PHYS 202323/60323: Fall 2020 LaTeX Example

1. Consider a particle confined in a two-dimensional infinite square well

$$V(x,y) = \begin{cases} 0, if 0 \geq x \geq a, 0 \geq y \geq a \\ \infty, otherwise \end{cases} (1)$$

The eigenfunctions have the form:

$$\Psi(x,y) = \frac{2}{a} sin\left(\frac{n\pi x}{a}\right) sin\left(\frac{m\pi y}{a}\right) \tag{2}$$

with the corresponding energies being given by:

$$E_n m = (n^2 + m^2)\frac{\pi^2 h^2}{2ma^2}(3)$$

(a) (5 points) What are the levels of degeneracy of the five lowest energy values?

(b) (5 points) Consider a perturbation given by:

$$\hat{H}' = a^2 V_0(x - \frac{a}{2})(y - \frac{a}{2}) \tag{4}$$

Calculate the first order correction to the ground state energy

2.The following questions refer to the stars in the Table below.

Note: There may be multiple answers.

Name	Mass	Luminosity	Lifetime	Temperature	Radius
Zeta	60. $M_s un$	$10^6 L_{sun}$	$8.0x10^5 years$		
Epsilon	$6.0M_s un$	$10^3 L_{sun}$		20,000K	
Delta	$2.0M_s un$		$5.0x10^8 years$		2 R_{sun}
Beta	$1.3M_s un$	$3.5L_{sun}$			
Alpha	$1.0M_s un$				1 R_{sun}
Gamma	$0.7M_{sun}$		4.5x $10^10 years$	5000K	

(a) (4 points) Which of these stars will produce a planetary nebula at the end of their life.

(b) (4 points) Elements heavier than Carbon will be produced in which stars