

Nuclear Physics*(Past Year Topical Questions 2010-2015)*May/June 2010 (11)**38** Which row describes the properties of α -particles?

	ionizing effect	radiation stopped by aluminium?
A	large	no
B	large	yes
C	small	no
D	small	yes

39 A radioactive substance has a half-life of 2 weeks. At the beginning of an investigation the substance emits 3000 β -particles per minute.How many β -particles will it emit per minute after 6 weeks?

- A**
- 0
- B**
- 375
- C**
- 500
- D**
- 1500

40 The nuclide notation for radium-226 is ${}_{88}^{226}\text{Ra}$.

How many electrons orbit the nucleus of a neutral atom of radium-226?

- A**
- 0
- B**
- 88
- C**
- 138
- D**
- 226

May/June 2010 (12)

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39 What are cathode rays?

- A a beam of electrons
B a beam of neutrons
C a beam of protons
D electromagnetic waves

40 A cathode-ray tube has an anode and an earthed cathode.

Which row shows the charge on the **anode** and the temperature of the **cathode**?

	anode charge	cathode temperature
A	negative	cool
B	negative	hot
C	positive	cool
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May/June 2010 (13)

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October/November 2010 (11)

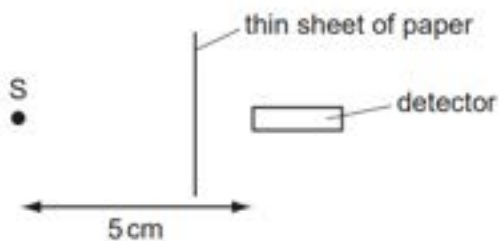
38 A radioactive element has a half-life of 70 s.

The number of emissions per second, N , of a sample of the element is measured at a certain time.

What was the number of emissions per second 70 s earlier?

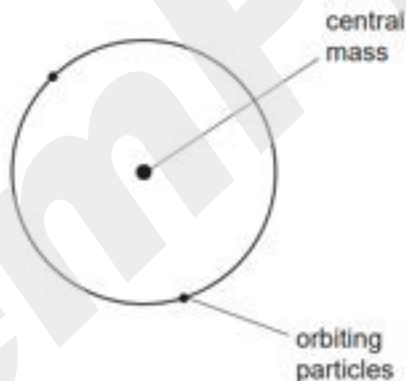
- A** 0
- B** $N/2$
- C** N
- D** $2N$

- 39 S is a radioactive source emitting α -particles, β -particles and γ -rays. A detector is placed 5 cm away from S. A thin sheet of paper is placed as shown in the diagram.



Which radiations can be detected?

- A α -particles and β -particles only
 - B α -particles and γ -rays only
 - C β -particles and γ -rays only
 - D α -particles, β -particles and γ -rays
- 40 In the atomic model, an atom consists of a central mass, orbited by much smaller particles.

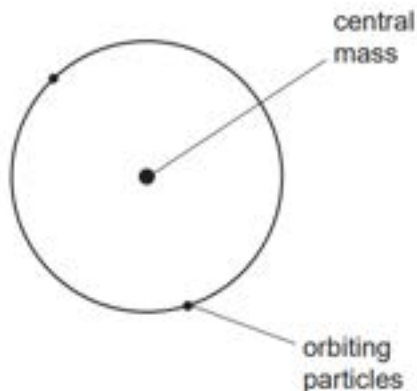


What is the name of the central mass and of the orbiting particles?

	central mass	orbiting particles
A	neutron	α -particles
B	neutron	electrons
C	nucleus	α -particles
D	nucleus	electrons

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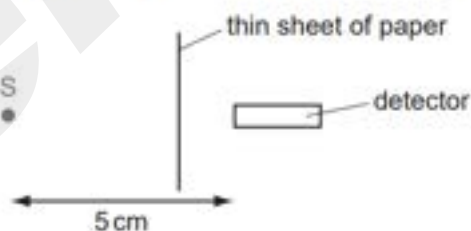
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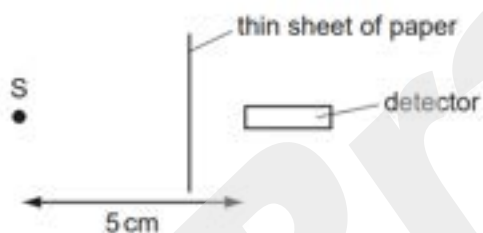
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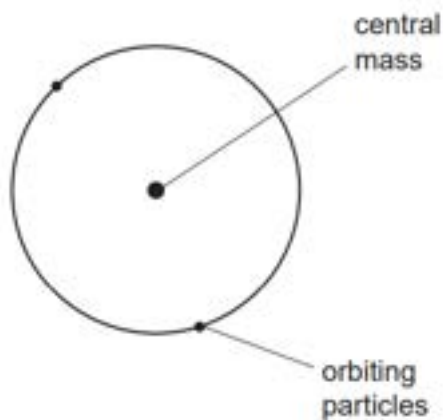
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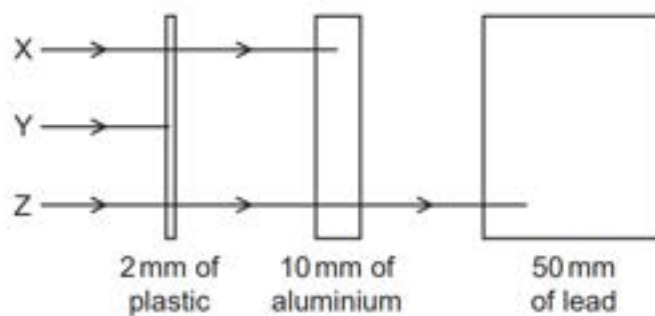
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What happens to the proton number (atomic number) of the nucleus?

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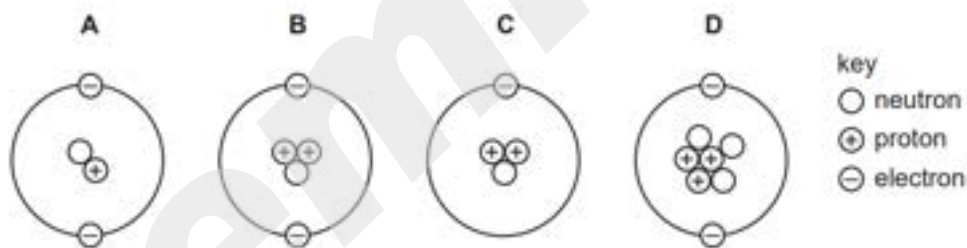
39 The diagram shows the paths of three different types of radiation, X, Y and Z.



Which row in the table correctly identifies X, Y and Z?

	X	Y	Z
A	α -particles	β -particles	γ -rays
B	β -particles	α -particles	γ -rays
C	β -particles	γ -rays	α -particles
D	γ -rays	α -particles	β -particles

40 Which diagram could represent the structure of a neutral atom?



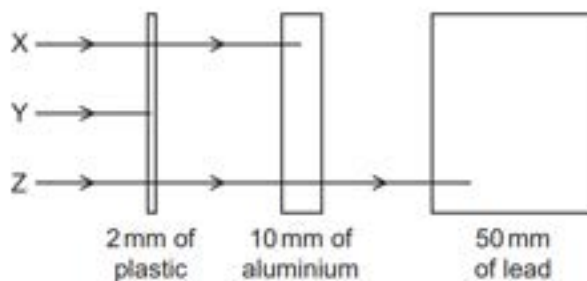
May/June 2011 (12)

38 When measuring the emissions from a radioactive rock brought into the laboratory, a teacher mentions that background radiation must be taken into account.

What is this background radiation?

- A** infra-red radiation from warm objects in the laboratory
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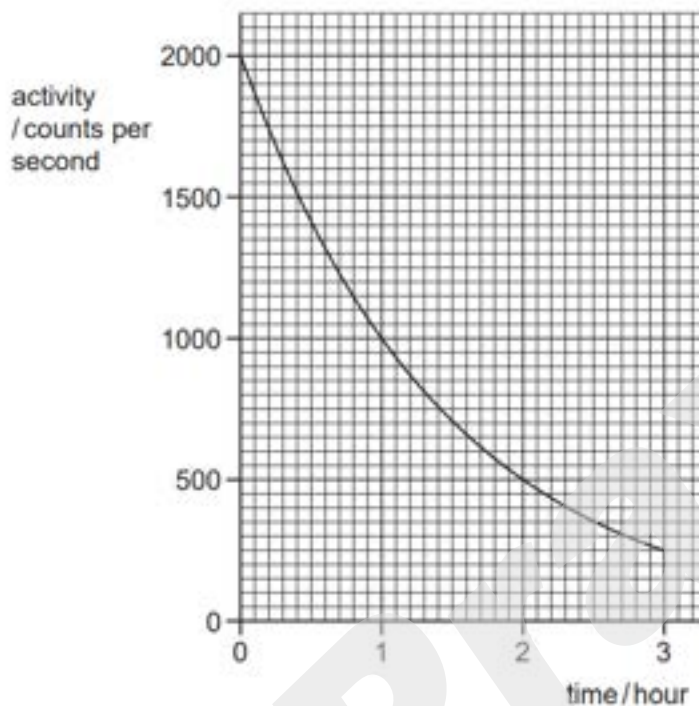
October/November 2011 (11)

38 A scientist needs to use a source of γ -rays as safely as possible.

Which action will **not** reduce the amount of radiation that reaches the scientist?

- A** keeping the distance between the source and the scientist as large as possible
- B** keeping the temperature of the source as low as possible
- C** keeping the time for which the scientist uses the source as small as possible
- D** placing a lead screen between the scientist and the source

39 The graph shows the activity of a radioactive source over a period of time.



What is the half-life of the source?

- A $\frac{1}{2}$ hour B 1 hour C $1\frac{1}{2}$ hours D 3 hours

40 A nuclide of substance X has the symbol ${}_{12}^{26}\text{X}$.

How many electrons are there in a neutral atom of substance X?

- A 12 B 14 C 26 D 38

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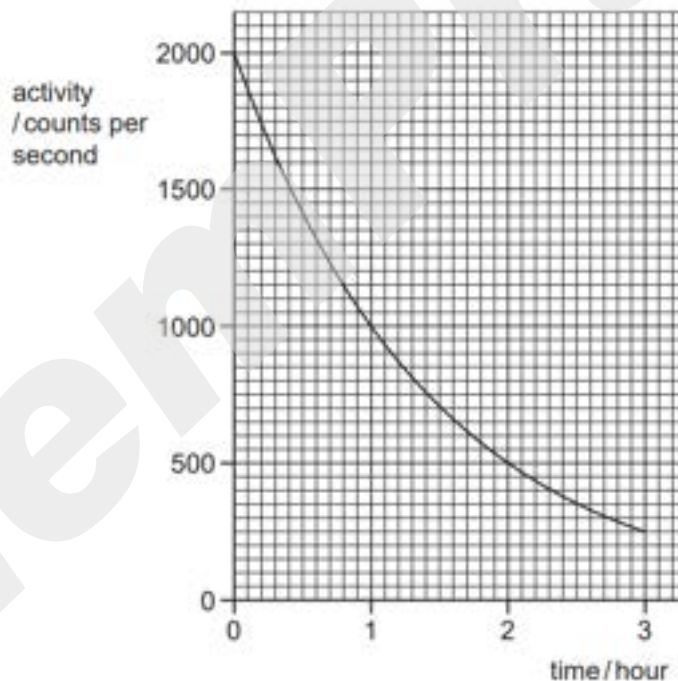
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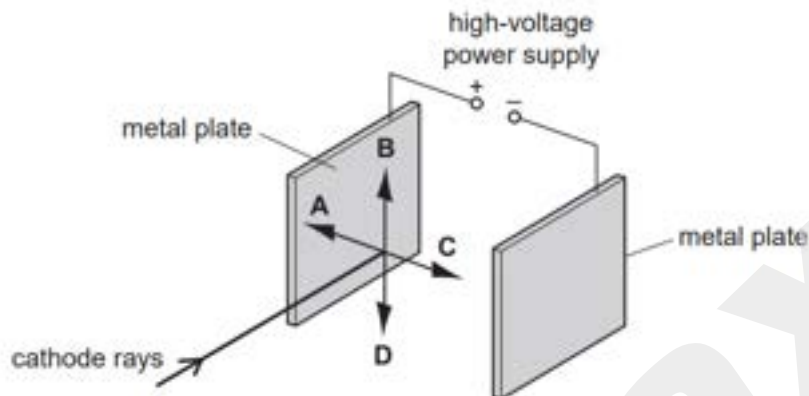


What is the half-life of the source?

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- 40** Two parallel metal plates in a vacuum are connected to the terminals of a high-voltage power supply. A beam of cathode rays is passed into the space between the two plates, as shown.

In which direction does the beam of cathode rays deflect?



May/June 2012 (11)

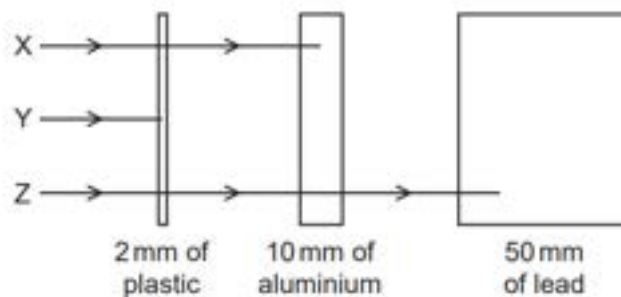
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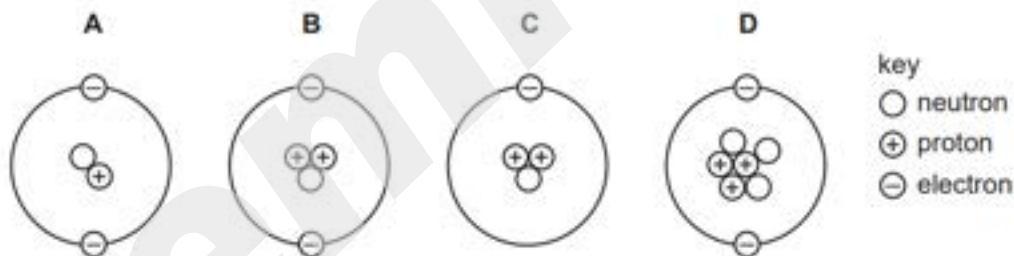
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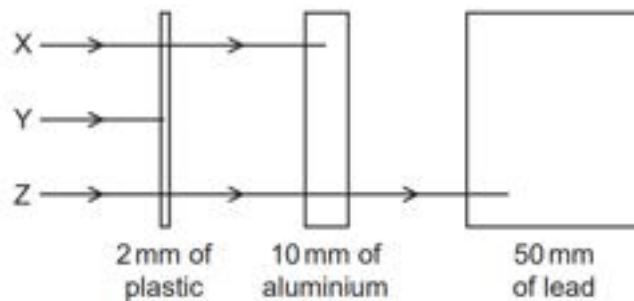
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38 How does the ionising effect of α -particles compare with that of β -particles and γ -rays?

	compared with β -particles	compared with γ -rays
A	α -particles are less strongly ionising	α -particles are less strongly ionising
B	α -particles are less strongly ionising	α -particles are more strongly ionising
C	α -particles are more strongly ionising	α -particles are less strongly ionising
D	α -particles are more strongly ionising	α -particles are more strongly ionising

39 The table shows the count rates obtained from four radioactive sources. The measurements were taken at noon on four consecutive days.

Which source has the longest half-life?

	count rate / counts per second			
	day 1	day 2	day 3	day 4
A	100	48	27	11
B	200	142	99	69
C	300	297	292	290
D	400	202	99	48

40 Which statement about a carbon nucleus represented by ${}^{14}_6\text{C}$ is correct?

- A** It contains 6 neutrons.
- B** It contains 6 electrons.
- C** It contains 8 protons.
- D** It contains 14 nucleons.

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- 38 How do the ionising effect and the penetrating ability of α -particles compare with those of β -particles and γ -rays?

	ionising effect	penetrating ability
A	higher	higher
B	higher	lower
C	lower	higher
D	lower	lower

- 39 A student is investigating how the radiation from a radioactive source changes with time.

The table shows the results from the detector.

time / min	count-rate / counts per min
0	340
2	180
4	100
6	60
8	40

The experiment is repeated by other students, who also measure the count-rate every two minutes.

The half-life of the source is known to be exactly two minutes.

Why is the measured count-rate **always** higher than half the previous value?

- A** Radioactive emissions occur randomly with time.
- B** The detector used is very close to the source.
- C** There is background radiation present.
- D** The radioactive source is decaying.

40 Which of the following is **not** a charged particle?

- A α -particle
- B β -particle
- C neutron
- D proton

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