NUCLEAR RADIATION

OCR A LEVEL PHYSICS H556
Module 6: Particles and medical physics
6.4 Nuclear and particle physics
6.4.3 Radioactivity
a) radioactive decay; spontaneous and random nature of decay
b) i) alpha-particles, beta-particles and gamma-rays; nature, penetration and range of these radiations
b) ii) techniques and procedures ... investigate absorption ...

Outline = simply investigating radioactive decay

Text book reference = pages 220-222

Independent study = page 222 questions

What is this lesson about?

- What is radiaoactivity?
- Why might isotopes decay?*
- What are the types of radiation?
- What is their nature?
- Investigating absorption, ionisation, deflection
- Investigating the inverse square law for gamma
- Safety around radiation

*later we'll discuss why same istope always decays same way

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What is radioactive decay?

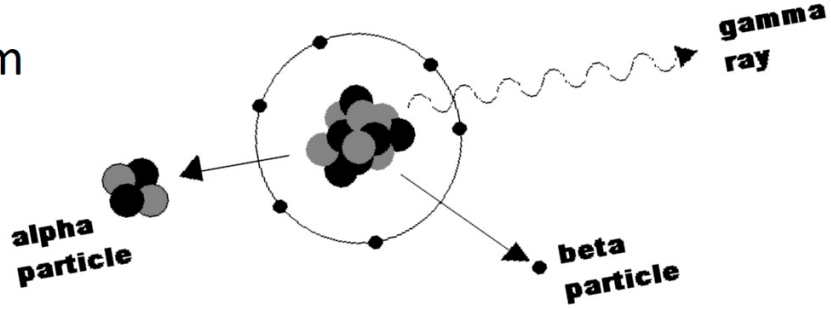
- Some **isotopes** have **nuclei** that are **not stable**
- **Spontaneous emission of ionising radiation**
- Spontaneous = without obvious cause
- Random = without obvious pattern
- Ionsining = causes atoms to become charged
- Parent nucleus decays to daughter nucleus
- **Activity is the emissions per unit time**
- Sometimes this continues to granddaughter
- Decay chain

What are the mechanisms for radioactive decay?

- Alpha decay = emission of alpha particle ($2p^+$ & 2n)
- Beta$^-$ decay = emission of an electron (e^-)
- Beta$^+$ decay = emission of a positron (e^+)
- Gamma decay = emisison of a photon (of energy)

All of this happens from the nucleus!

Same isotope, same decay!



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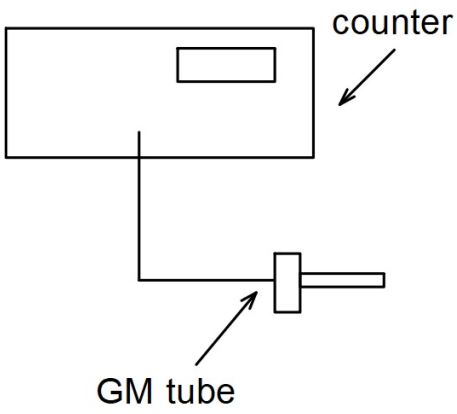
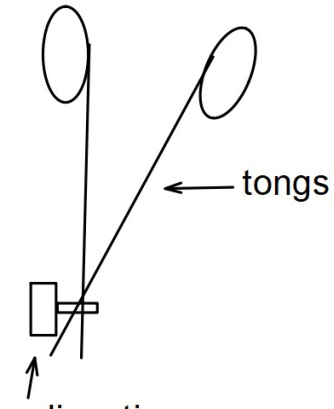
Investigation 1 = activity

- try different sources
- comparison?
- is it fair?





Investigation 1 = activity

Think! Will the detector be able to detect alpha and beta and gamma equally effectively?

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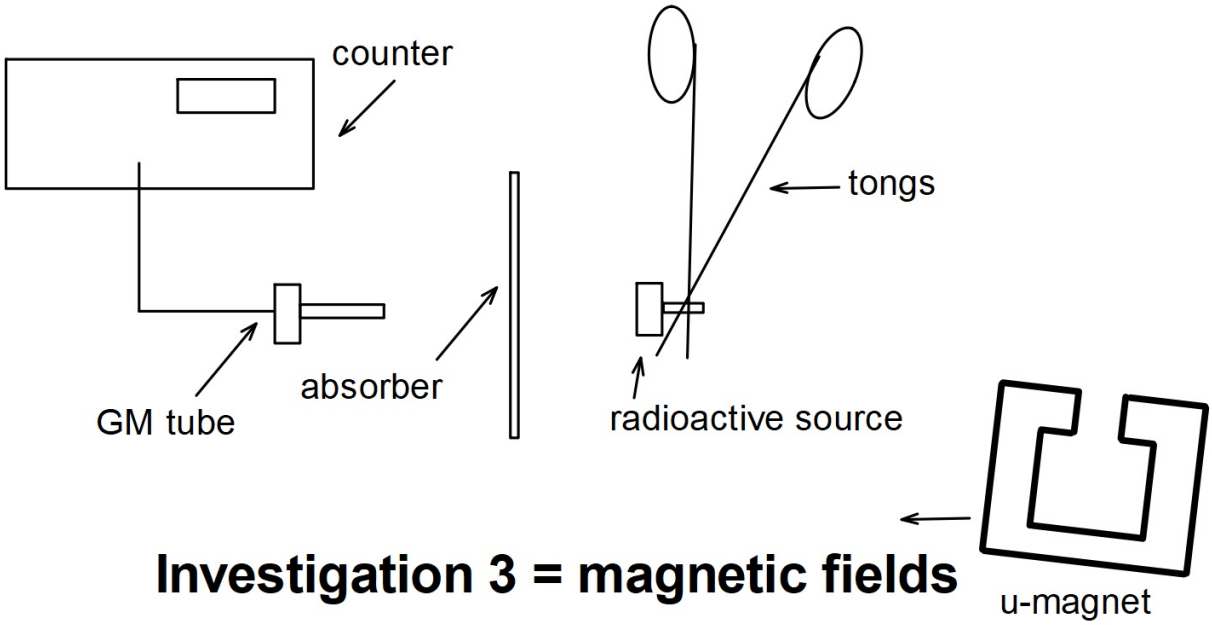
Investigation 2 = absorption

- try different sources
- comparison?
- is it fair?



Investigation 3 = magnetic fields

Investigation 2&3 = absorption & magnetic fields

Think! Design an experiment through which you could identify the radiation from different sources.

Radiation	Range in air	Absorption	Magnetic fields
alpha			
beta			
gamma			

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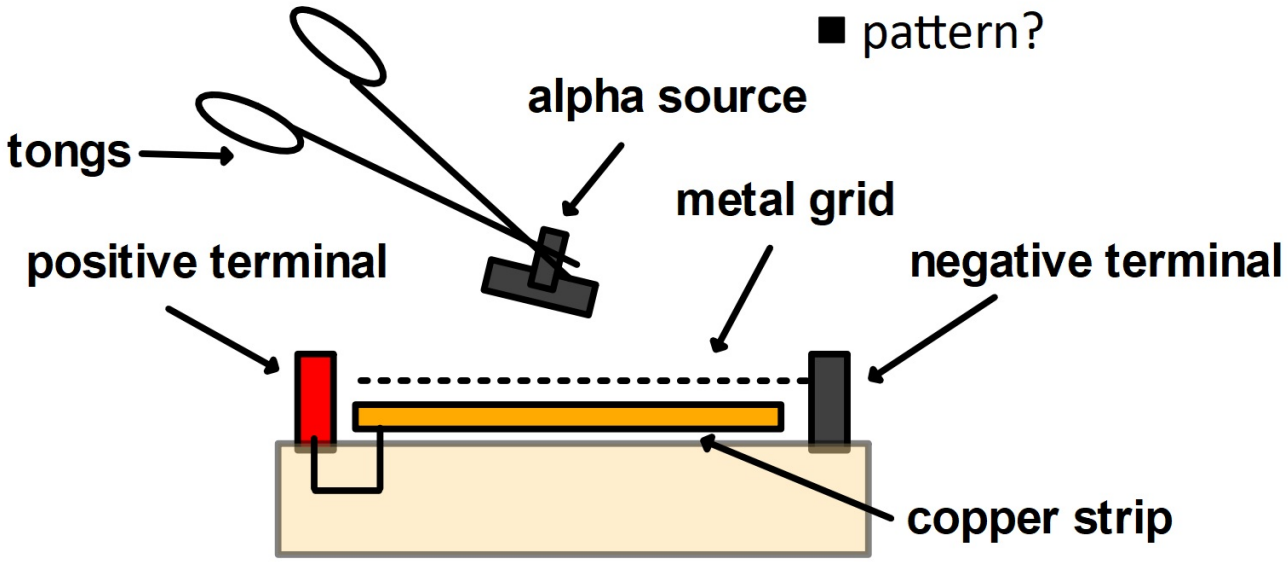
Investigation 4 = spark counter

- alpha sourse
- kV pd across plates
- we see sparks!
- pattern?



Investigation 4 = the spark counter

Think! What does this tell us about radioactive decay?

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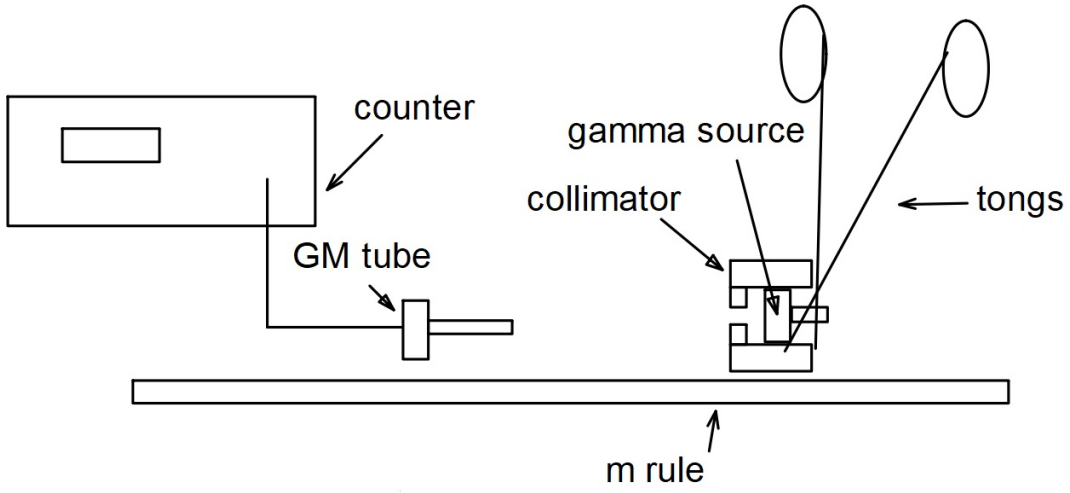
Investigation 5 = inverse square law for gamma



Investigation 5 = inverse square law for gamma

Think! Design an experiment through which you could investigate the theory that gamma radiation obeys an inverse square law.

intensity proportional to 1/distance from source^2