1) 162(1): Theory of Absorption with Momentum Exchange.

The usual theory of absorption is expressed as:

$$E_i + \hbar\omega = E_f \quad -(1)$$

where E_i is the initial energy of an electron in an atom and E_f its final energy. The photon of energy $\hbar\omega$ is absorbed into the atom. The de Broglie energy postulate gives:

$$E_i = \gamma' m_2 c^2 \quad -(2)$$

$$E_f = \gamma'' m_2 c^2 \quad -(3)$$

$$\hbar\omega = \gamma m_1 c^2 \quad -(4)$$

where m_1 is the photon mass and m_2 is the electron mass.

Therefore:

$$\gamma m_1 c^2 + \gamma' m_2 c^2 = \gamma'' m_2 c^2, \quad -(5)$$

with

$$\hbar\omega' = \gamma' m_2 c^2 \quad -(6)$$

$$\hbar\omega'' = \gamma'' m_2 c^2 \quad -(7)$$

So:

$$\frac{\omega''}{\omega'} = \frac{\gamma''}{\gamma'}, \quad \frac{\omega'}{\omega} = \frac{m_2}{m_1}\frac{\gamma'}{\gamma}, \quad \frac{\omega''}{\omega} = \frac{m_2}{m_1}\frac{\gamma''}{\gamma} \quad -(8)$$

It follows that eq. (5) is:

$$\boxed{\omega = \omega'' - \omega'} \quad -(9)$$

Using:

$$E_i = \hbar\omega', \quad E_f = \hbar\omega'' \quad -(10)$$

eq. (9) and eq. (1) are the same, Q.E.D.

Consider the laws of conservation of momentum corresponding to eq. (1):

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

The de Broglie momentum postulate gives:

$$\underline{p} = \hbar \underline{\kappa} = \gamma m_1 \underline{v} \quad -(12)$$

$$\underline{p}'' = \hbar \underline{\kappa}'' = \gamma'' m_2 \underline{v}'' \quad -(13)$$

$$\underline{p}' = \hbar \underline{\kappa}' = \gamma' m_2 \underline{v}' \quad -(14)$$

Here $\underline{p}$ is the photon momentum, $\underline{p}'$ is the orbital electron momentum in orbital 1, $\underline{p}''$ is the orbital electron momentum in orbital 2. Therefore:

$$\kappa^2 = \kappa''^2 + \kappa'^2 - 2\kappa''\kappa'\cos\theta. \quad -(15)$$

Using the de Broglie equation:

$$\kappa = \omega v / c^2 \quad -(16)$$

eq. (15) is:

$$\omega^2 v^2 = \omega''^2 v''^2 + \omega'^2 v'^2 - 2\omega'\omega'' v' v'' \cos\theta \quad -(17)$$

If $x_1 = m_1 c^2/\hbar$, $x_2 = m_2 c^2/\hbar$ $-(18)$

Then eq. (17) is:

$$\omega^2 - x_1^2 = \omega''^2 - x_2^2 + \omega'^2 - x_2^2 - 2\left(\omega''^2 - x_2^2\right)^{1/2}\left(\omega'^2 - x_2^2\right)^{1/2}\cos\theta \quad -(19)$$

The photon mass is given by the non-constant: $-(20)$

$$\boxed{x_1^2 = 2x_2^2 - \left(\omega''^2 + \omega'^2\right) - \left(\omega'' - \omega'\right)^2 + 2\left(\omega''^2 - x_2^2\right)^{1/2}\left(\omega'^2 - x_2^2\right)^{1/2}\cos\theta}$$

The theory of absorption collapses.