7 **(a)** An unstable nucleus ${}^{A}_{Z}X$ decays by emitting a β^- particle.

(i) Determine quantitatively the changes, if any, in A and Z when X decays.

change in A = ...

change in Z = ...
[2]

(ii) In addition to the β^- particle, another lepton is emitted during the decay.

State the name of the other lepton that is emitted.

..... [1]

(b) A particle P is composed of an up quark (u) and a down antiquark ($\overline{d}$).

(i) Calculate the charge q of particle P in terms of e, where e is the elementary charge.

Show your working.

q = ... e [2]

(ii) Particle P belongs to **two** classes (groups) of particles.

State the names of these two classes.

1 .....

2 .....
[2]

[Total: 7]