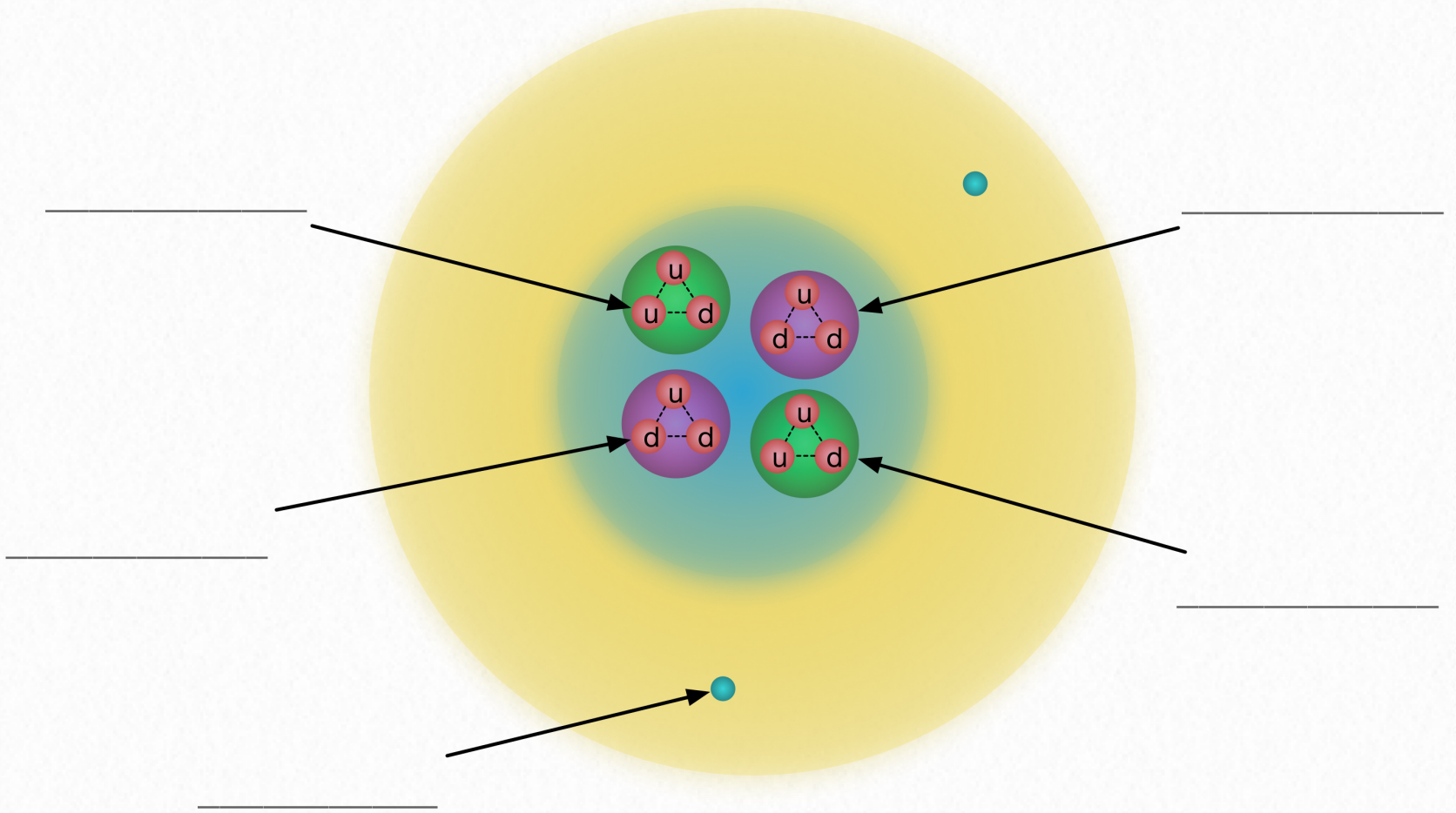
Questions

Particle Physics

1. Label the diagram of the particles within the atom below:



2. State what is meant by a fundamental particle

3. The particles within an atom can be divided into fundamental particles and non-fundamental particles.

   a) Give two examples fundamental particles:

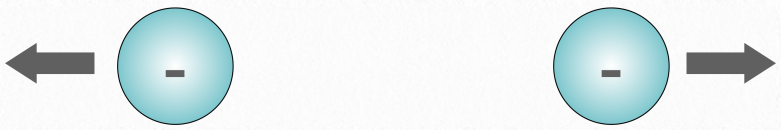
   b) Give two examples of non-fundamental particles:

Questions Continued

Particle Physics

4. Name the four fundamental forces.

5. Two electrons approach each other but do not collide. They exert a force on each other and move apart.



a) Which of the four fundamental forces is involved in this process.

b) Name the exchange particle that plays a role in this interaction.

6. State the quark composition of:

a) The proton

b) The neutron

7. A π^o particle is classed as a meson. It has a charge of 0 and a baryon number of 0. Using the quark table below, which of the following combinations could correspond to a π^o meson.

A. $s\bar{u}$

B. udd

C. $d\bar{d}$

D. $u\bar{d}$

Quark	Charge
u	+2/3
d	-1/3
s	-1/3

Questions Continued

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8. An unstable nuclei undergoes radioactive emission to become more stable. Two possible decays are: β^- and β^+ decay. An isotope of carbon ${}^{14}_{6}C$ decays by beta emission into an isotope of nitrogen ${}^{14}_{7}N$. An isotope of magnesium ${}^{23}_{12}Mg$ decays by beta emission into an isotope of sodium ${}^{23}_{11}Na$.

   a) Complete the following decay equations for the carbon and magnesium isotopes.

      i. carbon decay (β^- emission where a neutron "turns into" a proton)

$$ {}^{14}_{6}C \longrightarrow {}^{14}_{....}N + e^- + \bar{\nu}_e $$

      ii. magnesium decay (β^+ emission where a proton "turns into" a neutron)

$$ {}^{23}_{12}Mg \longrightarrow {}^{....}_{....}Na + e^+ + \nu_e $$

   b) State the two beta decays in terms of a quark model of the nucleons.

      i. beta-plus decay

      ii. beta-minus decay

9. State why the following reaction is not possible

$$ p + n \longrightarrow p + p + \bar{p} $$

Questions Continued

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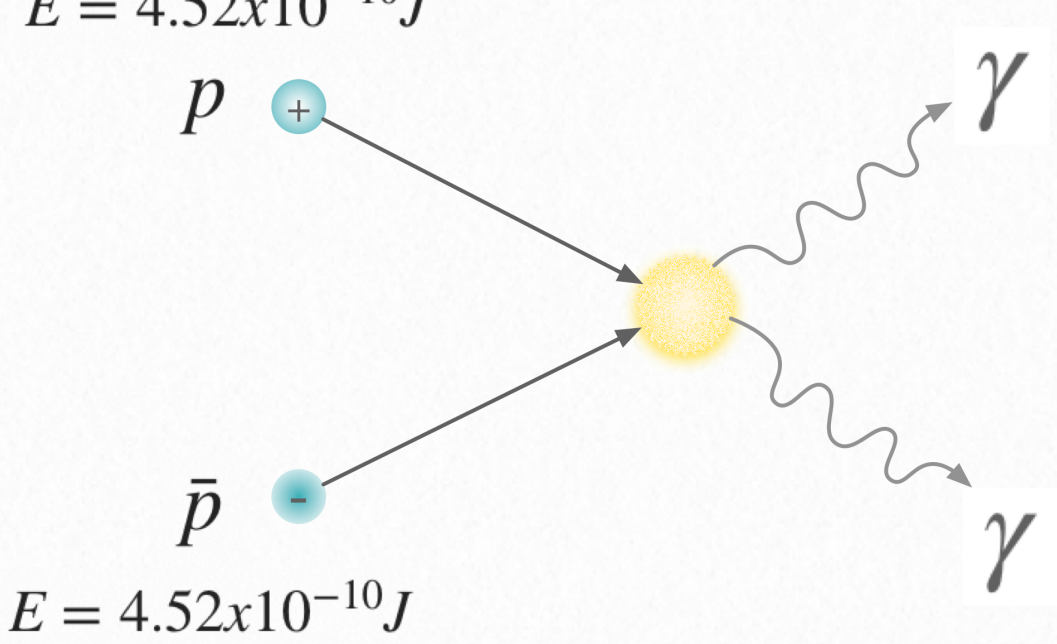
10. A proton and an antiproton can annihilate each other, in this strong interaction:

$$p + \bar{p} \longrightarrow \pi^{+} + x$$

Look at the conservation of charge, baryon number and lepton number to help suggest the identity of particle x.

11. A proton and anti-proton, each of energy $E = 4.52x10^{-10}J$, annihilate and produce two gamma photons.



Calculate the wavelength of each gamma photon.