	type of radiation emitted	half-life
P	alpha	460 years
Q	alpha	10 days
R	beta	29 years
S	beta	14 days
T	gamma	30 years

(i) Define half-life of a radioactive isotope.

.....

..... [1]

(ii) Fig. 9.2 shows a simplified diagram of a machine that produces thin sheets of aluminium of constant thickness.

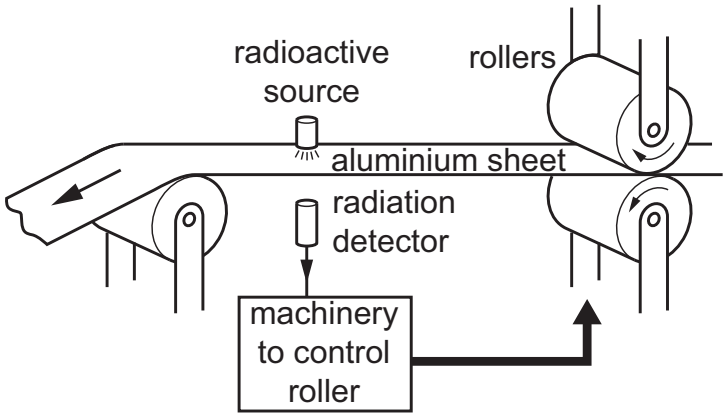


Fig. 9.2

The radiation detector is used to measure the thickness of the aluminium sheets and control the gap between the rollers.

State the most suitable radioactive source in Table 9.1 for the machine in Fig. 9.2.

Explain why this radioactive source is the most suitable and why the other sources are unsuitable.

most suitable source .....

explanation .....

.....

.....

.....

.....

.....

.....

[4]

[Total: 9]