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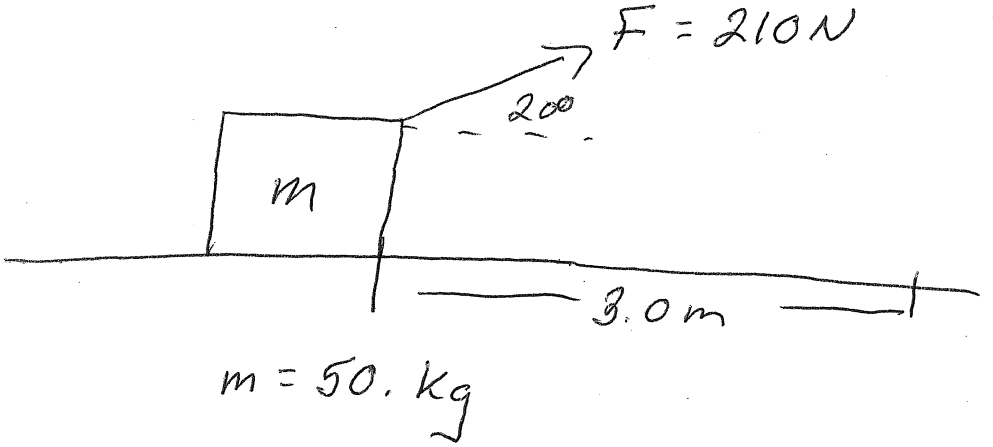
Frictionless



$m = 50.\ kg$

As the crate is moved, what is the work done by

a) The force F

b) The gravitational force

c) the normal force

d) total work done on the crate

a) $W = Fd = 210N(\cos 20^\circ)\ 3.0m = \boxed{\cancel{257J}\ \ 590J}$

b) 0 J

c) 0 J

d) $\cancel{257J}$ $\boxed{590J}$

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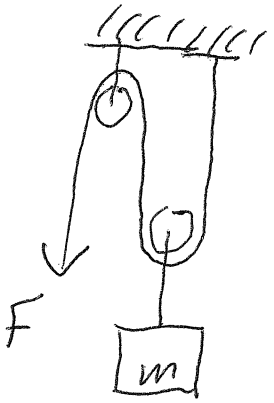


$m = 20\,kg$

a) Determine F, such that m is lifted at constant speed.

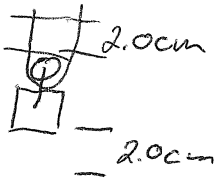
$$\Sigma F_y = 0 = 2F + -mg$$

$$2F = 20\,kg\ 9.81\,m/s^2$$

$$F = \frac{20\,kg\,(9.81\,m/s^2)}{2}$$

$$F = \boxed{98.1\,N}$$

b) During a lift of 2.0cm, how far must the rope be pulled? ~~and how much~~



Each support must move 2.0cm.

4.0cm pull on the rope

c) How much work does F do?

$$W = Fd = 98.1\,N\,(0.040\,m) = 3.92\,J$$

d) How much work does F_g do?

$$W = Fd = -\left[20\,kg\left(9.81\,m/s^2\right)\right](0.020\,m) = -3.92\,J$$

72 $\vec{d} = (8m)\hat{i} + (c)\hat{j}$

$\vec{F} = (2N)\hat{i} + (-4N)\hat{j}$

The displacement and force acting on a particle are given above. Determine c if a) $W = 0$

b) $W = +$

c) $W = -$

a) $W = \vec{F} \cdot \vec{d} = F_x d_x + F_y d_y = 0$

$(2N)(8m) + (4N)c = 0$

$16J = 4Nc$

$\boxed{4m = c}$

b) $W = \vec{F} \cdot \vec{d} = F_x d_x + F_y d_y = +$

$2N(8m) + (-4N)c = +$

$\boxed{c < 4m}$

c) $(2N)8m + (-4N)c = -$

$\boxed{c > 4m}$

75 $F_{(x)} = 10\, e^{-\frac{x}{2.0}}$

Determine the work done by $\vec{F}$ as the object moves from $x = 0$ to $x = 2.0\,m$.

$$W = \int F_{(x)}\, dx$$

$$= \int_0^{2.0} 10\, e^{-\frac{1}{2.0}x}\, dx$$

$$\int e^{-ax}\, dx = -\frac{1}{a}\, e^{-ax}$$ from integral sheet

$$= 10 \int_0^{2} e^{-\frac{1}{2.0}x}\, dx$$

$$= 10 \left[-(2.0)\, e^{-\frac{1}{2.0}x} \Big|_0^2 \right]$$

$$= 10 \left[-2.0\, e^{-\left(\frac{1}{2.0}\right)(2)} - -2.0\, e^{-\left(\frac{1}{2.0}\right)(0)} \right]$$

$$= 12.64\,J$$

79 $F(x) = \frac{a}{x^2}$ $a = 9.0\ N m^2$

Determine the work done by force $\vec{F}$ if it moves an object from $x = 1.0\ m$ to $x = 3.0\ m$

$$W = \int F(x)\, dx$$

$$= \int_{1.0\,m}^{3.0\,m} \frac{9.0\ N m^2}{x^2}\, dx = 9.0 \int_{1.0}^{3.0} x^{-2}\, dx$$

$$= 9.0 \left[\frac{x^{-1}}{-1} \Big|_{1.0}^{3.0} \right]$$

$$= 9.0 \left[\frac{3^{-1}}{1} - \frac{1^{-1}}{1} \right]$$

$$= 9.0 \left(\frac{1}{3} - 1 \right)$$

$$= \boxed{-6.0\ J}$$