Problems/questions: Introductory particle physics

1. Natural units.
3. Virtual particles and Heisenberg uncertainty.
4. Beta decay, lepton number conservation.
5. Colour in QCD. Some arguments for it (theoretical, experimental).
6. Effective electric charge: running of fine structure constant
7. Quarks confinement, asymptotic freedom
9. Which particles are responsible for exchange of fundamental interactions?
10. Why exploration of matter at smaller and smaller scale requires higher and higher energies? Is it any alternative?
11. Relative strength of basic interactions (gravity, weak, electromagnetic, strong)
12. Basic interactions, coupling constants.
14. Lepton and barion numbers.
15. Isospin, strangeness, charm, hypercharge.
17. $SU(2)$ and $SU(3)$ groups. Mesoscopic and barionic multiplets.
18. Continuity equation, Schrödinger equation.
20. Dirac equation, Dirac matrices.
22. Feynman rules.
23. Cross section, decay width.
24. Kinematics and Mandelstam variables.
27. Feynman parton model. Valence quarks, sea quarks.
28. Gauge invariance and basic interactions.
29. Spontaneous symmetry breaking.
31. Neutrino oscillations.
32. GUT models, supersymmetry, extra dimensions.
33. Elementary particles and cosmology.

Enjoy and good luck!
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