Assignment 5

Due Tuesday, October 10

Problem 1
Evaluate the ratios between the cross sections at the same energy of
(1) \( \pi^- + p \rightarrow K^0 + \Sigma^0 \),
(2) \( \pi^- + p \rightarrow K^+ + \Sigma^- \),
(3) \( \pi^+ + p \rightarrow K^+ + \Sigma^+ \),
taking into account the contributions of both isospin amplitudes, \( A_{1/2} \) and \( A_{3/2} \).

Problem 2
Evaluate the ratio of the cross sections of the processes \( p + d \rightarrow ^3\text{He} + \pi^0 \) and \( p + d \rightarrow ^3\text{H} + \pi^+ \) at the same value of the CM energy \( \sqrt{s} \). Note that \(^3\text{He} \) and \(^2\text{H} \) are an isospin doublet.

Problem 3
Express the ratio of cross sections of the elastic \( \pi^- + p \rightarrow \pi^- + p \) and the charge exchange \( \pi^- + p \rightarrow \pi^0 + n \) scattering processes in terms of the isospin amplitudes \( A_{1/2} \) and \( A_{3/2} \).

Problem 4
The state \( \Delta(1232) \) has isospin \( I = 3/2 \).
(1) What is the ratio between the decay rates \( \Delta \rightarrow p + \pi^- \) and \( \Delta \rightarrow n + \pi^0 \)?
(2) What would it have been if \( I = 1/2 \)?
Problem 5

Considering the relevant conservation laws in the following three processes, guess which particle is represented by $X$ in each one; explain the answers.

(a) $\pi^- + p \rightarrow \Sigma^0 + X$

(b) $e^+ + n \rightarrow p + X$

(c) $\Xi^0 \rightarrow \Lambda + X$