(a) $c_1 = \frac{4\sqrt{15}}{\pi^3}(1 - \cos(\pi)) = 8\sqrt{15}/(\pi^3)$ [1 mark]

$c_2 = \frac{4\sqrt{15}}{8\pi^3}(1 - \cos(2\pi)) = 0$ [1 mark]

$c_3 = \frac{4\sqrt{15}}{27\pi^3}(1 - \cos(3\pi)) = 8\sqrt{15}/(27\pi^3)$ [1 mark]

general form is $c_n = 0$ for even n, $c_n = 8\sqrt{15}/(n^3\pi^3)$ for odd [1 mark]

all even n will be zero as these are all antisymmetic about the midpoint whereas the wavefunction to be described is symmetic. [2 marks]

(b) $< E >= \sum_n c_n^2 E_n$ [1 mark]

$= \sum_{oddn} 64.15/(n^6\pi^6)n^2 E_1$ [1 mark]

$= \sum_n (64.15/\pi^6)E_1/n^4 = (64.15/96)E_1/\pi^2 = 10E_1/\pi^2$ [1 mark]

no single measurement can give this as its not one of E_n. [1 mark]