Year 12 Physics
Tutorial 9.8.C – Radioactive Decay

Module	9.8 – From Quanta to Quarks
Topic	9.8.C – Radioactive Decay
Name	**Date**

1. Account for the fact that some nuclei are stable, even though there is a force of repulsion between the positively charged protons in the nucleus.

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2. Describe the properties of the two opposing forces in the nucleus.

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3. Explain why radioisotopes are unstable and undergo spontaneous radioactive decay.

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4. Determine the number of protons and neutrons in each of the following:

   (a) polonium-201

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   (b) potassium-40

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   (c) americium-241

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5. Complete the following nuclear equations:

   (a) ${}^{226}_{88}Ra \rightarrow {}^{222}_{86}Rn + x$

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   (b) ${}^{14}_{6}C \rightarrow {}^{14}_{7}N + x + y$

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   (c) ${}^{22}_{11}Na \rightarrow {}^{22}_{10}Ne + x + y$

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   (d) ${}^{243}_{90}Th \rightarrow z + {}^{0}_{-1}e + \bar{\nu}$

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   (e) $z \rightarrow {}^{234}_{90}Th + {}^{4}_{2}He$

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   (f) $z \rightarrow {}^{57}_{27}Co + {}^{0}_{+1}e + \nu$

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6. Write equations for the following decay processes:

   (a) beta minus decay of potassium-43

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   (b) beta plus decay of xenon-122

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   (c) the alpha decay of americium-239

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(d) the gamma decay of technetium-99

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7. Account for the change in atomic number when a radionuclide undergoes beta plus and minus decay.

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8. When radon-226 undergoes alpha decay the mass lost is equivalent to 4.871 MeV. When the kinetic energy of the alpha particle is measured experimentally, it is only 4.78 MeV. Account for the difference in energy.

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9. Explain how Pauli was able to predict that there was another particle called the neutrino involved in beta decay.

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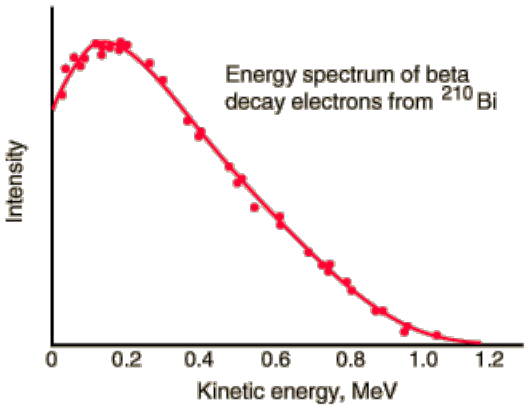
10. In a particular decay, explain why beta particles can have a range of kinetic energies shown in the graph while alpha particles always have the same energy.



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11. Identify a radioisotope used in industry or medicine and outline how it is made and how its properties relate to its use.

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12. Suggest a sequence in which mercury-200 might be changed into gold-196 and write nuclear equations for the reactions involved.

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