

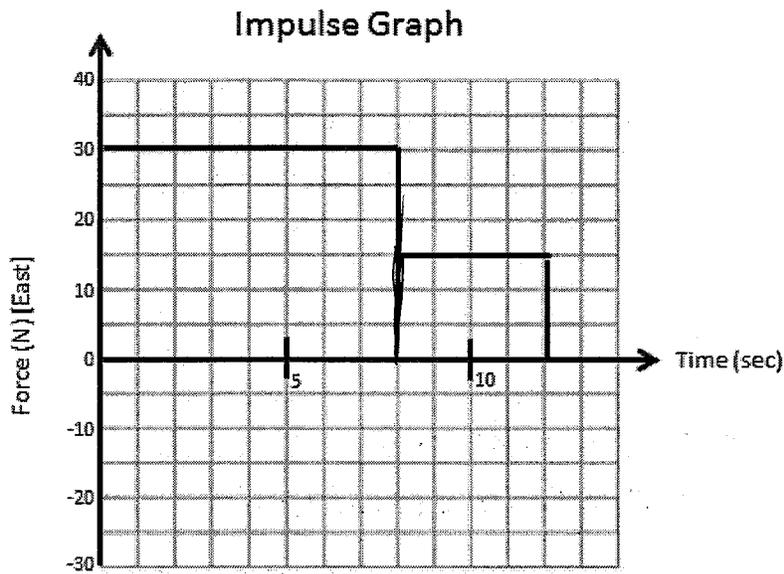
First Name: _____

Last Name: _____

Physics 30 – Unit A: Momentum – L03 – Impulse Graphs

The graph below depicts the forces acting on an initially stationary 3kg mass. Use this information to answer the questions below.

$$v_i = 0 \text{ m/s}$$



Q1: What is the impulse acting on the 3kg mass over the first 8 seconds?

$$\begin{aligned} \text{Impulse} &= \text{Area under graph} \\ &= (30 \text{ N})(8 \text{ s}) \\ &= 240 \text{ N}\cdot\text{s} \text{ [East]} \end{aligned}$$

Q2: What is the velocity of the 3kg mass at 8 seconds?

$$\begin{aligned} \text{Impulse} &= m \Delta \vec{v} \\ 240 \text{ N}\cdot\text{s} &= (3 \text{ kg}) \Delta \vec{v} \\ \Delta \vec{v} &= 80 \text{ m/s [East]}, \text{ where } v_i = 0 \text{ m/s. So } \vec{v}_f = 80 \text{ m/s [East]} \end{aligned}$$

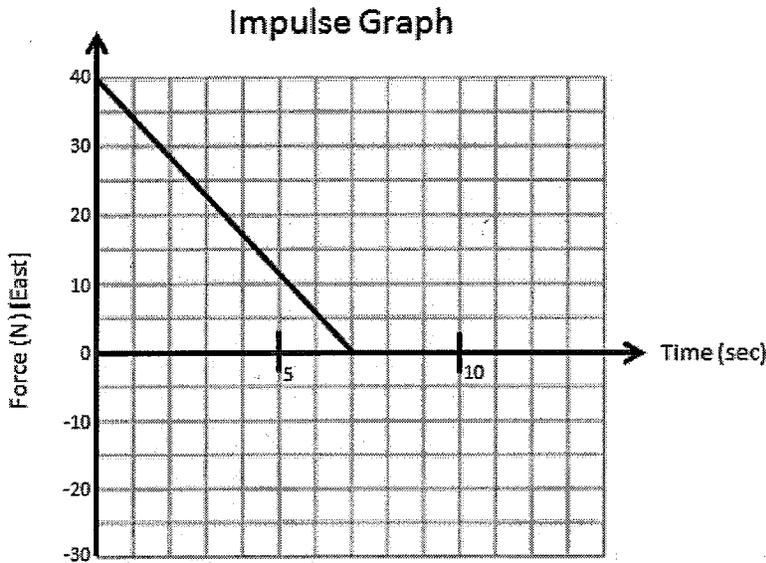
Q3: What is the impulse acting on the 3kg mass over the total 12 seconds?

$$\begin{aligned} \text{Impulse} &= \text{Area under graph} \\ &= (30 \text{ N})(8 \text{ s}) + (15 \text{ N})(4 \text{ s}) \\ &= 240 + 60 \\ &= 300 \text{ N}\cdot\text{s} \text{ [East]} \end{aligned}$$

Q4: What is the velocity of the 3kg mass at 12 seconds?

$$\begin{aligned} \text{Impulse} &= m \Delta \vec{v} \\ 300 \text{ N}\cdot\text{s} \text{ [East]} &= 3 \text{ kg } \Delta \vec{v} \\ \Delta \vec{v} &= 100 \text{ m/s [East]}, \text{ where } v_i = 0 \text{ m/s so } \vec{v}_f = 100 \text{ m/s [East]} \end{aligned}$$

The graph below depicts the forces acting on a 12kg mass. Use this information to answer the questions below.



Q5: The 12kg mass experiences an impulse of $a.bc \times 10^d$, where $a, b, c,$ and d are , , , and .

1	4	0	2
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$$\begin{aligned} \text{Impulse} &= \text{Area under graph} \\ &= \frac{(40)(7)}{2} = 140 \text{ N}\cdot\text{s} [\text{East}] \\ &= 1.40 \times 10^2 \text{ N}\cdot\text{s} [\text{East}] \end{aligned}$$

Q6: If the 12kg mass was initially moving at 15 m/s [West], then its final velocity is $a.bc \times 10^d$, where $a, b, c,$ and d are , , , and .

3	4	0	0
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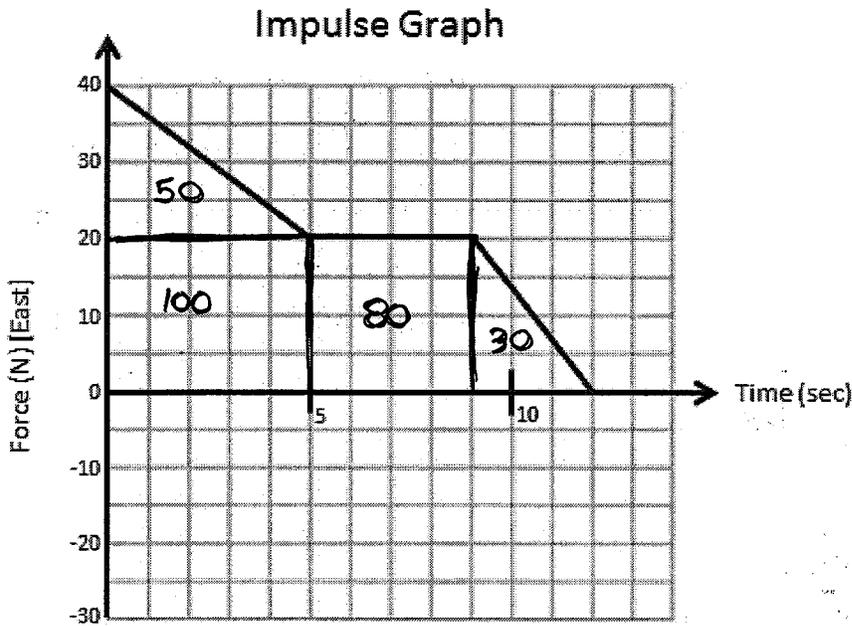
$$\begin{aligned} \text{Impulse} &= m \Delta \vec{v} \\ 1.40 \times 10^2 \text{ N}\cdot\text{s} &= 12 \text{ kg } \Delta \vec{v} \\ \Delta \vec{v} &= 11.6 [\text{East}] \end{aligned}$$

$$\begin{aligned} \Delta \vec{v} &= \vec{v}_f - \vec{v}_i \\ 11.6 \text{ m/s} [\text{E}] &= \vec{v}_f - (-15 \text{ m/s} [\quad]) \\ 11.6 &= v_f + 15 \\ -15 &\quad -15 \\ v_f &= -3.4 \text{ m/s} [\text{E}] \\ v_f &= 3.4 \text{ m/s} [\text{W}] \\ &= 3.40 \times 10^0 \text{ m/s} [\text{W}] \end{aligned}$$

KEY

The graph below depicts the forces acting on an initially stationary 5kg mass. Use this information to answer the questions below.

$$v_i = 0 \text{ m/s}$$



Q7: The instantaneous velocity of the 5kg mass at 5 seconds is $a.bc \times 10^d$, where a , b , c , and d are __, __, __, and __.

3	0	0	1
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Impulse = Area under graph
 $= 150 \text{ N}\cdot\text{s} [E]$

$$\vec{F} \Delta t = m \Delta \vec{v}$$

$$150 \text{ N}\cdot\text{s} [E] = 5 \text{ kg } \Delta \vec{v}$$

$$\Delta \vec{v} = 30 \text{ m/s} [E] \quad \text{where } \vec{v}_i = 0 \text{ m/s} \quad \text{so } \vec{v}_f = 30 \text{ m/s} [E]$$

$$\vec{v}_f = 3.00 \times 10^1 \text{ m/s} [E]$$

Q8: The instantaneous velocity of the 5kg mass at 9 seconds is $a.bc \times 10^d$, where a , b , c , and d are __, __, __, and __.

4	6	0	1
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Impulse = Area under graph
 $= 230 \text{ N}\cdot\text{s} [E]$

$$\vec{F} \Delta t = m \Delta \vec{v}$$

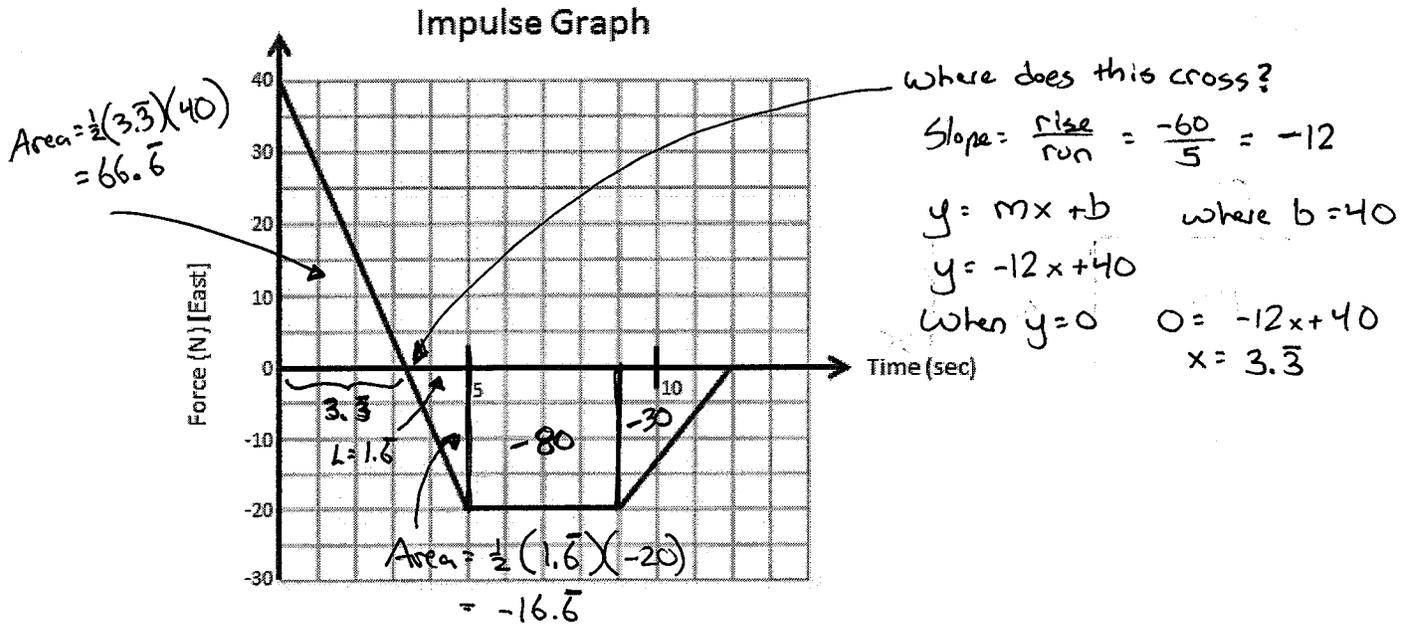
$$230 \text{ N}\cdot\text{s} [E] = 5 \text{ kg } \Delta \vec{v}$$

$$\Delta \vec{v} = 46 \text{ m/s} [E], \quad \text{where } \vec{v}_i = 0 \text{ m/s} \quad \text{so } \vec{v}_f = 46 \text{ m/s} [E]$$

$$\vec{v}_f = 4.60 \times 10^1 \text{ m/s} [E]$$

KEY

The graph below depicts the forces acting on an initially stationary 5kg mass. Use this information to answer the questions below.



Q9: The total impulse acting on the 5kg mass over the 12 seconds is $\underline{\hspace{1cm}}$ $\times 10^w$ Ns.
(Record your **two-digit answer** in the numerical-response section on the answer sheet.)

6	.	0	
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$$\begin{aligned} \text{Area under graph} &= +66.6 - 16.6 - 80 - 30 \\ &= -60 \text{ N}\cdot\text{s} \\ &= -6.0 \times 10^1 \text{ N}\cdot\text{s} \end{aligned}$$

Q10: The speed of the 5kg mass at 12 seconds is $\underline{\hspace{1cm}}$ $\times 10^w$ m/s.
(Record your **two-digit answer** in the numerical-response section on the answer sheet.)

1	.	2	
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$$\begin{aligned} \text{Impulse} &= -60 \text{ N}\cdot\text{s} \text{ [E]} \\ \vec{F}\Delta t &= m\Delta\vec{v} \\ -60 \text{ N}\cdot\text{s} &= (5 \text{ kg})\Delta\vec{v} \\ \Delta\vec{v} &= 12 \text{ m/s} \text{ [W]} \\ &= 1.2 \times 10^1 \text{ m/s} \text{ [W]} \end{aligned}$$