# QM4226
# QUANTUM THEORY : REVISION OF SEC.3

1. The TISE, with appropriate assumptions, takes the form :
   $-(\frac{S'}{\hbar})^2 + \frac{iS''}{\hbar} + \frac{P^2(x)}{\hbar^2} = 0$ Derive this and explain the symbols.

2. By expanding $S$ in a power series, derive the form of the WKB wavefunction in a classically allowed region (eq 3.14 in the notes).

3. Explain all the assumptions that went into the WKB (ie say something appropriate about $\lambda'$ and something about $\hbar$).

4. Justify in physical terms the form of the prefactor in the WKB wavefunction $1/\sqrt{p}$. Explain why it means you need connection formulae.

5. By linearising the TISE around a turning point, obtain the differential eq. solved by Airy functions. ie $\psi'' - z\psi = 0$ where $z = (2mg/\hbar^2)^{1/3}\ (x - a)$. What useful properties do the Airy functions $Ai$ and $Bi$ have, far from the turning points?

6. Explain why you need arrows in the connection formulae. (see handout)

7. Given eq 3.26, show that a potential well, with no rigid walls has a $(n + \frac{1}{2})\pi$ quantization condition. Compare with Bohr-somerfeld quantization condition.

8. Show that a potential well with one rigid wall has a $(n + \frac{3}{4})\pi$ quantization condition.

9. Show that a potential well with two rigid walls has a $(n + 1)\pi$ quantization condition.

10. Derive the WKB formula for tunneling $T = e^{-2\Lambda}$... long derivation!