



HOMEWORK BOOKLET

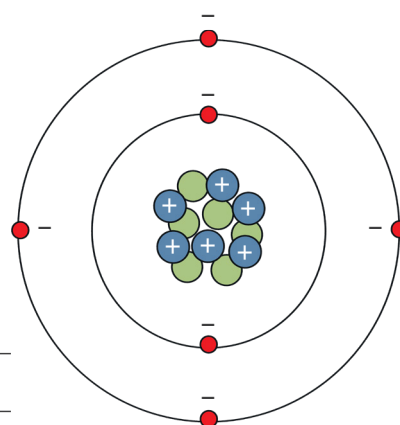
P4 Foundation

Atomic Structure

State the name of each of the subatomic particles represented in **Figure 1**.

- + _____
- _____
- - _____

Figure 1.



Outline why the nucleus is positively charged.

What is the approximate radius of a typical atom?
Circle **one** answer.

1×10^{-10} cm

1×10^{10} cm

1×10^{-10} m

$\frac{1}{10\,000}$ m

Atomic Number and Mass Number

Complete the sentences using the words in the box below. Words may be used more than once.

electrons	protons	neutrons
-----------	---------	----------

The atomic number is the number of _____ in the nucleus of an atom of an element.

The mass number is the number of _____ and _____ in the nucleus of an atom of an element.

An atom of oxygen has an atomic number of 8 and a mass number of 16.

State the number of protons in the nucleus of this oxygen atom. _____

Calculate the number of neutrons in the nucleus of this oxygen atom. _____

Isotopes

Isotopes are atoms of the same element with different numbers of _____.

Complete the table to compare two isotopes of oxygen.

Isotope	Atomic Number	Mass Number	Protons	Neutrons	Electrons
oxygen-16	8	16	8	8	8
oxygen-18		18			8

Changing the Number of Subatomic Particles

The boxes on the left-hand side describe a change in the subatomic particles of an atom. Draw **one** line from each box to the statement which describes the new particle formed as a result of this change.

A proton is added to the nucleus of an atom.

A negatively charged ion is formed.

An electron is gained in the outer shell of an atom.

A positively charged ion is formed.

Two electrons are lost from the outer shell of an atom.

A new element is formed.

Two neutrons are lost from the nucleus of an atom.

A different isotope of the same element is formed.

Development of the Model of the Atom

Write the statements in the boxes below in the correct order to show the timeline of the development of the model of the atom.

The nuclear model was described.

The plum pudding model was described.

The nucleus contains positively charged particles called protons.

1. Atoms were tiny spheres that could not be divided.

2. _____

3. _____

4. Electrons orbit the nucleus at specific distances.

5. _____

6. Discovery of the neutron.

State the name of the experiment carried out by Ernest Rutherford in 1909 that provided evidence for the nuclear model of the atom.

Radioactive Decay

Decide whether each statement in the table below is true or false.

Statement	True	False
Unstable atoms have too many or too few neutrons in their nucleus.		
Stable atoms emit radiation to become unstable.		
We can predict exactly when radioactive decay will happen.		
The activity of a radioactive source is measured in becquerel (Bq).		
Count-rate can be measured using a Geiger-Müller tube.		

Nuclear Radiation

Each of the statements describes a property of one of the three types of nuclear radiation. Circle **one** answer for each statement.

This type of radiation has the longest range in air.

alpha beta gamma

This type of radiation has the highest ionising power.

alpha beta gamma

This type of radiation is a particle made of two protons and two neutrons.

alpha beta gamma

This type of radiation is a high-speed electron.

alpha beta gamma

This type of radiation is the most penetrating.

alpha beta gamma

This type of radiation can be stopped by a thin sheet of paper.

alpha beta gamma

This type of radiation has a range in air of around 1m.

alpha beta gamma

This type of radiation is an electromagnetic wave.

alpha beta gamma

Nuclear Equations

Decide which type of radioactive decay each statement in the table describes.
Each statement may describe more than one type of radioactive decay.

Statement	Alpha	Beta	Gamma
This causes the mass number to decrease by four.			
This causes no change to the mass number.			
This causes a change in the atomic number.			
This causes the atomic number to increase			

An atom of uranium-238 undergoes alpha decay. It produces an atom of thorium-234 and a helium nucleus.

Which of the following correctly shows the alpha decay of this uranium-238 atom?

Tick **one** box.

- a) ${}_{92}^{234}\text{uranium} \longrightarrow {}_{90}^{238}\text{thorium} + {}_2^4\text{helium}$
- b) ${}_{92}^{238}\text{thorium} \longrightarrow {}_{90}^{234}\text{uranium} + {}_2^4\text{helium}$
- c) ${}_{92}^{238}\text{uranium} \longrightarrow {}_{90}^{234}\text{thorium} + {}_2^4\text{helium}$
- d) ${}_{92}^{238}\text{thorium} \longrightarrow {}_{90}^{234}\text{helium} + {}_2^4\text{uranium}$

An atom of carbon-14 undergoes beta decay. Its mass number stays the same but its atomic number increases by one. It also releases a beta particle.

Which of the following correctly shows the beta decay of this carbon-14 atom?

Tick **one** box.

- a) ${}_{6}^{14}\text{carbon} \longrightarrow {}_{7}^{14}\text{nitrogen} + {}_{-1}^0\text{proton}$
- b) ${}_{6}^{12}\text{carbon} \longrightarrow {}_{7}^{12}\text{nitrogen} + {}_{-1}^0\text{proton}$
- c) ${}_{6}^{14}\text{carbon} \longrightarrow {}_{8}^{14}\text{nitrogen} + {}_{-1}^0\text{electron}$
- d) ${}_{6}^{14}\text{carbon} \longrightarrow {}_{7}^{14}\text{nitrogen} + {}_{-1}^0\text{electron}$

Half-Life

Describe what is meant by the term 'half-life.'

Figure 2 shows a graph of the activity of a sample of polonium-220.

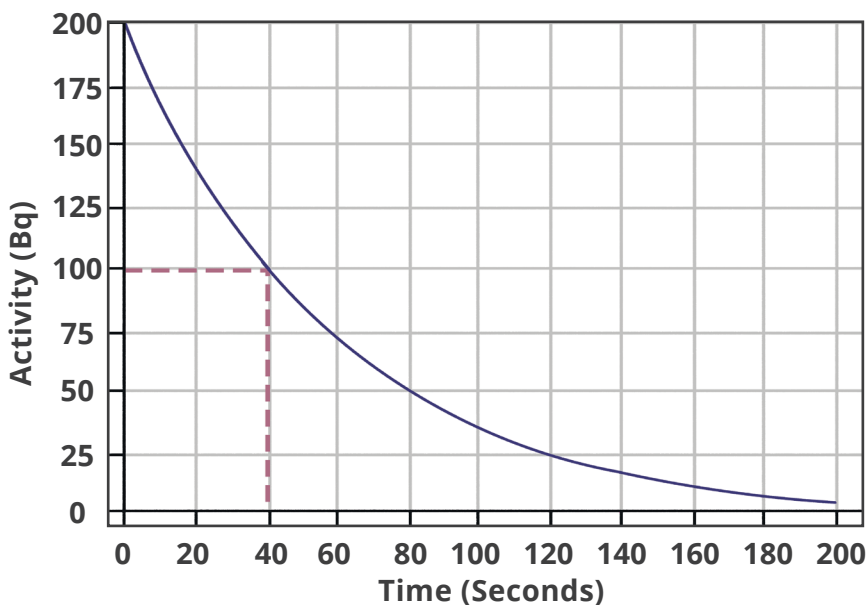
State the initial activity of the sample.

_____ Bq

Use the graph to determine the half-life of polonium-220.

_____ seconds

Figure 2



Radioactive Contamination

Complete the sentences using the words in the box below.

atoms	contamination	irradiation	radioactive
-------	---------------	-------------	-------------

_____ is the process of exposing an object to nuclear radiation. The object does not become _____ itself.

Radioactive _____ is the unwanted presence of materials containing radioactive _____ on other materials.

Radioactive sources can be used in medicine to diagnose and treat some conditions.

Describe the properties a radioactive source used for this purpose should have in order to be used as safely and effectively as possible.
