

Follow along worksheet for

## Fundamentals of Particle Physics by Emmanuel Olaiya

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