Multiple Choice

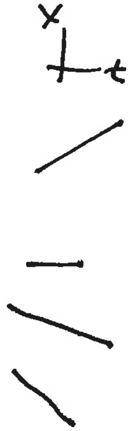
Ph 105-004
exam 1 (A)

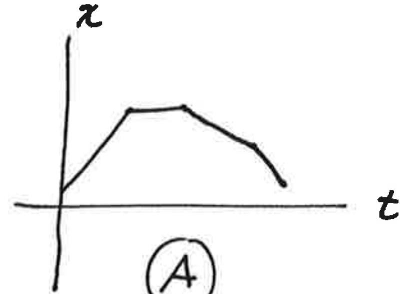
1.) $2\frac{m}{s}$ east, 3 sec $\Rightarrow$ 6 m

1 s stopped

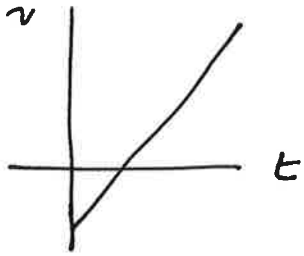
2 m in 3 sec west

+1 $\frac{m}{s}$ west for 2 sec

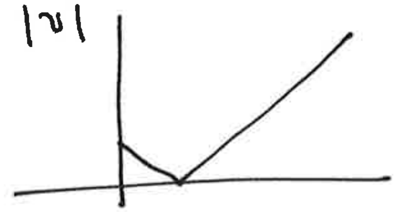




2.)



Speed is $|v|$ $\Rightarrow$

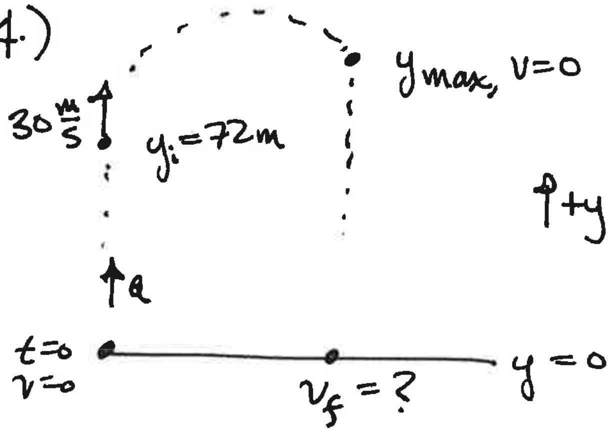


A decreases, then increases

3.) $t_B = 2t_A$ free-fall: $h = \frac{1}{2}gt^2$
$v_i = 0$

$$\Rightarrow \frac{h_A}{h_B} = \frac{\frac{1}{2}g t_A^2}{\frac{1}{2}g t_B^2} = \frac{t_A^2}{t_B^2} = \frac{t_A^2}{(2t_A)^2} = \frac{1}{4}$$ A

4.)



start from moment of burnout

$v_i = 30\frac{m}{s}$, $a_y = -g$, $y = y_i = 72m$

at y_{max}, $v=0$

$$v_{top}^2 = 0 = v_i^2 + 2a_y \Delta y = v_i^2 - 2g\Delta y$$

$$\Rightarrow \Delta y = \frac{v_i^2}{2g} \quad \text{so} \quad y_{max} = y_i + \Delta y$$

from top, falls from y_{max} with $v_{top} = 0$

$$v_f^2 = v_{top}^2 + 2a_y y_{max} = 0 + 2g y_{max} \qquad (g<0, \Delta y<0)$$

$$v_f = \sqrt{2g y_{max}} = \sqrt{2g(y_i + \Delta y)} = \sqrt{2g\left(y_i + \frac{v_i^2}{2g}\right)}$$

$$v_f = \sqrt{2g y_i + v_i^2} \simeq 48.1\frac{m}{s} \quad \text{(B)}$$

5.) $m_1 = 45kg$ $m_2 = 60kg$

$v_{1f} = 0.375\frac{m}{s}$ $v_{2f} = ?$

$v_{1i} = 0$ $v_{2i} = 0$

Cons. momentum

$$P_i = P_f$$

$$0 = m_1 v_{1f} - m_2 v_{2f}$$

$$v_{2f} = \frac{m_1}{m_2} v_{1f} \simeq 0.281\frac{m}{s} \quad \text{(E)}$$

6.) $m_1 = 2.3\,kg$ $m_2 = 3.5\,kg$

$v_{1i} = 6.1\,\frac{m}{s}$ $v_{2i} = -4.8\,\frac{m}{s}$

!

elastic:
given eqn $v_{1f} = \left(\frac{m_1 - m_2}{m_1 + m_2}\right) v_{1i} + \left(\frac{2m_2}{m_1+m_2}\right) v_{2i} \simeq -7.1\,\frac{m}{s}$ B

7.) truck always has greater v until point T ($v_{truck,avg} > v_{car,avg}$)

given same amount of time, covers greater distance

since $v_{truck,avg}\,T > v_{car,avg}\,T$

truck will have traveled farther C

8.) free fall: only influence is gravity, $|a| = g$

$\Rightarrow$ $x(t) = x_i + v_i t + \frac{1}{2} a t^2$ parabolic $x(t)$

- graphs with line segments are out
- position constantly changes, graphs with flat regions out

$\Rightarrow$ D

9.) if the tile hits the ground, only $P_{tile} + P_{ground}$ is conserved, not P_{tile} alone.

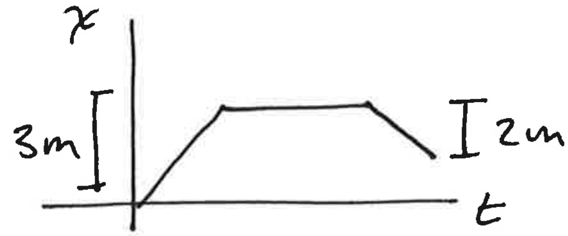
False

10.) elastic: p & K for the system as a whole are conserved (not each object seperately) D

Short Answer

11.) length of path

3 m forward
+ 2m back



(a) $\boxed{5m}$

(b) displacement $= x_{end} - x_{start} = 1 - 0 = \boxed{1m}$

12.) $\Delta t = 8.6s$
$\Delta x = 87m$
$v_i = 0$

a) $\Delta x = x_f - x_i = \underbrace{v_i t}_{0} + \frac{1}{2}at^2$

$\Delta x = \frac{1}{2}at^2$

$a = \frac{2\Delta x}{t^2} = \frac{2(87m)}{(8.6s)^2} \simeq \boxed{2.4 \frac{m}{s^2}}$

b) in $\Delta t + 1 = 9.6s$,

$\Delta x = \frac{1}{2}at^2 = \frac{1}{2}(2.4\frac{m}{s^2})(9.6s)^2 \simeq \boxed{110 m}$

13.) $J = \Delta p = mv_f - \underbrace{mv_i}_{0} = mv_f$

falls from $h = 3.75m$ $v_f^2 = v_i^2 + 2ah = 0 + 2gh$ (a, h in same direction so +)

$v_f = \sqrt{2gh}$

$J = m\sqrt{2gh} \simeq \boxed{21.4 \ N \cdot s}$

14.) $m_1 = 0.62\,kg$ $\quad m_2 = 0.32\,kg$ $\quad v_{1i} = 2.1\,m/s$ $\quad v_{2i} = -3.8\,m/s$

! !

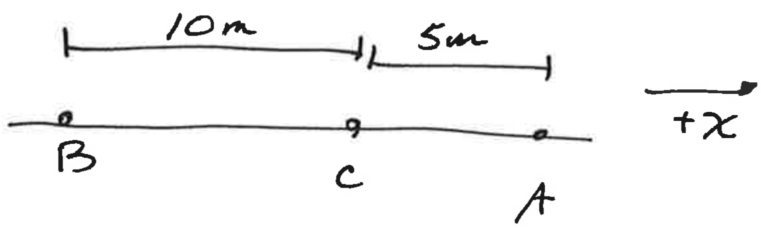
like #6 mult. choice

$$v_{1f} = \left(\frac{m_1 - m_2}{m_1 + m_2}\right) v_{1i} + \left(\frac{2m_2}{m_1 + m_2}\right) v_{2i} \simeq -1.92\ m/s \quad (\text{similarly, } v_{2f} = 4\tfrac{m}{s})$$

$$\Delta K_1 = K_{f1} - K_{i1} = \tfrac{1}{2} m_1 v_{1f}^2 - \tfrac{1}{2} m_1 v_{1i}^2 = \tfrac{1}{2} m_1 (v_{1f}^2 - v_{1i}^2) = \boxed{-22.4\,J}$$

lost

15.)



A → B 20s
B → C 8s
} total $\Delta t = 28s$ whole trip

a) $|\vec{v}_{av}| = \frac{\Delta x}{\Delta t} = \frac{C - A}{28s} = \frac{5m}{28s} \simeq \boxed{0.179\,\frac{m}{s}}$

b) avg speed $= \frac{\text{total dist}}{\text{total time}} = \frac{AC + BC + BC}{\Delta t} = \frac{5 + 10 + 10}{28} = \frac{25}{28} \simeq \boxed{0.893\,\frac{m}{s}}$