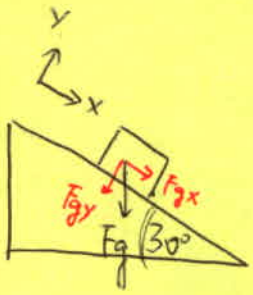
Physics 1A(9) Fall 2010 Quiz 3 Version A

Solutions

(1.)



In x direction:

$\sum F_x = 0$ (Net force = 0 because it's motionless)

$F_{gx} + F_f = 0$ (↑ friction)

$|F_f| = |F_{gx}| = |F_g \sin\theta|$

$= 50 \times \sin 30° = 25$ (N)

⇒ choose (C.)

(2.)

The net force exerted on the wheelbarrow is:

$(40-24) = 16$ (N)

$W = (\sum F) \cdot \Delta x = 16 \times 6 = 96$ (J) ⇒ choose (d.)

(3)

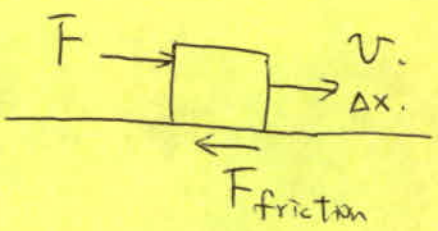
The work done by the weightlifter is converted to potential energy of the object.

$P = \frac{\Delta W}{\Delta t} = \frac{\Delta U}{\Delta t} = \frac{mg\Delta y}{\Delta t} = \frac{250 \times 9.8 \times 2}{2} = 2450$ (W)

⇒ choose (b.)

(4.) To move at a constant speed, the net force exerted on the crate must be zero.

The force you exert on the crate is 230 N but in opposite direction to the friction force.

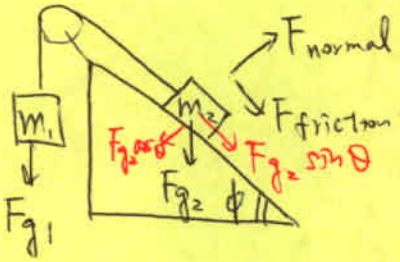


$F = -|F_{friction}|$, but $F \parallel \Delta x$.

$W = F\,\Delta x = 230 \times 4 = 920\,(J)$

choose (C.)

(5)



$|F_{normal}| = |F_{g2}\cdot\cos\theta| = 5 \times 9.8 \times \cos 30^\circ$

$= 42.4\ (N)$

$|F_{friction}| = \mu_k |F_{normal}| = 0.26 \times 42.4$

$= 11.0\,(N)$

For whole m_1-m_2 system, we have

$\Sigma F = (\Sigma m)\, a \Rightarrow |F_{g1}| - |F_{g2}\sin\theta| - |F_{friction}| = (m_1 + m_2)\, a$

$a = \dfrac{|F_{g1}| - |F_{g2}\sin\theta| - |F_{friction}|}{m_1 + m_2} = \dfrac{20\times 9.8 - 5\times 9.8 \sin 30^\circ - 11}{20+5} = 6.4\left(m/s^2\right)$

$\Rightarrow$ choose (C.)

(6.) $\vec{F} = (4x^2, 3y^3)$

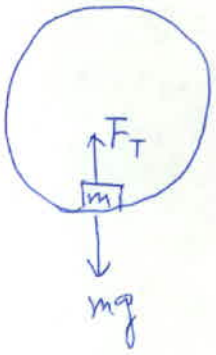
$d\vec{r} = (dx, dy)$

$\vec{F} \cdot d\vec{r} = 4x^2 dx + 3y^3 dy$

$$\int \vec{F} \cdot d\vec{r} = \int_0^3 4x^2 dx + \int_0^0 3y^3 dy = \frac{4}{3}x^3\Big|_0^3 = \frac{4}{3}3^3 = 4 \cdot 9 = 36 \text{ (J)}$$

$\Rightarrow$ choose (C)

(7.)



F_T is the force from track.

For uniform circular motion, you need a net force for centripetal acceleration.

$$\underbrace{F_T - mg}_{\text{centripetal force}} = m\frac{v^2}{r} \qquad F_T = m\frac{v^2}{r} + mg$$

$= 2000 \times 13.5 + 2000 \times 9.8$

$= 4.7 \times 10^4$ (N)

choose (C)

(8.) $\Delta W = \Delta K = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$= \frac{1}{2}m(v_f^2 - v_i^2) = \frac{1}{2} \cdot 5(10^2 - 6^2) = 160$ (J)

choose (d)