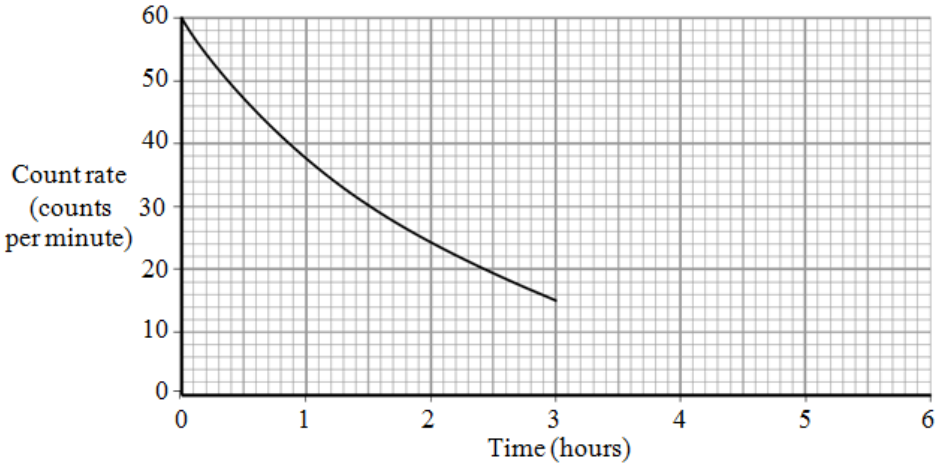
Half Life MCQS

Q:1 The graph shows how the count rate of a radioactive sample changes over a period of 3 hours.



A The half-life of this isotope is . . .

1)1/2 hour

2)1 hour

3)1 1/2 hours

4)3 hours

B If the count rate of the sample was *x* counts per minute at the start of the experiment, what value would it have fallen to after 6 hours?

1)x 4

2)x 6

3)x 8

4)x

C The radioactive sample used in the experiment . . .

1)must be an alpha particle emitter.

2)will become totally inactive after about 12 hours.

3)would emit radiation at a higher rate if heated.

4)would produce the same shape of graph if it had been reacted with acid before the start.

D A radioactive isotope should not have a long half-life if it is used . . .

1)as a source of energy in a submarine.

2)as a tracer injected into someone's small intestine.

3)in a smoke detector.

4)to monitor the thickness of a roll of paper as it is being manufactured.

Q:2 Carbon-14 is a radioactive isotope of carbon. It is a beta (β) particle emitter with a half-life of approximately 5750 years. Carbon-14 makes up a tiny proportion of all naturally occurring carbon on our planet.

When living things die the carbon-14 they contain continues to decay and is not replaced. So the approximate age of the object which was once part of a living plant or animal, can be calculated by measuring the proportion of carbon-14 which it now contains.

A An organism has been dead for 17 000 years.

Approximately how many half-lives of carbon-14 have passed during this time?

1)2

2)3

3)4

4)5

B A small sample of material taken from a plant contains 32 billion atoms of carbon-14.

Approximately how many of these atoms will it contain in 13 000 years time?

1)4 billion

2)7 billion

3)15 billion

4)30 billion

C It is difficult to date samples more than 50 000 years old using carbon-14.

This is because . . .

1)all the carbon-14 will have decayed away.

2)carbon-14 did not exist more than 50 000 years ago.

3)so little carbon-14 remains that it is very difficult to detect and measure.

4)from the start there was no carbon-14 in samples of this age.

D Carbon-14 dating cannot be used for . . .

1)a cotton cloak.

2)a gold plate.

3)a paper scroll.

4)a wooden mast.

Q:3 An isotope, X, is radioactive and decays into isotope Y, which is not radioactive.

Rocks such as granite contain both of these isotopes.

The half-life of isotope X is 4 million years.

A A sample of granite is found to contain one atom of Y for each atom of X.

The age of the rock is about . . .

1)1 million years.

2)2 million years.

3)4 million years.

4)6 million years.

B Another sample of rock is known to be 8 million years old.

The ratio of the number of atoms of X to the number of atoms of Y would be . . .

1)1 : 2

2)1 : 3

3)1 : 4

4)2 : 1

C A sample of rock contains atoms of isotope X, but no atoms of isotope Y. This is because . . .

1)all the atoms of Y have decayed.

2)the atoms of X in this sample are not radioactive.

3)the half-life of atoms of X in this sample is greater than 4 million years.

4)the rock has only recently been formed.

D Isotope X decays by emitting alpha particles. An alpha particle consists of . . .

1)2 electrons only.

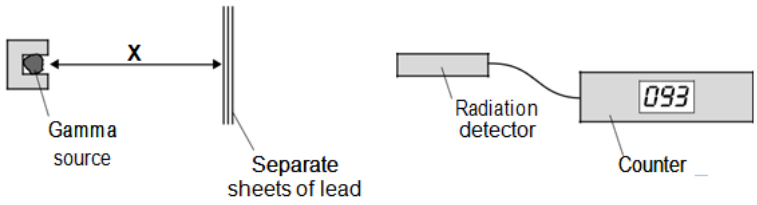
2)2 protons and 2 neutrons.

3)2 neutrons only.

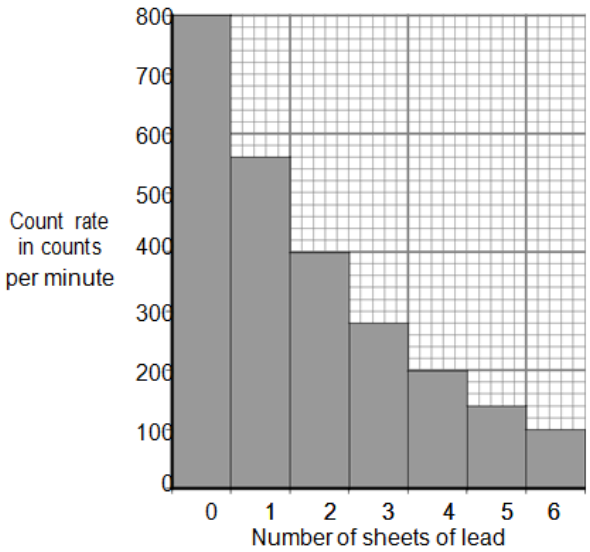
4)2 protons and 2 electrons.

Q:4 A teacher demonstrated to her class the effectiveness of lead for absorbing gamma radiation.

The diagram shows the apparatus she used.



The detector measured the count rate each time a sheet of lead was added. The distance X was kept constant. The class drew a bar chart of her results.



A Although a bar chart was drawn, the class could have drawn either a bar chart or a line graph because.

1)the independent variable is continuous and the dependent variable is discrete.

2)the independent variable is discrete and the dependent variable is continuous.

3)both the independent and dependent variables are categoric.

4)both the independent and dependent variables are continuous.

B The bar chart shows that the count rate is halved . . .

1) when the thickness is halved.

2) when the thickness is doubled.

3) each time a sheet of lead is added.

4) each time two sheets of lead are added.

C The teacher measured the thickness of the lead sheets with a micrometer, which measures to 0.01 mm.

She used a micrometer rather than a ruler with a millimetre scale because the micrometer . . .

1) is more reliable than the ruler.

2) is more precise than the ruler.

3) is less likely to produce random errors.

4) is less likely to produce systematic errors.

D The average thickness of the lead sheets was 2.50 mm.

What thickness of lead, in mm, is needed to reduce the count rate from 800 counts per minute to 200 counts per minute?

1) 4.00

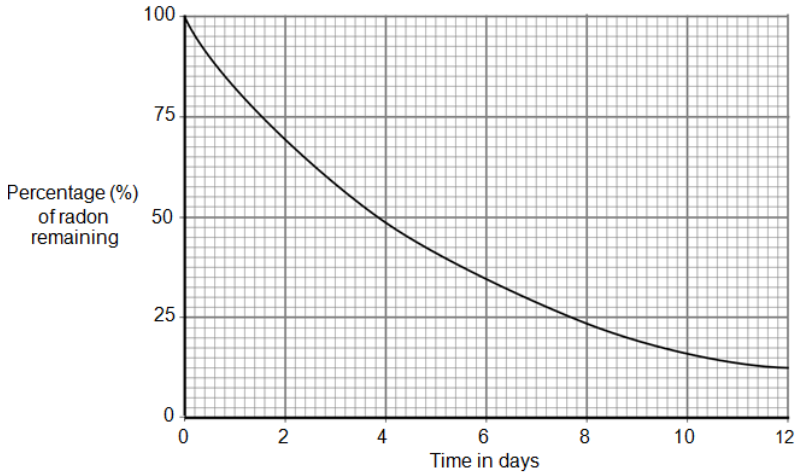
2) 5.00

3) 10.00

4) 12.50

Q:5 Radon is a radioactive gas.

The graph shows how one isotope of radon decays with time.



A What is the half-life of this isotope of radon?

1)3.8 days

2)6.0 days

3)11.4 days

4)50.0 days

B The count rate at the start was 240 counts per second.

What was the count rate after 11.4 days?

1)0 counts per second

2)12.5 counts per second

3)30 counts per second

4)80 counts per second

C When a nucleus of radon decays, it produces a nucleus of polonium and a nucleus of helium. What type of radiation is produced by radon when it decays?

1)alpha radiation

2)beta radiation

3)gamma radiation

4)infra red radiation

D Radon gas is given off by certain rocks in the ground. In some areas of the UK, radon gas can collect in houses as it rises through gaps in the floor.

Why is radon particularly dangerous to health?

1)Because it is a gas, it can easily catch fire.

2)Because it is a gas, it is difficult to detect.

3)Because it is a gas, it is impossible to see it.

4)Because it is a gas, it can easily enter the body.

Q:6 Radon is a radioactive gas which seeps up from the ground into houses in some parts of the country.

The table shows the results of a survey of radioactive emissions due to radon gas in four houses in one local authority.

House	Radioactive emissions in Bq per m^3 of air
1	11
2	33
3	15
4	21

A What was the average of the radioactive emissions in the four houses?

1)20.0 Bq per m3

2)26.6 Bq per m3

3)40.0 Bq per m3

4)80.0 Bq per m3

B The local authority wanted a more reliable average for the houses in their area.

Scientists could obtain more reliable results by . . .

1)increasing the number of houses sampled.

2)measuring radioactive emissions in 1cm3 of air in each house.

3)using a different unit for the radioactive emissions.

4)sampling the air outside the houses.

C Radon gas causes cancer. Which part of the body is most likely to be the site of a cancer caused by radon gas?

1)brain

2)legs

3)stomach

4)lungs

D What advice would you give to a householder whose house has a high level of radioactive emissions from radon gas?

1)keep the house well ventilated

2)fit double glazing

3)take up all the carpets

4)place draught excluders around all the windows and doors

Q:7 Nitrogen-16 is a radioactive isotope of nitrogen. It decays to stable oxygen-16 by beta (β) emission.

A A beta particle is . . .

1)a helium nucleus.

2)a neutron.

3)a proton.

4)an electron.

B The rate of emission of beta particles from the nitrogen-16 would . . .

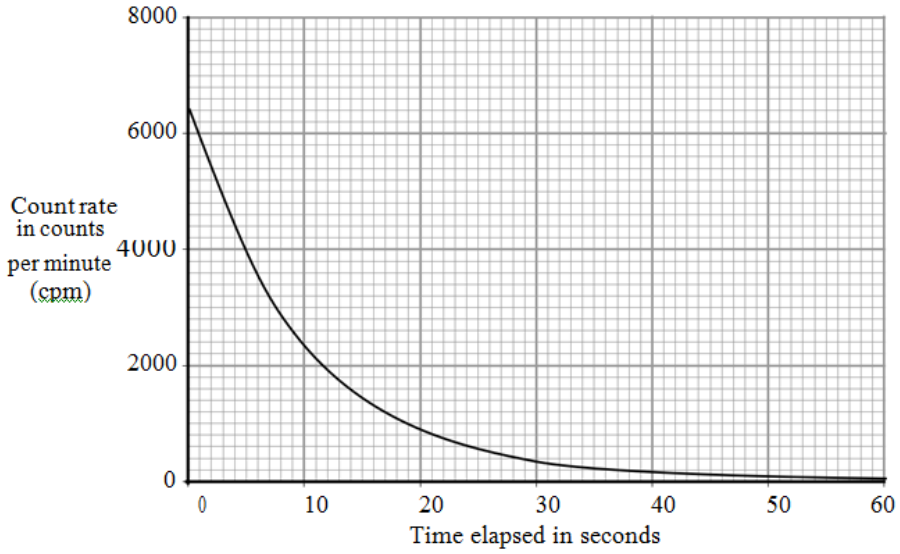
1)be increased by increasing its temperature.

2)be reduced by increasing the pressure of the air around it.

3)be reduced by liquefying it.

4)be unaffected by changes in temperature, pressure or its state.

The graph shows the decay curve for a sample of nitrogen-16.



C Using information from the graph, calculate the approximate half-life of nitrogen-16.

1)7 seconds

2)30 seconds

3)60 seconds

4)3200 seconds

D According to the graph, what is the approximate value to which the count rate of the nitrogen-16 would have fallen after four half-lives?

1)3200 cpm

2)1600 cpm

3)800 cpm

4)400 cpm

Q:8 Many atoms have nuclei that decay and emit alpha particles. Some of these nuclei have very short half-lives, others have very long ones.

A What is an alpha particle?

1)an electron from outside the nucleus

2)an electron from inside the nucleus

3)a helium nucleus

4)a proton from inside the nucleus

B How can the rate, at which a particular radioactive substance decays, be changed?

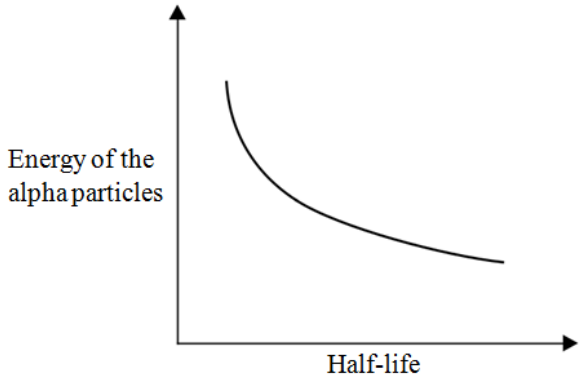
1)by changing the temperature of the nucleus

2)by changing the atmospheric pressure

3)by changing the amount of humidity

4)The rate cannot be changed.

The graph shows the relationship between the energy of the emitted alpha particles and the half-life of the nuclei from which they came.



C What relationship does the graph show?

1)Alpha particles always have the same amount of energy.

2)The longer the half-life, the less energy the alpha particles have.

3)The longer the half-life, the more energy the alpha particles have.

4)There is no relationship between the half-life and the energy of the alpha particles.

D What is the meaning of the term half-life ?

1)half of the time taken for all the atoms originally present to decay

2)the time halfway between when an atom was formed and when it decays

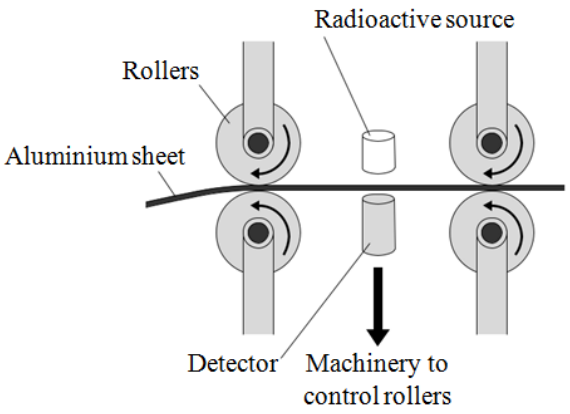
3)the time taken for half of the atoms originally present to decay

4)the time taken for one atom to split in half

Q:9 The table shows the type of radiation emitted by, and the half-life of four radioactive isotopes, P, Q, R and S.

Radioactive isotope	Radiation emitted	Half-life
P	beta	6000 years
Q	alpha	400 years
R	gamma	6 hours
S	beta	30 seconds

A The diagram shows how a radioactive isotope is used to monitor the thickness of aluminium in the continuous manufacture of aluminium sheet.



Which of the isotopes should be used?

1)P

2)Q

3)R

4)S

B A smoke alarm uses a small mass of a radioactive isotope. So that the alarm can be used safely in a house, isotope Q is used.

This is because isotope Q is an alpha emitter . . .

1)with a short half-life; alpha particles have a short range in air.

2)with a short half-life; alpha particles have a long range in air.

3)with a long half-life; alpha particles have a short range in air.

4)with a long half-life; alpha particles have a long range in air.

C Radioactive isotopes can be injected into the human body to act as tracers in medical diagnosis.

The isotope used is . . .

1)P because it has a very long half-life and beta particles can reach the detector.

2)Q because it has a long half-life and alpha particles are relatively safe outside the body.

3)R because it has a short half-life and gamma rays can reach the detector.

4)S because it has a short half-life and beta particles can reach the detector.

D Trees contain the radioactive isotope carbon-14. After a tree has been chopped down, the count rate from the carbon-14 it contains gradually decreases. By measuring the count rate and knowing the half-life of the isotope, the age of the dead wood can be estimated.

Which isotope could be used to estimate the age of a wooden box thought to be about 18 000 years old?

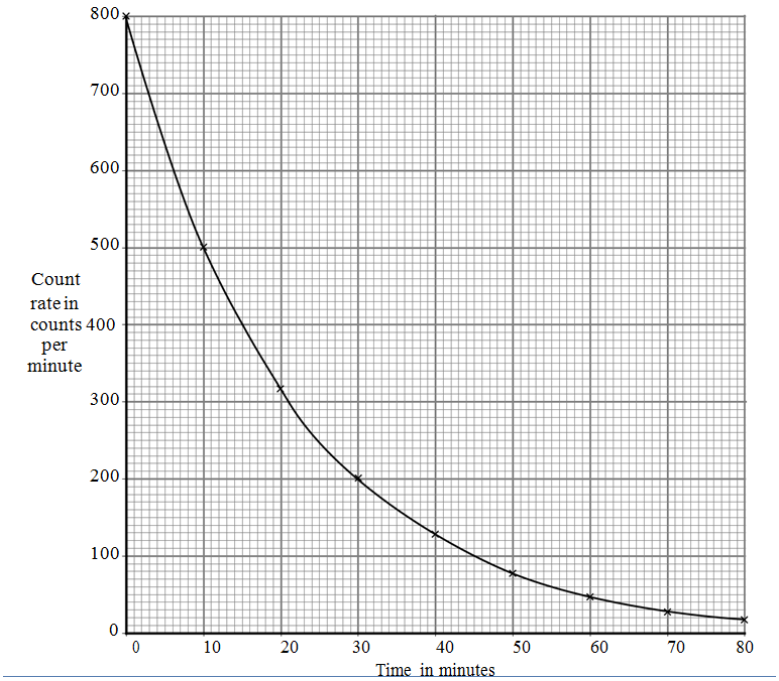
1)P because its half-life is about 6000 years so the box has existed for 3 half-lives.

2)Q because its half-life is about 400 years which means that the box has existed for 45 half-lives.

3)R because its half-life is about 30 seconds which means that it is safe to do the estimation.

4)S because its half-life is about 6 hours which is enough time to do the estimation.

Q:10 The graph shows how the count rate of a radioactive isotope varies with time.



A What is the half-life of the isotope?

1)10 minutes

2)15 minutes

3)20 minutes

4)80 minutes

B The person who plotted the graph has drawn a line graph rather than a bar chart.

What is the reason for this?

1)Both the count rate and time are continuous variables.

2)Time is a discrete variable and count rate is a continuous variable.

3)Time is a continuous variable and count rate is a categoric variable.

4)Both the count rate and time are discrete variables.

C The government recommends that all homes are fitted with smoke alarms. Americium-241 is used in these alarms. Americium-241 emits alpha particles and has a half-life of 460 years.

The americium-241 is safe to use in homes because . . .

1)it has a long half-life.

2)alpha particles travel only a few centimetres in air.

3)smoke alarm batteries are replaced regularly.

4)its nucleus has 146 neutrons.

D This information is about the isotope technetium-99.

It emits gamma radiation.

Its half-life is 6 hours.

It decays to a stable isotope of rubidium.

It is used for diagnostic medical studies.

It is put into the body.

A doctor wants to convince a patient that technetium-99 is safe to use to diagnose a medical problem.

Which of the following should he use to reassure the patient?

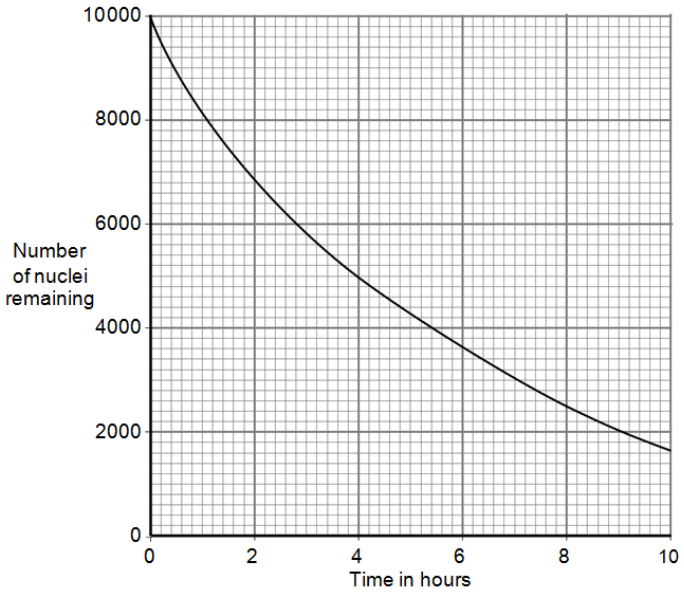
1)Rubidium is a rare metallic element.

2)Gamma radiation is part of the electromagnetic spectrum.

3)The half-life of the technetium-99 isotope is relatively short.

4)There is no risk in using radioactive materials.

Q:11 The graph shows the decay of a small sample of radioactive isotope. At the start, the sample contains 10 000 nuclei.



A What is the half-life of the isotope shown in the graph?

1)2 hours

2)4 hours

3)6 hours

4)8 hours

B How many of the original nuclei would remain after three half-lives?

1)1250

2)2500

3)3333

4)none

C This radioactive isotope may be suitable . . .

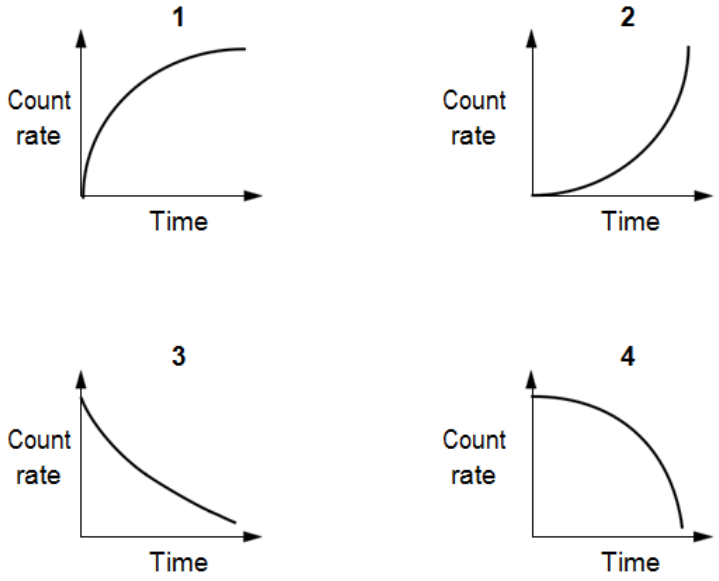
1)as a source of radiation in a smoke alarm.

2)as a source of radiation to monitor the thickness of paper in a paper mill.

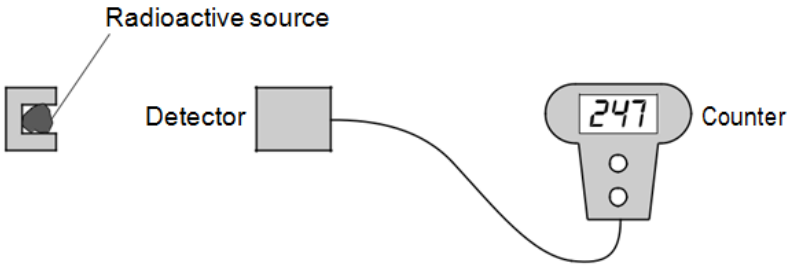
3)as a medical tracer in the human body.

4)to use in finding the age of an ancient bone.

D Which one of the following graphs would show how the count rate for this isotope changes with time?



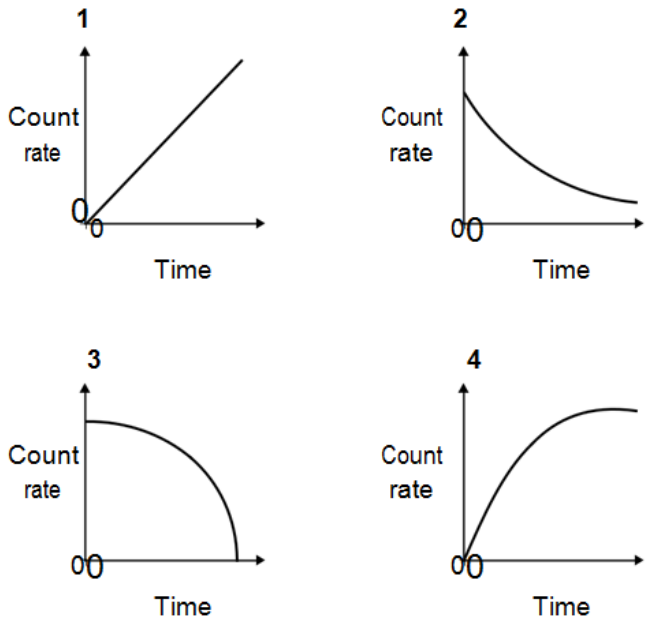
Q:12 A teacher used the apparatus shown in the diagram to measure the count from a radioactive source.



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.

A 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?



B 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

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

1)the pressure in the room

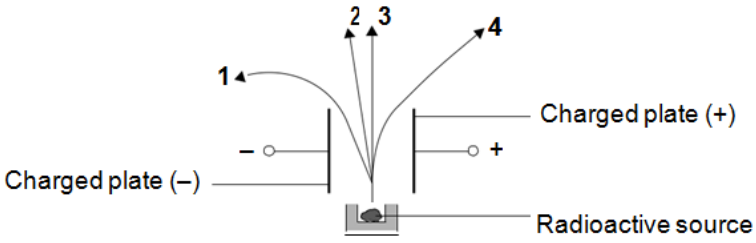
2)the original number of nuclei in the sample

3)the temperature of the room

4)the temperature of the sample

D 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?



Q:13 Nitrogen-16 is a radioactive isotope of nitrogen. This isotope decays to stable oxygen-16 by beta emission.

A A beta particle is . . .

1)a helium nucleus.

2)a neutron.

3)a proton.

4)an electron.

B The rate of emission of beta particles from the nitrogen-16 would . . .

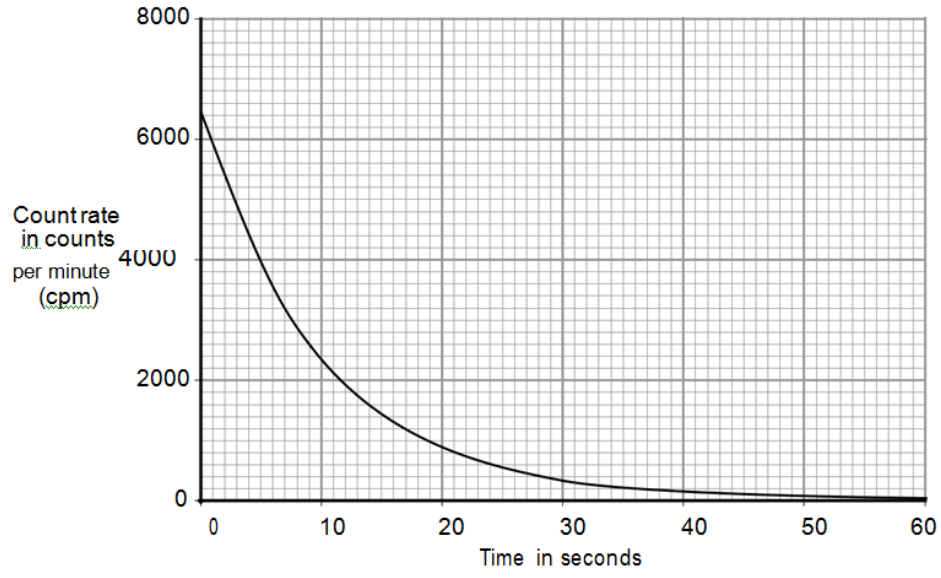
1)be increased by increasing the temperature.

2)be reduced by increasing the pressure of the surrounding air.

3)be reduced by liquefying the nitrogen-16.

4)be unaffected by changes in temperature, pressure or state.

The graph shows the radioactive decay curve for a sample of nitrogen-16.



C Using information from the graph, what is the approximate half-life of nitrogen-16?

1)7 seconds

2)30 seconds

3)60 seconds

4)3200 seconds

D The initial count rate of the nitrogen-16 sample is 6400 counts per minute.

What is the approximate value of the count rate after four half-lives?

1)3200 cpm

2)1600 cpm

3)800 cpm

4)400 cpm

TOTAL MARKS=52