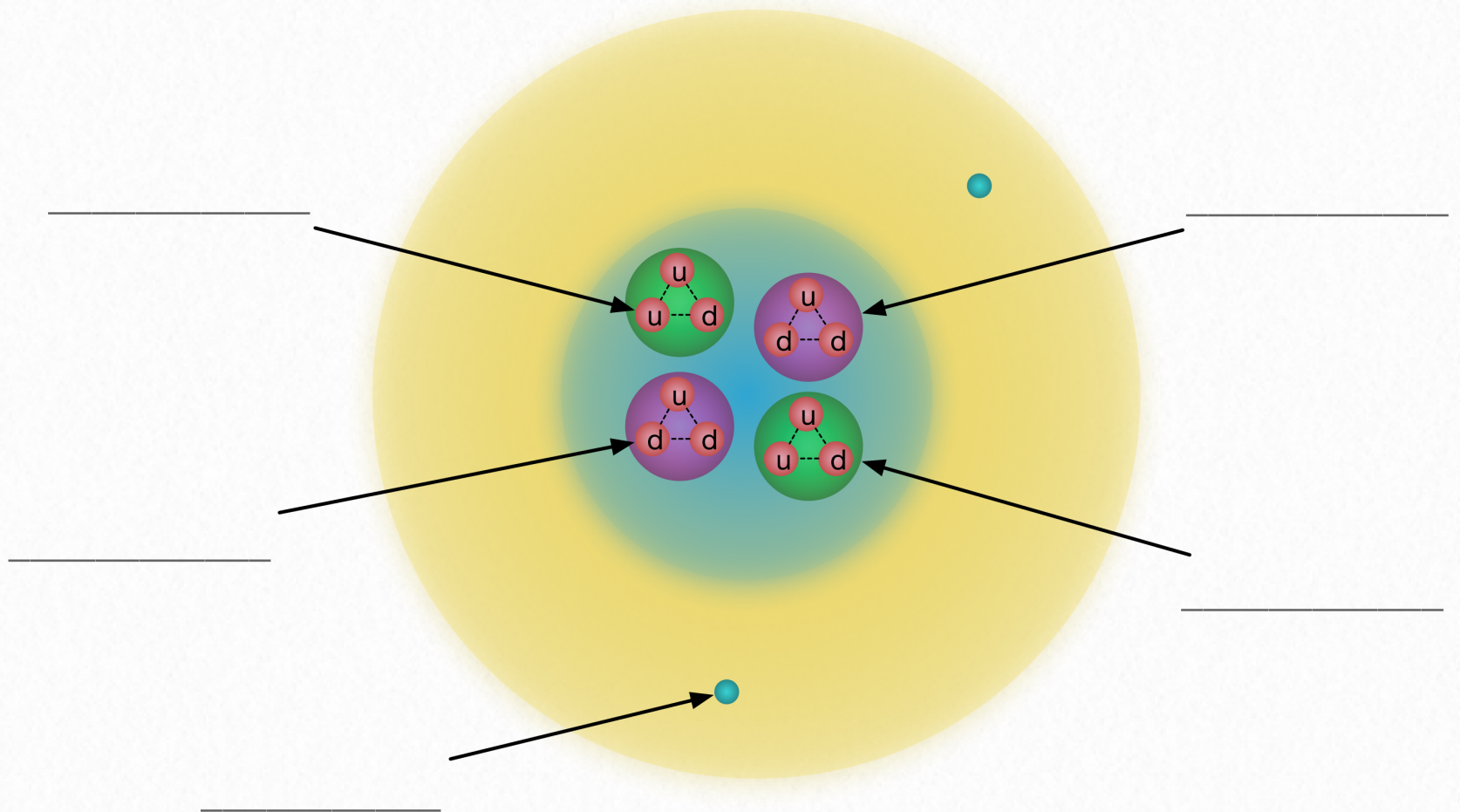


Questions

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:

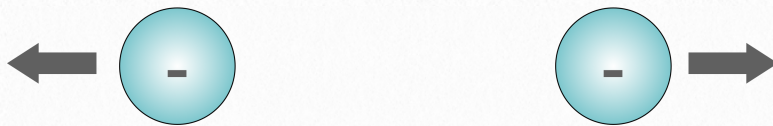
b) Give two examples of non-fundamental particles:

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^0 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^0 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

Particle Physics

8. An unstable nuclei undergoes radioactive emission to become more stable. Two possible decays are: β^- and β^+ decay. An isotope of carbon ${}^1_6\text{C}$ decays by beta emission into an isotope of nitrogen ${}^1_7\text{N}$. An isotope of magnesium ${}^{23}_{12}\text{Mg}$ decays by beta emission into an isotope of sodium ${}^{23}_{11}\text{Na}$.

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

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



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

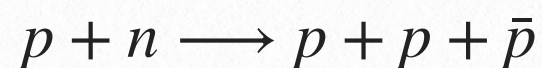


- b) State the two beta decays in terms of a quark model of the nucleons.

- i. beta-plus decay

- ii. beta-minus decay

9. State why the following reaction is not possible



Questions Continued

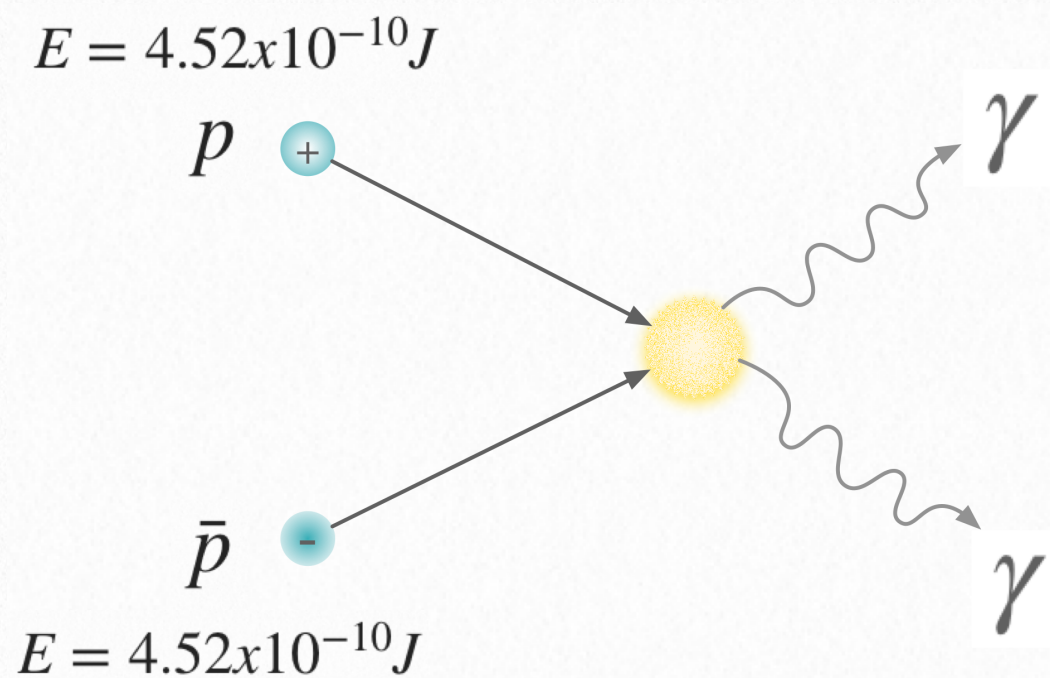
Particle Physics

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



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 $E = 4.52 \times 10^{-10} \text{ J}$, annihilate and produce two gamma photons.



Calculate the wavelength of each gamma photon.