AP Physics - Unit 5

Tippen #1 - Unit 5 - KEY

#1. A) $p = mv$

$A > C > D > B$

A: $p = (8\,kg)(3\,m/s) = 24\ kg\cdot m/s$

B $p = (2\,kg)(-7\,m/s) = -14\ kg\cdot m/s$

C $p = (5\,kg)(3\,m/s) = 15\ kg\cdot m/s$

D $p = (2\,kg)(7\,m/s) = 14\ kg\cdot m/s$

B) $KE = \frac{1}{2}mv^2$

$B = D > A > C$

A $KE = \frac{1}{2}(8\,kg)(3\,m/s)^2 = 36\ J$

B $KE = \frac{1}{2}(2\,kg)(7\,m/s)^2 = 49\ J$

C $KE = \frac{1}{2}(5\,kg)(3\,m/s)^2 = 22.5\ J$

D $KE = \frac{1}{2}(2\,kg)(7\,m/s)^2 = 49\ J$

#2 $J = F\Delta t$

Can rank just on force since Δt is the same for all 4

$D > A = B > C$

#3 A) less than

$W_{net} = \Delta KE$

$= \frac{1}{2}m(v_f^2 - v_i^2)$

∴ same mass both cars only depends on Δv^2

Amanda

$= (20^2 - 10^2) =$

$= 400 - 100 = 300$

Bertha

$= (30^2 - 20^2)$

$= 900 - 400 = 500$

B) same as

$J = F\Delta t = \Delta p$

$\Delta p = m\Delta v$

$F\Delta t = m\Delta v$

Both Δv: $30 - 20 = 10$

$20 - 10 = 10$

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#4 A) B = C > A

Ranked on Velocity, Based on magnitude of the momentum $= mv$

Key word

Velocity only matters since the mass is the same

B) B = C > A

Ranked on Velocity, based on $KE = \frac{1}{2}mv^2$

Velocity only matters since mass is the same

direction doesn't matter, KE is scaler

#5 A) Block A less than Block B

Block A has smaller mass ($PE_g = mgh$) & they Both fall from same height

B) Same speed

$$\cancelto{0}{KE_i} + U_{g_i} = KE_f + \cancelto{0}{U_{g_f}}$$
$$\cancel{m}gh = \frac{1}{2}\cancel{m}v_f^2$$
$$V_f = \sqrt{2gh}$$

Energy is conserved & mass cancels out

V same for Both

C) Block A Less momentum than Block B

$p = mv$

Block A has smaller mass than Block B

& Both Blocks have same V

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\#6 Rank time to stop $D > A = C > B$

Impulse → $F\Delta t = \Delta p$

$= mv$

$\Delta t = \frac{mv}{F}$ same Fnet for all

$\therefore \Delta t = mv$

A) $= (3000\,kg)(10\,m/s) = 30{,}000$

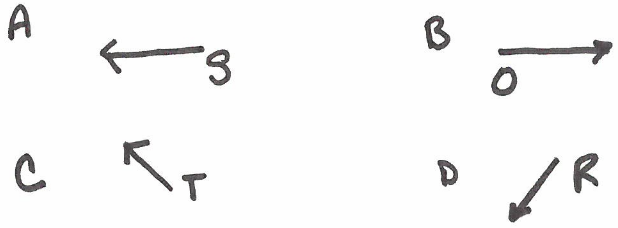
B) $= (1000\,kg)(20\,m/s) = 20{,}000$

C) $= (1000\,kg)(30\,m/s) = 30{,}000$

D) $= (2000\,kg)(20\,m/s) = 40{,}000$

Since the same force is acting on all cars and we are asked about the time interval to bring the cars to rest, the physical quantity involved is the momentum. The barriers are going to exert an impulse on the cars bringing them to rest and that impulse will be equal to the change in momentum for the cars. So the ranking is based on the product of the mass and velocity.

\#7 A)



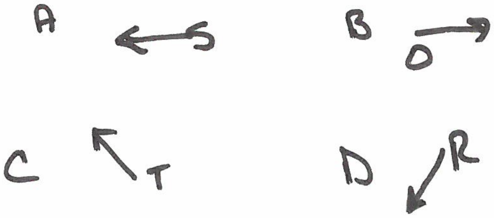
Impulse is the Δ in p

So we need to take the

final p − Initial p

Also p is a vector

B)



Both part A, B are

the same since

Impulse = Δp

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#8 All have same $\Delta p = -40\ kg \cdot m/s$

$\Delta p = m\Delta v$
$= m(v_f - v_i)$

A) $= 10kg(0 - 4m/s)$
$= -40\ kg \cdot m/s$

C) $= 10kg(-2 - 2m/s)$
$= -40\ kg \cdot m/s$

B) $= (10kg)(-1 - 3m/s)$
$= -40\ kg\,m/s$

D) $= 5kg(-3 - 5m/s)$
$= -40\ kg \cdot m/s$

#9 $B > A = D > C$

$\Delta p = \cancel{m}\,\Delta v$

All have same mass
∴ Δv is what Δp depends on

A) $= 0 - 10m/s$
$= -10$

B) $= -10 - 10$
$= -20$

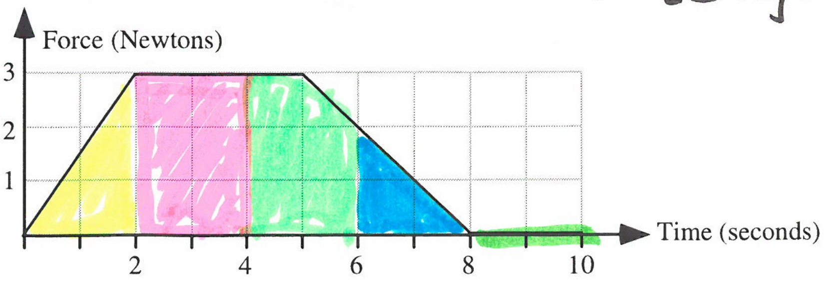
C) $= 20 - 20$
$= 0$

D) $= -20 - -10$
$= -10$

#10 *Answer: This statement is incorrect because momentum is a vector so the change in momentum (taking to the right as the positive direction) is equal to 2 kg (–7 m/s – (+3 m/s)) = –20 kg • m/s, or 20 kg • m/s to the left.*

Δp
$F\Delta t = m\Delta v = m(v_f - v_i) = 2kg(-7m/s - 3m/s)$
$= -20\ kg\,m/s$

#11



Rank the impulse applied to the box by this force during each 2-second interval indicated below.

A. 0 to 2 s **B. 2 to 4 s** **C. 4 to 6 s** **D. 6 to 8 s** **E. 8 to 10 s**

Answer: B > C > A > D > E.

The impulse for each time interval is equal to the area under the graph during that time interval. From zero to 2 seconds this is 2 kg m/s; from 2 to 4 seconds it is 4 kg m/s; from 4 to 6 seconds it is 3.67 kg m/s; from 6 to 8 seconds it is 1.33 kg m/s; and from 8 to 10 seconds it is zero. (Note that you don't really need to calculate values as a visual inspection will enable one to rank the areas.)