Phy 523
PARTICLE PHYSICS
Problem sheet X

30th March 2009

(due date) Just before the final examination

All the problems below pertain to the Standard Model

46. Write down the matrix element for the processes (include normalisation and momentum conservation) for

$$\nu_e + e^- \rightarrow \nu_e + e^-$$

$$\bar{\nu}_e + e^- \rightarrow \bar{\nu}_e + e^-$$

47 Write down the matrix element for(include normalisation and momentum conservation)

$$e^- + u \rightarrow e^- + u$$

$$\nu_e + d \rightarrow u + e^-$$

48. Calculate the decay rate for (a) $Z^0 \rightarrow \nu_e + \bar{\nu}_e$ (b) $Z^0 \rightarrow e^+ + e^-$.

49. Calclate the decay rate for (a) $W^- \rightarrow e^- + \bar{\nu}_e$ (b) $W^- \rightarrow \bar{u} + d$

50. Calculate the total cross section for the reaction in the c.m frame

$$\nu_e + d \rightarrow u + e^-$$