

# Quiz 01

October 7, 2004

Name:

1. Give a few examples of the following ingredients of Standard Model.
  - leptons:
  - quarks:
  - gauge bosons:
2. Explain the role of the gauge bosons in the Standard Model.
3. Total cross section of  $e^+e^- \rightarrow \mu^+\mu^-$  reaction is given by  $\frac{4\pi\alpha^2}{3s}$ . What's the cross section in nb at  $s = 223\text{GeV}^2$ ? (Use  $\frac{4\pi\alpha^2}{3} \simeq 2.23 \times 10^{-4}$  and  $(\hbar c)^2 \simeq 0.389\text{GeV}^2\text{mb}$ )
4. When combining 3 quarks to form baryons, symmetry argument gives  $\mathbf{3} \otimes \mathbf{3} \otimes \mathbf{3} = \mathbf{10} \oplus \mathbf{8} \oplus \mathbf{8} \oplus \mathbf{1}$ . Why only  $\mathbf{10}$  and  $\mathbf{1}$  are used to explain hadron spectrum? Why the two  $\mathbf{8}$  configurations are not used?

5. Give a reason why we need a new quantum number of 3 *colors*?
  
  
  
  
  
  
  
  
  
  
6. When we try to separate out *one* individual quark, what happens?
  
  
  
  
  
  
  
  
  
  
7. When we have luminosity  $\mathcal{L} = 10^{33} \text{cm}^{-2} \text{s}^{-1}$ , what's the expected counting rates for a reaction with cross section of  $10 \mu\text{b}$  ( $1 \text{ b} = 10^{-24} \text{cm}^2$ )?
  
  
  
  
  
  
  
  
  
  
8. When electron scatters off the proton *elastically*, what's the value of the Bjorken variable  $x$ ?
  
  
  
  
  
  
  
  
  
  
9. Why do physicists want to build new machines to achieve high  $Q^2$  region?

