$t_A = 3.5\,s$ A

$t_B = 12\,s$ B

$\Delta t = 12\,s - 3.5\,s = 8.5\,s$ travel time

$t_{hit} = t_A + \frac{\Delta t}{2} = 3.5\,s + \frac{8.5\,s}{2} = 7.75\,s$

$\Delta x = c\,\frac{\Delta t}{2} = (3\times10^8\,m/s)\left(\frac{8.5\,s}{2}\right)$

$\Delta x = 1.275\times10^9\,m$

$L = 100\,m$

$x' = 0$ rear

$x = 0$ light

$t = t' = 0$ and $x = 0 = x'$

$v = 20\,m/s$

at $t = 10\,s$ headlight at

$x' = ?$ $x = ?$

$x' = 100\,m$ front of train

$x' = x - vt$

$x = x' + vt = 100\,m + (20\,m/s)(10\,s)$

$= 300\,m$

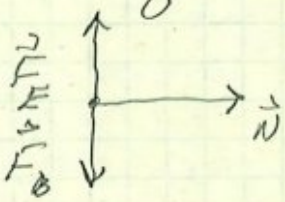
3) $\vec{E} = -E\hat{k}$ $\vec{B} = B\hat{j}$ $B = 20 \times 10^{-3}\,T$

$E = qvB\sin\alpha$ $\alpha = 90°$

$E = vB$

$= (1.62 \times 10^{7}\,m/s)(20 \times 10^{-3}\,T)$

$$E = 3.24 \times 10^{5}\ \frac{N}{C}$$



$E = \frac{1}{2}mv^2$

$v = \sqrt{\frac{2E}{m}}$

give from this $= \sqrt{\frac{2\,(750\ eV)\,(1.6 \times 10^{-19}\ J/eV)}{9.11 \times 10^{-31}\ kg}}$

$= 1.62 \times 10^{7}\ m/s$

Units: $\frac{m}{s}\ \frac{N}{C}\ \frac{s}{m} = \frac{N}{C}$

$t = 0$ A

$t = 45\ s$ B $\quad \Delta t = 45\ s$

$L = 9 \times 10^9\ m = \Delta x = 30\ l\text{-}s$

$\Delta s_{AB} = ? \quad \Delta t' = ?$

$$\Delta s_{AB}^2 = c^2 \Delta t'^2 = c^2 \Delta t^2 - \Delta x^2$$

$$\Delta s_{AB} = \left[\left(3 \times 10^8 \frac{m}{s}\right)^2 \left(45\ s_{2025}\right)^2 - (9 \times 10^9\ m)^2 \right]^{1/2}$$

$$\boxed{\Delta s_{AB} = 1.01 \times 10^{10}\ m} \quad \text{or} \quad 33\ l\text{-sec}$$

$$c^2 \Delta t'^2 = \Delta s_{AB}^2$$

$$\Delta t' = \frac{\Delta s}{c}$$

$$= \frac{1.01 \times 10^{10}\ m}{3 \times 10^8\ m/s}$$

$$\boxed{\Delta t' = 33.5\ s} < 45\ s$$