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IGCSE PHYSICS 0625 · TOPICAL PAST PAPERS

Radioactivity

Paper 1 — Multiple-Choice Questions (topical compilation)

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RADIOACTIVITY

PAPER 1 QUESTIONS

Detection of radioactivity

Characteristics of the three types of emission

QUESTION # 1: M/J 16 P11

38 Which type of radiation consists of electrons?

- A** alpha-particles
- B** beta-particles
- C** gamma-rays
- D** X-rays

QUESTION # 2: M/J 16 P12

38 Which states the three types of radiation emitted by radioactive isotopes in order of their ionising effect from highest to lowest?

- A** alpha-particles, beta-particles, gamma-rays
- B** alpha-particles, gamma-rays, beta-particles
- C** beta-particles, gamma-rays, alpha-particles
- D** gamma-rays, beta-particles, alpha-particles

QUESTION # 3: M/J 18 P11

37 Which of alpha, beta and gamma radiations are waves?

- A** alpha only
- B** beta only
- C** gamma only
- D** alpha and beta

QUESTION # 4: M/J 19 P12

40 A proton has charge q and mass m .

What is the charge and what is the mass of an alpha-particle?

	charge	mass
A	q	$2m$
B	$2q$	$2m$
C	$2q$	$4m$
D	$4q$	$2m$

QUESTION # 5: O/N 16 P11

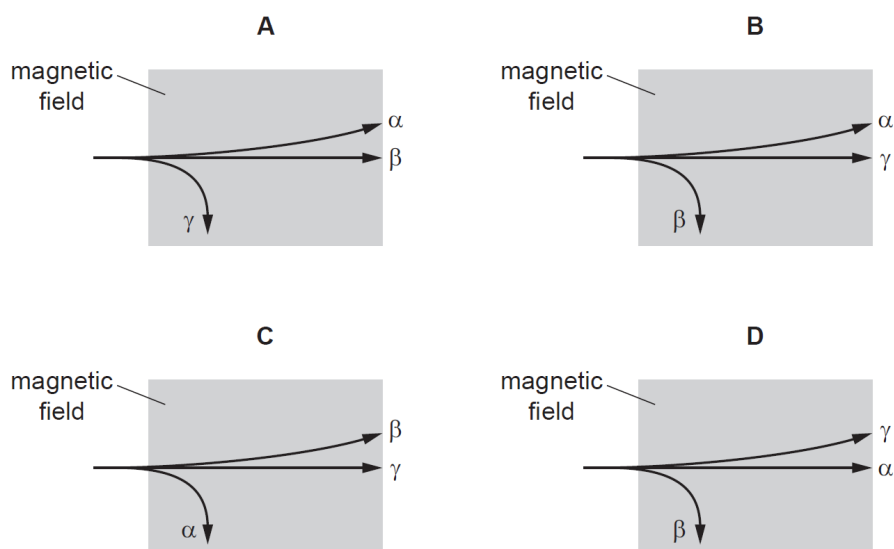
38 Which types of radiation may be emitted by radioactive nuclei?

- A** beta and gamma
- B** microwaves and infra-red
- C** radio waves and microwaves
- D** ultra-violet and X-rays

QUESTION # 6: O/N 17 P12

38 A beam, consisting of alpha-particles (α), beta-particles (β), and gamma rays (γ), passes into a magnetic field.

Which diagram shows their paths in the magnetic field?



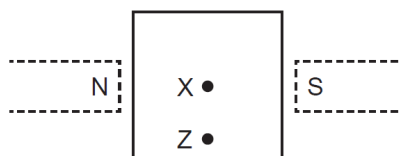
QUESTION # 7: O/N 18 P11

39 What does the alpha-radiation given off by radioactive nuclei consist of?

- A** fast-moving protons
- B** helium nuclei
- C** microwaves
- D** radio waves

QUESTION # 8: O/N 19 P11

40 A narrow beam of radiation from a radioactive source travels out of the page through the point X.



The poles of a magnet are placed on either side of the beam. Radiation is now detected both at X and at Z.

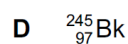
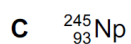
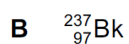
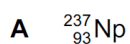
Which types of radiation are present in the beam?

- A** alpha and beta radiation
- B** alpha and gamma radiation
- C** alpha, beta and gamma radiation
- D** beta and gamma radiation

Nuclear reactions

QUESTION # 1: M/J 16 P12

37 Which nucleus is produced when americium-241 ($^{241}_{95}\text{Am}$) emits an alpha-particle?



QUESTION # 2: M/J 17 P11

40 Which row is correct for nuclear fission and for nuclear fusion?

	fission	fusion
A	produces larger nuclei	is the energy source of a star
B	produces larger nuclei	releases energy in a power station
C	produces smaller nuclei	is the energy source of a star
D	produces smaller nuclei	releases energy in a power station

QUESTION # 3: M/J 17 P12

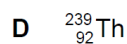
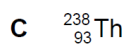
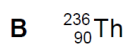
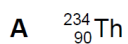
40 What happens to the proton number (atomic number) of a nucleus as it emits an alpha-particle?

- A It decreases by one.
- B It decreases by two.
- C It decreases by four.
- D It does not change.

QUESTION # 4: O/N 16 P12

40 A nucleus of uranium $^{238}_{92}\text{U}$ decays to thorium by emitting an alpha-particle.

What is the resulting thorium nucleus?



QUESTION # 5: O/N 17 P11

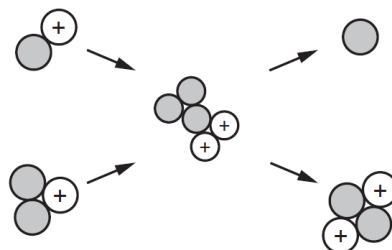
38 A nucleus of phosphorus $^{32}_{15}\text{P}$ emits a beta-particle to form a new nucleus.

What is the nucleon number and what is the proton number of the new nucleus?

	nucleon number (mass number)	proton number (atomic number)
A	28	13
B	31	14
C	31	15
D	32	16

QUESTION # 6: O/N 18 P11

37 The diagram shows a nuclear reaction.



The shaded particles are uncharged.

What are the products shown in this reaction?

- A** a helium atom and a neutron
- B** a helium atom and a proton
- C** a helium nucleus and a neutron
- D** a helium nucleus and a proton

QUESTION # 7: O/N 18 P12

38 Which statement about the reactor in a nuclear power station is correct?

- A** In the reactor, the main reaction occurs when protons hit uranium nuclei.
- B** The process taking place in the reactor is called nuclear fusion.
- C** The reactor produces energy to boil water and to produce steam.
- D** Carbon dioxide is the major waste product from the reactor.

QUESTION # 8: O/N 19 P12

- 40** An isotope of lead, $^{212}_{82}\text{Pb}$, is radioactive. After three decays, two beta-particles and an alpha-particle have been emitted. Another radioactive isotope of lead is formed.

What is the mass number (nucleon number) of the new isotope of lead?

- A** 200 **B** 208 **C** 212 **D** 216

Half-life

QUESTION # 1: M/J 16 P11

- 39** A sample of a radioactive isotope produces a count rate of 10 000 counts per minute. The half-life of the isotope is one day.

What was the count rate of the sample two days ago?

- A** 2500 counts per minute
- B** 5000 counts per minute
- C** 20 000 counts per minute
- D** 40 000 counts per minute

QUESTION # 2: M/J 16 P12

- 39** Which statement about the half-life of a radioactive isotope is correct?

- A** Half-life changes as the isotope decays.
- B** Half-life is the time it takes for the nucleon number of the isotope to halve.
- C** Half-life is half the time it takes for the number of nuclei of the isotope to decrease to zero.
- D** Half-life is the time it takes for the number of nuclei of the isotope to decrease by half.

QUESTION # 3: M/J 18 P11

- 38** A radioactive isotope of hydrogen has a half-life of 12 years.

A sample contains 40 million atoms of this isotope.

How many atoms of this isotope are left after 24 years?

- A** 20 million
- B** 10 million
- C** 5 million
- D** zero

QUESTION # 4: M/J 20 P11

- 39 $^{14}_6\text{C}$ is a natural radioactive isotope of carbon and is present in all living things. It has a half-life of 5700 years.

How old is a bone that is found to have only $\frac{1}{4}$ of the natural proportion of $^{14}_6\text{C}$?

- A 5700 years
- B 11 400 years
- C 17 100 years
- D 22 800 years

QUESTION # 5: O/N 16 P11

- 39 A freshly made sample of radioactive material gives a count rate of 8000 counts per minute. After 20 days, it gives a count rate of 500 counts per minute.

What is the half-life of the material?

- A 4.0 days
- B 5.0 days
- C 20 days
- D 80 days

QUESTION # 6: O/N 17 P12

- 37 A sample contains atoms of an isotope that has a half-life of 7.2 years.

Which quantity halves every 7.2 years?

- A the mass of the sample
- B the nucleon (mass) number
- C the number of atoms of the isotope
- D the proton (atomic) number

QUESTION # 7: O/N 20 P11

- 40 An isotope P is radioactive and has a half-life of 7.0 years. A sample initially contains 0.016 kg of P.

After how long will the sample contain 0.0020 kg of P?

- A 7.0 years
- B 14 years
- C 21 years
- D 28 years

QUESTION # 8: O/N 20 P11

39 What is the definition of the half-life of a radioactive element?

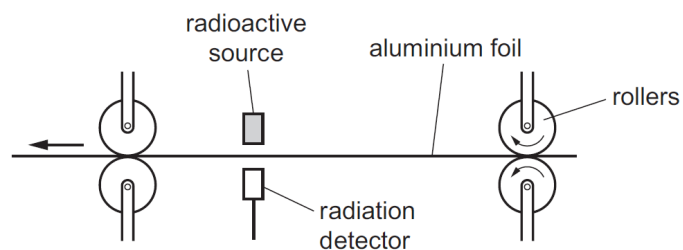
- A** half of the time it takes for one atom to decay
- B** half of the time taken for all the atoms in a sample to decay
- C** the time taken for half of the atoms in a sample to decay
- D** the time taken for the nucleon number (mass number) to halve

Uses of radioactive isotopes including safety precautions

QUESTION # 1: M/J 18 P11

36 Thin aluminium foil is used in cooking.

The diagram shows a system used to control the thickness of aluminium foil being made in a factory.



What is the most suitable radioactive source for the system?

	source	half-life of source
A	beta	1 hour
B	beta	6 years
C	gamma	1 hour
D	gamma	6 years

QUESTION # 2: M/J 20 P11

38 Radioactivity is used in several activities that take place in hospitals.

Which activity **never** uses radioactivity?

- A** cooking meals
- B** diagnosing illnesses
- C** sterilising equipment
- D** treating illnesses

QUESTION # 3: O/N 19 P12

39 Radioactive substances are used as tracers in medical examinations.

A liquid tracer is injected into a patient. A detector 20 cm above the patient shows where the radioactive substance is in the body.

What is the best radioactive substance to use?

- A** an alpha-particle emitter with a half-life of a few hours
- B** an alpha-particle emitter with a half-life of a few years
- C** a gamma ray emitter with a half-life of a few hours
- D** a gamma ray emitter with a half-life of a few years