Dr. Sasha

I would like to remind you that we debate the task N15 from 5.06.2015.

It is the citation from your text (file answer15re.pdf)

1. Sorry, there was a misspelling.. The correct answer is

$$\Omega = \sqrt{\frac{g^2}{\omega^2 l^2} - \omega^2},$$

with a correct dimension.

How this expression may be truth? For example: $\omega = 2$ rad/s, $\sqrt{\frac{g}{l}} = 1$ rad/s ($\omega > \sqrt{\frac{g}{l}}$) then $\Omega = \frac{i\sqrt{15}}{4}$ (imaginary quantity).

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3. Let $\vec{p}_\gamma$ be the momentum of the incident photon, $\vec{p}_p$ and $\vec{p}_\pi$ be the momentum of the proton and the pion respectively after the reaction. Then due to conservation laws

$$\vec{p}_\gamma = \vec{p}_p + \vec{p}_\pi,$$
$$p_\gamma c + m_p c^2 = \sqrt{m_p^2 c^4 + p_p^2 c^2} + \sqrt{m_\pi^2 c^4 + p_\pi^2 c^2}.$$

It may be proved that in case of constant momentum the energy of the products is minimal when $p_\pi = 0$. Then the equations may be simplified:

$$p_\gamma c + m_p c^2 = \sqrt{m_p^2 c^4 + p_\gamma^2 c^2} + m_\pi c^2,$$

which implies

$$p_\gamma = m_\pi c \frac{2m_p - m_\pi}{2\left(m_p - m_\pi\right)}.$$

For discussion, I present another solution of the system equations:

$$\vec{p}_\gamma = \vec{p}_p + \vec{p}_\pi$$
$$p_\gamma \cdot c + m_p \cdot c^2 = \sqrt{m_p^2 \cdot c^4 + p_p^2 \cdot c^2} + \sqrt{m_\pi^2 \cdot c^4 + p_\pi^2 \cdot c^2} , \qquad (1)$$

where $p_\gamma = m_\pi \cdot c \cdot \left(1 + \frac{m_\pi}{2m_p}\right)$, $p_p = m_\pi \cdot c \cdot \left(1 - \frac{m_\pi}{2(m_p + m_\pi)}\right)$, $p_\pi = p_\gamma - p_p$. From this solution the threshold photon energy $p_\gamma \cdot c \approx 144.7$ MeV.

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Then the threshold energy of the photon is

$$\varepsilon_{\min} = p_\gamma c = m_\pi c^2 \frac{2m_p - m_\pi}{2(m_p - m_\pi)} = 146.3 \text{ MeV}.$$

How do you think it is possible that some one receive value of the threshold energy less than 144.7 MeV ?.