P424 Assignment 2

1) Fun with isospin

(a) For which of the following is strong decay forbidden by isospin conservation? To determine the quark content and properties of the particles listed below, refer to the Review of Particle Properties summaries of mesons and baryons:
http://pdg.lbl.gov/2005/tables/contents_tables.html

1. $\omega(783) \rightarrow \rho^+(770)\pi^-$
2. $\phi(1680) \rightarrow \phi(1020)\pi^0$
3. $K^*(892) \rightarrow K\pi$
4. $\rho^0(770) \rightarrow \pi^0\pi^0$

Note that some of these may be forbidden by other things (e.g. kinematics), and that decays forbidden by isospin can occur via electromagnetic or weak decay, so don't just look for the presence or absence of a decay mode in the PDG tables when answering this question. Look at the isospin quantum number for each particle and use angular momentum addition (or Clebsch-Gordon tables).

2) Selection rules

Parity and Charge Conjugation are good symmetries of both the strong and the electromagnetic interactions, as is angular momentum. Use these to answer the following questions.

(a) The η decays to three pions but not to two; what prevents it?

(b) The decay $B^+ \rightarrow K^+\gamma$ is forbidden - by what?

(c) What forbids the decay $\pi(1300) \rightarrow 3\gamma$?

(d) The decay $K^+ \rightarrow \pi^+\pi^0$ violates isospin and parity (verify this for yourself). How does it occur?