1) 162(7): Test of Eq. (8) of Note 162(6) with H Atom

The energy levels of the H atom are given by:

$$E = -\frac{E_R}{n^2}, \quad n = 1, 2, \ldots \quad -(1)$$

where

$$E_R = -2.2 \times 10^{-18} J. \quad -(2)$$

So

$$E_1 = -2.2 \times 10^{-18} J \quad -(3)$$

$$E_2 = -0.55 \times 10^{-18} J \quad -(4)$$

If the rest mass of the electron is accepted to be:

$$m = 9.10953 \times 10^{-31} kgm \quad -(5)$$

then

$$E_0 = mc^2 = 8.1872 \times 10^{-14} J \quad -(6)$$

Therefore:

$$\cos\theta = \frac{E_1 E_2 - E_0^2}{(E_1^2 - E_0^2)^{1/2}(E_2^2 - E_0^2)^{1/2}}$$

$$\sim -1 \quad -(7)$$

In eqs. (13) - (16) of note 162(6), eq. (7) gives:

$$a = 2, \quad b = (E_1 - E_2)^2, \quad c' = 2E_1^2 E_2 \quad -(8)$$

so:

$$E_0^2 = \frac{1}{4}\left[-(E_1 - E_2)^2 \pm \left((E_1 - E_2)^4 - 8E_1^2 E_2^2\right)^{1/2}\right] \quad -(9)$$

in which:

$$(E_1 - E_2)^4 = 7.41 \times 10^{-72} \quad J^4$$

$$8E_1^2 E_2^2 = 11.71 \times 10^{-72} \quad J^4$$

So the result (9) is wildly self-inconsistent.

2) The theory of atomic absorption fails completely if conservation of momentum is considered. Conservation of momentum is:

$$\underline{p}' + \hbar \underline{\kappa} = \underline{p}'' \quad - (10)$$

where $\underline{p}'$ is the initial momentum of the electron in orbital 1, and $\underline{p}''$ the final momentum of the electron in orbital 2. We have:

$$\underline{p}' = \gamma' m \underline{v}' \quad - (11)$$

$$\underline{p}'' = \gamma'' m \underline{v}'' \quad - (12)$$

Therefore

$$c^2 p'^2 = \gamma'^2 m^2 c^4 \frac{v'^2}{c^2}$$

$$= \gamma'^2 m^2 c^4 \left(1 - \frac{1}{\gamma'^2}\right)$$

$$= \gamma'^2 m^2 c^4 - m^2 c^4$$

$$= E'^2 - E_0^2 \quad - (13)$$

So:

$$E'^2 = c^2 p'^2 + E_0^2 \quad - (14)$$

$$E''^2 = c^2 p''^2 + E_0^2 \quad - (15)$$

This gives eq. (7), QED from note 163(6), with $E_1 = E'$, $E_2 = E''$.