Quantum Electrodynamics

Question 1:

Show that the $\vec{E}$ and $\vec{B}$ fields are invariant to gauge transformations.

Question 2:(involved)

Use minimal substitution ($\vec{p} \rightarrow \vec{p} - e\vec{A}$) in the Lagrangian describing a non-relativistic charged particle in a time independent magnetic field and show that the Euler Lagrange equations are the ones you would expect.

Question 3:(involved)

Starting from eqn (41), which you may assume holds for the Klein Gordon equation, compute the leading order Feynman rules for a spinless, charged particle scattering with a photon.

Question 4:

Draw the two Feynman diagrams appropriate to Compton scattering.

Question 5:

Show that for two body scattering of particles of equal mass m

$$s \geq 4m^2, \quad t \leq 0, \quad u \leq 0$$

Hint: since all variables are Lorentz invariant work in the CoM frame.

Question 6:

Prove the Gordon Decomposition.