

Follow along worksheet for

Fundamentals of Particle Physics by Emmanuel Olaiya

- 00:01:00 **1.** It takes **3** elementary particles to describe the matter around us.
- 00:03:10 **2.** Energy and mass are **equivalent**.
- 00:04:00 **3.** **1** up quark(s) and **2** down quark(s) make up the neutron.
- 00:06:30 **4.** Interactions are described by **underlying** fields.
- 00:06:50 **5.** For every field there is a **particle**.
- 00:07:30 **6.** The standard model doesn't describe **gravity**
- 00:08:30 **7.** A quark with a greater mass is more **unstable**.
- 00:10:00 **8.** What we see as light is a **photon** in a particular frequency range.
- 00:12:20 **9.** Emmy Noether proved mathematically that if you have **symmetry** you will also have a conservation law.
- 00:15:20 **10.** We can create unstable particles in particle **accelerators**.
- 00:16:30 **11.** When matter is created, **antimatter** must also be created.
- 00:19:20 **12.** Gluons can experience forces via **gluon** exchange (the strong force).
- 00:20:00 **13.** At Desy, in Germany, in some experiments **electrons** were fired at protons.
- 00:23:00 **14.** The weak force is so weak because the W and Z **bosons** are heavy.
- 00:25:10 **15.** Muon pairs can be produced **electromagnetically** and weakly.
- 00:27:30 **16.** The average mass of the Z boson is **91** GeV.
- 00:28:00 **17.** If the energy input into the interaction is close to the mass of the Z boson the probability of producing one is much **higher**.
- 00:29:10 **18.** A greater momentum gives a greater force **propagator**.
- 00:30:40 **19.** The more massive a particle the more it interacts with the **Higgs** field.
- 00:34:30 **20.** Black holes bend **light**.
- 00:36:30 **21.** LIGO detected a **gravitational** wave distorting space time.