

Year 11 Transition to A Level Physics Projects

There are 3 tasks for you to work through with a focus on Particle Physics. These start with recapping of key GCSE concepts and then progress to introduce you to some A level content.

Task 1: Revision of GCSE. Go over the topics listed below and watch the suggested videos. Then complete the GCSE questions below.

Atomic structure – nuclear and electron?

Notation – mass number and atomic number (why is it called the atomic number and not just the proton number?)

Radioactivity – radioactive decay – half-life.

Alpha, beta and gamma decay.

Radioactive irradiation and contamination.

Rutherford's scattering experiment.

WATCH THESE VIDEOS

<https://www.youtube.com/watch?v=pHbrtbF3YsY>

<https://www.youtube.com/watch?v=cFMXgisrwpM>

DO THE GCSE QUESTIONS

Q1.

Atoms contain three types of particle.

(a) Draw a ring around the correct answer to complete the sentence.

The particles in the nucleus of the atom are

electrons and neutrons.
electrons and protons.
neutrons and protons.

(1)

(b) Complete the table to show the relative charges of the atomic particles.

Particle	Relative charge
Electron	-1
Neutron	
Proton	

(2)

- (c) (i) A neutral atom has no overall charge.

Explain this in terms of its particles.

(2)

- (ii) Complete the sentence.

An atom that loses an electron is called an

and has an overall _____ charge.

(2)

(Total 7 marks)

Q2.

Atoms are very small and most of their mass is concentrated in the nucleus.

Electrons orbit at different distances from the nucleus.

- (a) A nucleus is much smaller than an atom.

Approximately how many times smaller is a nucleus than an atom?

Tick **one** box.

100

1000	<input type="checkbox"/>
10 000	<input type="checkbox"/>
100 000	<input type="checkbox"/>

(1)

- (b) The electrons in an atom can only orbit at specific distances from the nucleus.

State what causes an electron's distance from the nucleus to increase or decrease.

Increase

Decrease

(2)

- (c) Atoms have different atomic numbers and mass numbers.

In terms of sub-atomic particles, describe the difference between an atom's atomic number and its mass number.

(2)

- (d) Transmutation is the name given to a process where one element changes into another.

Explain and compare how two different types of radioactive decay can cause transmutation.

(4)
(Total 9 marks)

Q3.

The Chernobyl disaster was a nuclear accident that happened in 1986

Radioactive isotopes were released into the environment.

The radioactive isotopes emitted alpha, beta and gamma radiation.

(a) What is an alpha particle?

Tick **one** box.

2 charged particles and 2 neutral particles.

2 charged particles and 4 neutral particles.

4 charged particles and 2 neutral particles.

4 charged particles and 4 neutral particles.

(1)

(b) Which statement about beta radiation is true?

Tick **one** box.

It is the fastest moving type of radiation.

It is the type of radiation with a negative charge.

It is the type of radiation with the greatest mass.

It is the type of radiation with the greatest range in air.

(1)

(c) Which statement about gamma radiation is true?

Tick **one** box.

It is a low frequency electromagnetic wave.

It causes the charge of the nucleus to change.

It causes the mass of the nucleus to change.

It has a very long range in air.

(1)

The table below shows the half-lives of two of the radioactive isotopes that contaminated the environment.

Isotope	Half-life
Caesium-137	30 years
Iodine-131	8 days

(d) A soil sample was taken from the area around Chernobyl in 1986

The soil sample was contaminated with equal amounts of caesium-137 and iodine-131

Explain how the risk linked to each isotope has changed between 1986 and 2018

Both isotopes emit the same type of radiation.

(4)

(e) Determine the year when the activity of the caesium-137 in the soil sample will be $\frac{1}{32}$ of its original value.

Year = _____

(3)

(Total 10 marks)

Q4.

A beta particle is a high-energy electron.

(i) Which part of an atom emits a beta particle?

(1)

(ii) How does the composition of an atom change when it emits a beta particle?

(1)

(Total 2 marks)

Q5.

- (a) (i) Describe the structure of alpha particles.

(2)

- (ii) What are beta particles?

(1)

- (b) Describe how beta radiation is produced by a radioactive isotope.

(1)

(Total 4 marks)

Q6.

Some rocks inside the Earth contain a radioactive element, uranium-238. When an atom of uranium-238 decays, it gives out an alpha particle.

- (a) The following statement about alpha particles was written by a student. The statement is **not** correct.

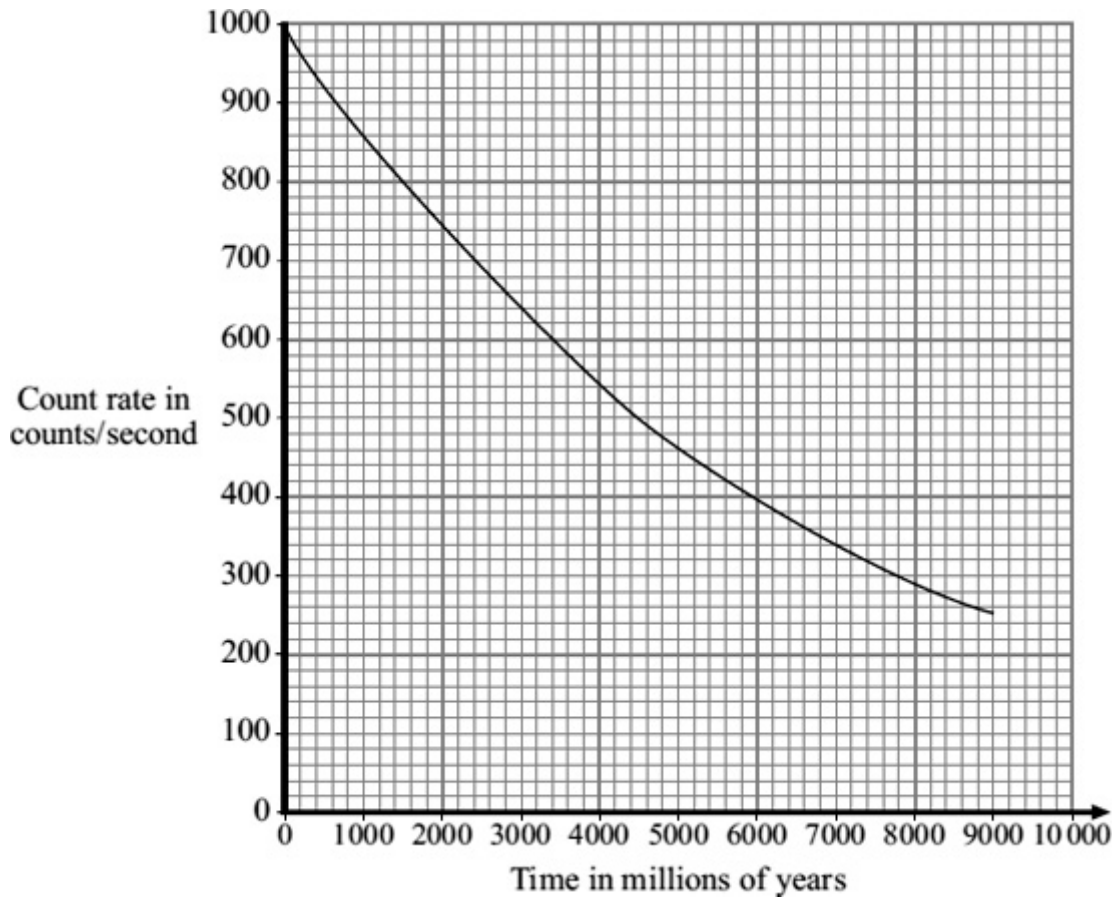
Alpha particles can pass through a very thin sheet of lead.

Change **one** word in the statement to make it correct.

Write down your **new** statement.

(1)

- (b) The graph shows how the count rate from a sample of uranium-238 changes with time.



The graph can be used to find the half-life of uranium-238. The half-life is 4 500 million years.

- (i) Draw on the graph to show how it can be used to find the half-life of uranium -238.
- (ii) There is now half as much uranium-238 in the rocks as there was when the Earth was formed.

(1)

How old is the Earth?

Draw a ring around your answer.

2250 million years

4500 million years

9000 million years

(1)

- (iii) If a sample of uranium-238 were available, it would not be possible to measure the half-life in a school experiment.

Explain why.

(2)

Task 2. Now that you have refreshed your knowledge of atomic structure you should see how this knowledge was collected. Research the following points. Present your work as a piece of writing/powerpoint/poster/leaflet. It must include the following information:

Describe who and how the following discoveries were made:-

The concept of the atom.

The discovery of electronic charge.

The electron. (What was actually measured?)

Why was it so many years before Chadwick discovered the neutron?

TASK 3= Until the 1960s although scientists knew there was more (due mainly to quantum theory), little more was discovered as to the particle make up. Now the theory gets much more complicated. Watch the following videos. Then do the topic questions on the save my exams website listed below these videos.

https://www.youtube.com/watch?v=aSAN1O_ZP3Q

<https://www.youtube.com/watch?v=C0NyYKJrogw>

<https://www.youtube.com/watch?v=Glmej8WpwjU>

<https://www.youtube.com/watch?v=ydzrEUbvfT8>

<https://www.youtube.com/watch?v=rZKfqQ5RT34>

<https://www.youtube.com/watch?v=edgsmtUH954>

<https://www.youtube.com/watch?v=3P-FGw5KUeo>

DO THE FOLLOWING QUESTIONS

<https://www.savemyexams.co.uk/a-level-physics-aqa-new/>

Click on Topic questions

Do:-

[Constituents of the Atom](#)

[Particles/Antiparticles/Photons](#)

[Particle Interaction](#)

[Classification of Particles](#)

[Quarks and Antiquarks](#)

Yes, these are hard. The jump to A level is the biggest jump you will ever do and you have to start on your own! Still the topic is fascinating, even more so when I can fill in some of the interesting bits when we get back. Take up the challenge!

Good Luck

Mr Mitchell

PS When you have finished watch this short film to blow your mind.

<https://www.youtube.com/watch?v=edvdzh9Pggg>