

PRACTICE TEST

PHYSICS[®]
ONLINE

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Atomic Physics & Radioactivity TEST

Please do this in 45 minutes only

* Required

Email *

What is your first and last name?

Q1

How many neutrons are in a nucleus of the nuclide ${}_{17}^{37}\text{Cl}$?

- A 17 B 20 C 37 D 54

Q1

10 points

Mark only one oval.

- A
- B
- C
- D

Q2

A certain element has several isotopes.

Which statement about these isotopes is correct?

- A They must have different numbers of electrons orbiting their nuclei.
- B They must have the same number of neutrons in their nuclei.
- C They must have the same number of nucleons in their nuclei.
- D They must have the same number of protons in their nuclei.

Q2

10 points

Mark only one oval.

- A
- B
- C
- D

Q3

A neutral atom consists of electrons orbiting a nucleus. The nucleus contains protons and neutrons.

Which statement about the atom **must** be correct?

- A The number of electrons is equal to the number of neutrons.
- B The number of electrons is equal to the number of protons.
- C The number of neutrons is equal to the number of protons.
- D The number of electrons, neutrons and protons are all different.

Q3

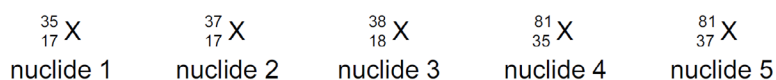
10 points

Mark only one oval.

- A
- B
- C
- D

Q4

Below are the symbols for five different nuclides.



Which two nuclides are isotopes of the same element?

- A nuclide 1 and nuclide 2
- B nuclide 2 and nuclide 3
- C nuclide 2 and nuclide 5
- D nuclide 4 and nuclide 5

Q4

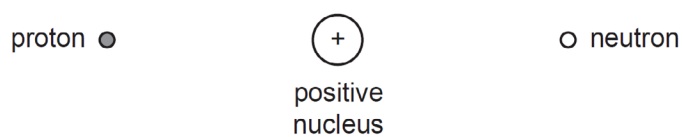
10 points

Mark only one oval.

- A
- B
- C
- D

Q5

A proton and a neutron are each close to a positive nucleus.



How does the charge on the nucleus affect the proton and the neutron, if at all?

- A The neutron is attracted; the proton is repelled.
- B The neutron is not affected; the proton is repelled.
- C The proton is attracted; the neutron is repelled.
- D The proton is not affected; the neutron is repelled.

Q5

10 points

Mark only one oval.

A

B

C

D

Q6

Below are four statements about isotopes of a certain element.

Which statement about the isotopes **must** be correct?

- A They are radioactive.
- B They are unstable.
- C They have the same number of neutrons.
- D They have the same number of protons.

Q6

10 points

Mark only one oval.

A

B

C

D

Q7

A nucleus of element X is represented as ${}_{26}^{56}\text{X}$.

Which is an isotope of element X?

A ${}_{56}^{26}\text{X}$

B ${}_{26}^{54}\text{X}$

C ${}_{24}^{56}\text{X}$

D ${}_{28}^{54}\text{X}$

Q7

10 points

Mark only one oval.

A

B

C

D

Q8

The charge on a proton is e .

What is the charge on an electron and what is the charge on a neutron?

	electron	neutron
A	e	e
B	e	0
C	$-e$	$-e$
D	$-e$	0

Q8

10 points

Mark only one oval.

A

B

C

D

Q9

$^{14}_6\text{C}$ is a nuclide of carbon.

What is the composition of one nucleus of this nuclide?

	neutrons	protons
A	6	8
B	6	14
C	8	6
D	14	6

Q9

10 points

Mark only one oval.

A

B

C

D

Q10

Which statement is correct for the nucleus of **any** atom?

- A** The nucleus contains electrons, neutrons and protons.
- B** The nucleus contains the same number of protons as neutrons.
- C** The nucleus has a total charge of zero.
- D** The nucleus is very small compared with the size of the atom.

Q10

10 points

Mark only one oval.

A

B

C

D

Q11

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

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

A 0

B 88

C 138

D 226

Q11

10 points

Mark only one oval.

A

B

C

D

Q12

A radioactive nucleus contains 128 nucleons. It emits a β -particle.

How many nucleons are now in the nucleus?

A 124

B 127

C 128

D 129

Q12

10 points

Mark only one oval.

A

B

C

D

Q13

A lithium nucleus contains 3 protons and 4 neutrons.

What is its nuclide notation?

A ${}^3_4\text{Li}$

B ${}^4_3\text{Li}$

C ${}^7_3\text{Li}$

D ${}^7_4\text{Li}$

Q13

10 points

Mark only one oval.

A

B

C

D

Q14

A particular nuclide of chlorine can be represented by the symbol shown.



How many electrons are there in a neutral atom of this nuclide?

A 17

B 20

C 37

D 54

Q14

10 points

Mark only one oval.

- A
- B
- C
- D

Q15

Which statement about the nuclei of all atoms is correct?

- A** They are very small compared with the size of the atoms.
- B** They always contain the same number of protons as neutrons.
- C** They contain electrons, neutrons and protons.
- D** They have a total charge of zero.

Q15

10 points

Mark only one oval.

- A
- B
- C
- D

Q16

A radioactive nucleus emits either an α -particle or a β -particle.

What are the products of these two types of radioactive emission?

	product after α -emission	product after β -emission
A	a nucleus of a different element	a nucleus of a different element
B	a nucleus of a different element	a nucleus of the same element
C	a nucleus of the same element	a nucleus of a different element
D	a nucleus of the same element	a nucleus of the same element

Q16

10 points

Mark only one oval.

A

B

C

D

Q17

A reading is taken every 10 minutes of the number of emissions per second from a radioactive source. The table shows the readings.

time/min	number of emissions per second
0	800
10	560
20	400
30	280
40	200
50	140
60	100

What is the half-life of the source?

A 10 min

B 20 min

C 40 min

D 60 min

Q17

10 points

Mark only one oval.

A

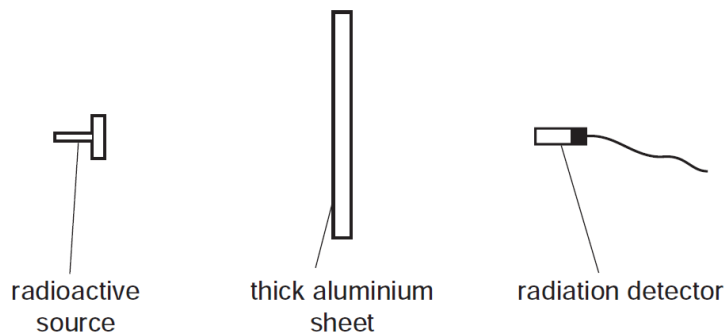
B

C

D

Q18

The diagram shows a radioactive source, a thick aluminium sheet and a radiation detector.



The radiation detector shows a reading greater than the background reading.

Which type of radiation is being emitted by the source and detected by the detector?

- A α -radiation
- B β -radiation
- C γ -radiation
- D infra-red radiation

Q18

10 points

Mark only one oval.

- A
- B
- C
- D

Q19

Radioactive materials should be handled carefully.

Which safety precaution does **not** reduce the risk to people using a radioactive material?

- A keeping the material a long distance from people
- B keeping the material at a low temperature
- C using lead screening between the material and people
- D using the material for only a short time

Q19

10 points

Mark only one oval.

- A
- B
- C
- D

Q20

A sample of a radioactive isotope has an initial rate of emission of 128 counts per minute and a half-life of 4 days.

How long will it take for the rate of emission to fall to 32 counts per minute?

- A** 2 days **B** 4 days **C** 8 days **D** 12 days

Q20

10 points

Mark only one oval.

- A
- B
- C
- D

Q21

Which row describes the nature of α -particles and of γ -rays?

	α -particles	γ -rays
A	helium nuclei	electromagnetic radiation
B	helium nuclei	electrons
C	protons	electromagnetic radiation
D	protons	electrons

Q21

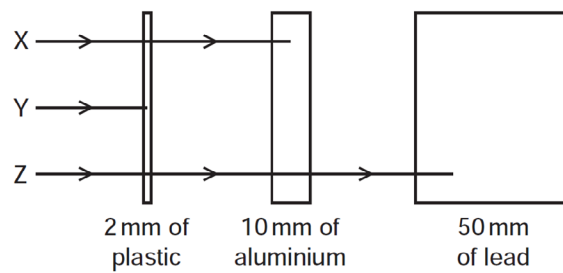
10 points

Mark only one oval.

- A
- B
- C
- D

Q22

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

Q22

10 points

Mark only one oval.

- A
- B
- C
- D

Q23

A powder contains 400 mg of a radioactive isotope that emits α -particles.

The half-life of the isotope is 5 days.

What mass of this isotope remains after 10 days?

- A** 0 mg **B** 40 mg **C** 100 mg **D** 200 mg

Q23

10 points

Mark only one oval.

- A
 B
 C
 D

Q24

Which row gives the properties of the radiation from radioactive materials?

	most penetrating radiation	most highly ionising radiation
A	α	β
B	β	γ
C	γ	α
D	γ	γ

Q24

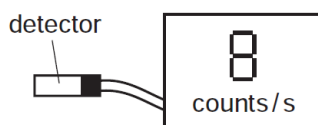
10 points

Mark only one oval.

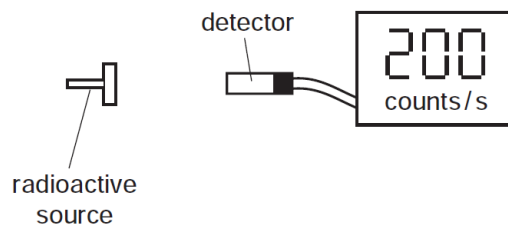
- A
 B
 C
 D

Q25

In a laboratory, a detector of ionising radiation records an average background count rate of 8 counts per second.



A radioactive source is now placed close to the detector. The count rate on the detector rises to 200 counts per second.



What is the count rate due to radiation from the radioactive source?

- A 25 counts/s
- B 192 counts/s
- C 200 counts/s
- D 208 counts/s

Q25

10 points

Mark only one oval.

- A
- B
- C
- D

Q26

Which statement about α -radiation is correct?

- A It is a stream of fast-moving electrons.
- B It is a form of electromagnetic radiation.
- C It is more highly ionising than γ -radiation.
- D It is more penetrating than β -radiation.

Q26

10 points

Mark only one oval.

- A
- B
- C
- D

Q27

A radioactive source produces a count rate on a detector of 1600 counts/s.

After 32 hours the count rate has fallen to 100 counts/s.

Both count rates have been corrected for background radiation.

What is the half-life of the source?

- A** 2.0 hours **B** 6.4 hours **C** 8.0 hours **D** 16 hours

Q27

10 points

Mark only one oval.

- A
- B
- C
- D

Q28

α , β and γ -radiations are emitted by radioactive substances.

Which statement is correct?

- A** α -radiation consists of charged particles and is the most highly ionising radiation.
- B** β -radiation consists of charged particles and is the most penetrating radiation.
- C** β -radiation consists of uncharged particles and is the least highly ionising radiation.
- D** γ -radiation consists of uncharged particles and is the least penetrating radiation.

Q28

10 points

Mark only one oval.

A

B

C

D

Q29

A radioactive substance has a half-life of 2 weeks. At the beginning of an investigation, a sample of 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

Q29

10 points

Mark only one oval.

A

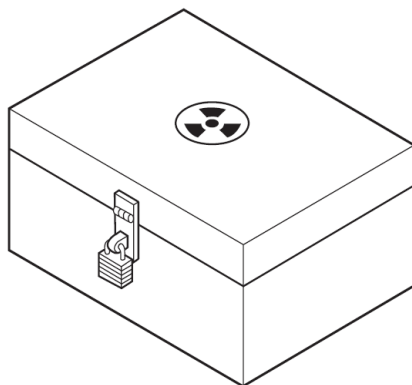
B

C

D

Q30

The diagram shows a box used for storing radioactive sources.



Which material is best for lining the box to prevent the escape of most radioactive emissions?

- A aluminium
- B copper
- C lead
- D steel

Q30

10 points

Mark only one oval.

- A
- B
- C
- D

Q31

The half-life of a radioactive substance is 10 minutes. A sample of the radioactive substance contains 2000 nuclei.

How many radioactive nuclei were in the sample half an hour earlier?

- A 250
- B 4000
- C 6000
- D 16000

Q31

10 points

Mark only one oval.

- A
- B
- C
- D

Q32

A radioactive substance emits a particle from the nucleus of one of its atoms. The particle consists of two protons and two neutrons.

What is the name of this process?

- A α -emission
- B β -emission
- C γ -emission
- D nuclear fission

Q32

10 points

Mark only one oval.

- A
- B
- C
- D

Q33

Why are some radioactive sources stored in boxes made from lead?

- A Lead absorbs emissions from the radioactive sources.
- B Lead decreases the half-life of radioactive sources.
- C Lead increases the half-life of radioactive sources.
- D Lead repels emissions from the radioactive sources.

Q33

10 points

Mark only one oval.

A

B

C

D

Q34

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
- B** infra-red radiation from the Sun
- C** ionising radiation from the radioactive rock brought into the laboratory
- D** ionising radiation in the laboratory when the radioactive rock is not present

Q34

10 points

Mark only one oval.

A

B

C

D

Q35

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

Q35

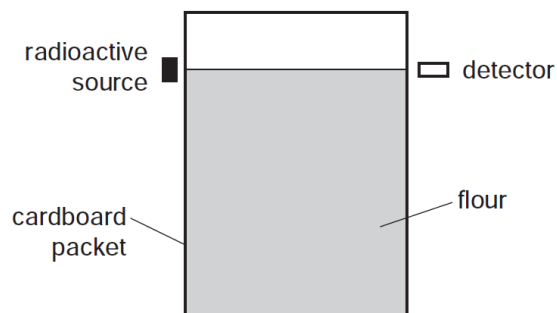
10 points

Mark only one oval.

- A
- B
- C
- D

Q36

The arrangement shown is used to check whether the flour inside a cardboard packet is above a certain level. If it is above this level, the flour absorbs the radiation from the source so that it doesn't reach the detector.



Which type of radiation is suitable to use?

- A α -particles only
- B β -particles only
- C either α -particles or β -particles
- D γ -rays only

Q36

10 points

Mark only one oval.

A

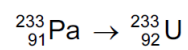
B

C

D

Q37

A radioactive decay can be represented as shown.



The equation is incomplete.

In this decay, the nucleus changes by

- A absorbing a neutron.
- B absorbing a proton.
- C emitting an α -particle.
- D emitting a β -particle.

Q37

10 points

Mark only one oval.

A

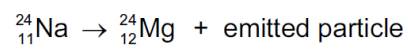
B

C

D

Q38

Sodium-24 decays to magnesium-24 according to the following equation.



What is the emitted particle?

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

Q38

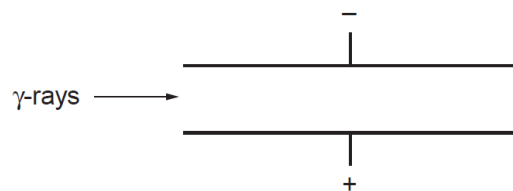
10 points

Mark only one oval.

- A
- B
- C
- D

Q39

A beam of γ -rays passes between two charged metal plates as shown in the diagram.



How do the γ -rays pass between the two charged plates?

- A The rays are deflected in a direction perpendicular to the page
- B The rays are deflected towards the negative plate.
- C The rays are deflected towards the positive plate.
- D The rays will continue in the same direction.

Q39

10 points

Mark only one oval.

A

B

C

D

Q40

The count rate from a radioactive isotope is recorded every hour. The count rate is corrected for background radiation.

The table shows the readings.

time/hours	0	1	2	3	4	5
$\frac{\text{corrected count rate}}{\text{counts/s}}$	800	620	480	370	290	220

What estimate of the half-life of the isotope can be obtained from the readings in the table?

A between 1 and 2 hours

B between 2 and 3 hours

C between 3 and 4 hours

D between 4 and 5 hours

Q40

10 points

Mark only one oval.

A

B

C

D