$$E = \sqrt{m^2 c^4 + p^2 c^2} = \gamma \cdot m \cdot c^2$$

Photon $m = \phi$

$$E = p \cdot c = \gamma \cdot m \cdot c^2 \quad \gamma = \infty \quad m = \phi$$

De Broglie $\lambda = h/p$ $\lambda = c/f$

$E = pc = hf$ frequency not change

glass $n = 1.5$ $v = \frac{c}{1.5}$ $\lambda = \frac{c}{n \cdot f}$