Properties of Nuclear Radiation
Questions for GCSE Physics (ANSWERS)

1. What are alpha particles, beta-minus particles and gamma rays?

Alpha: 2 protons and 2 neutrons (or a helium nucleus)

Beta: high energy electron

Gamma: electromagnetic radiation

2. State the relative mass and charge of each of these three types of radiation.

Alpha: mass = 4; charge = +2

Beta: mass = approximately 0; charge = -1

Gamma: mass = 0; charge = 0

3. Put alpha, beta and gamma radiation in order of increasing ionising power. Explain why ionising radiation can be harmful to living cells.

Gamma is the least ionising, then beta and alpha is the most ionising

Ionising radiation is harmful to living cells (it can cause cells to die or mutate or become cancerous)

[Ionising radiation can also cause living organisms to become sick and can cause burns]

4. Compare how far alpha, beta and gamma radiation travel through air.

Alpha can travel around 5cm in air

Beta can travel around 1m in air

Gamma can travel very long distances in air

5. What materials can stop alpha and beta radiation? How does thick lead affect gamma radiation?

Alpha radiation is stopped by paper or skin

Beta is stopped by a few millimeters of aluminium or soft tissue in the body

Thick lead may absorb gamma radiation, reducing its concentration.

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6. Radiation spreads out as it travels away from its source. What happens to its concentration?

The concentration of radiation decreases as the distance from the source increases

7. Describe how alpha, beta and gamma radiation behave between oppositely charged plates. Why is beta deflected more than alpha?

Alpha is positively charged and so is repelled by a positive plate and attracted to a negatively charged plate. Beta is negatively charged and so is repelled by a negative plate and attracted to a positively charged plate

Gamma has no charge and so is not affected by the positive or negative plates.

The force acting on alpha particles is larger but the beta particles have much less mass and so have greater acceleration

8. Alpha radiation cannot pass through skin. Explain why an alpha-emitting source can still be dangerous if it gets inside the body.

The outer layer of skin is dead and so if it absorbs alpha radiation it will cause little harm.

Alpha is the most ionising and if it is absorbed by living cells inside the body it will cause damage.

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