Question#19310

Two people (one with a mass of 40 kg and the other having a mass of 60kg) stand at one end of a small uniform boat of mass 100 kg and length 20 m. The 60kg person now slowly walks to the other end of the boat. Determine how far the boat moves in the process assuming no friction between the boat and water.

Solution:

Let:

M_1=40 kg

M_2=60 kg

M_b=100 kg

L=20 m

S - ?

According to the law of conservation of linear momentum (implied by Newton's laws):

$M_2V_2=(M_1+M_b)V_1$, were V_2, V_1 the velocities of the 60 kg person and boat+40 kg person respectively.

Such as:

S=Vt, were t-time of walking:

$V_2=L/t$;

$V_1=S/t$;

$M_2L/t=(M_1+M_b)S/t$

$M_2L=(M_1+M_b)S$

S= $M_2L/(M_1+M_b)$

S=20*60/(40+100)=8.57 m

Answer: 8.57 m.