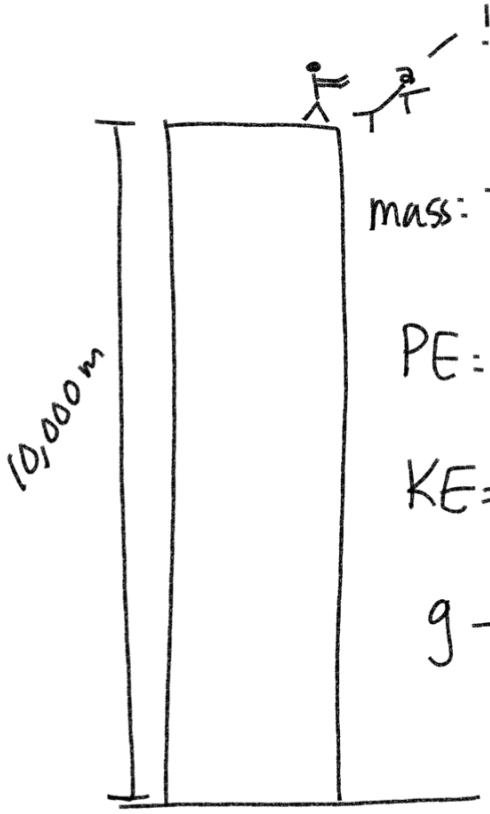
TH-GP General Physics Week 30 5/2



mass: 76 kg

PE: mgh

KE: $\frac{1}{2}mv^2$

$g \rightarrow -9.8\ m/s^2$

1.) What was Nate's potential energy at the top of the building?

2.) What was Nate's kinetic energy just prior to impact?

3.) What was Nate's velocity before impact?

1.) $PE = mgh = (76\text{ kg})(9.8\ m/s^2)(10{,}000\text{ m})$

$7{,}448{,}000$ **7448 kJ**

2.) KE at the ground → 7,448,000 J or 7448 kJ

3.) $(KE) = \left(\frac{1}{2}mv^2\right)$

$\frac{2KE}{m} = \frac{mv^2}{m}$

$\sqrt{\frac{2KE}{m}} = \sqrt{v^2}$

$v = \sqrt{\frac{2KE}{m}}$

$= \sqrt{\left(\frac{2(7{,}448{,}000\text{ J})}{76\text{ kg}}\right)}$

$=$ **442 m/s**

Liz finds Nate's lifeless, mangled body at the bottom of a newly made crater. She exerts 300N of force at an angle of 20° off the ground to drag him 1200m. The smell was awful. How much work did she do?

$W = F \cdot d$

$F d \cos\theta$

$(300N)(\cos 20)(1200m)$

$= \boxed{338,289\ J \quad 338.3\ kJ}$

Over several days, Liz used a constant force of $\langle 20N, 12N \rangle$ in a directin of $\langle 800m, 90m \rangle$. What work was dne?

$W = F \cdot d$

$(F_x * d_x) + (F_y * d_y)$

$(20 * 800) + (12 * 90)$

$16000 + 1080$

$= \boxed{17080\ J}$

$F: \langle 20N, 12N \rangle \quad d: \langle 800m, 90m \rangle$

$$F \cdot d = 17080\,J$$

Magnitude of force and displacement

$$r = \sqrt{x^2 + y^2}$$

$$|F| = \sqrt{(20)^2 + (12)^2}$$

$$\sqrt{400 + 144}$$

$$\sqrt{544} = 23.3N$$

$$|d| = \sqrt{(800)^2 + (90)^2}$$

$$\sqrt{640000 + 8100}$$

$$\sqrt{648100}$$

$$805\,m$$

$$\theta = \cos^{-1}\left(\frac{F \cdot d}{|F||d|}\right) = \cos^{-1}\left(\frac{17080}{(23.3)(805)}\right) = 24.4^\circ$$

W-GP Chapter 5 - 9 Pre-Test

1.) (5 pts) Briefly explain all three Newton's Laws of Motion.

1.) Law of inertia – Obj in motion stays in motion – At Rest, stays at rest

2.) $F=ma$

3.) Every force is met with an equal opposite force.

2.) (10 pts total, 5 pts each) **Draw each of the following free body diagrams**. Use the diagram to answer the question.

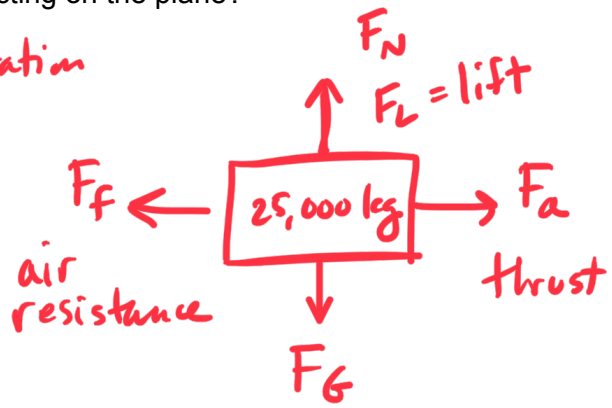
a) An airplane weighing 25,000 kg is flying at a relatively low altitude at a constant velocity. What is the net force acting on the plane?

constant velocity → no acceleration

acceleration = $0\ m/s^2$

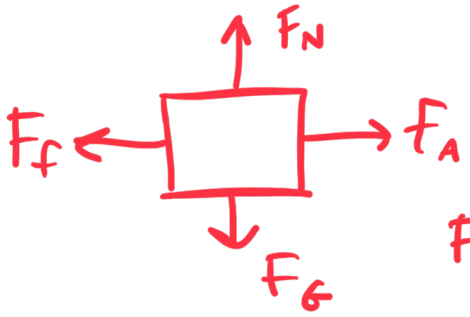
$[F_{net} = 0]$

$F = ma$



b) A block is being pushed along a surface with friction at constant speed. What must be true of the applied and frictional forces?

$F_{net} = 0$

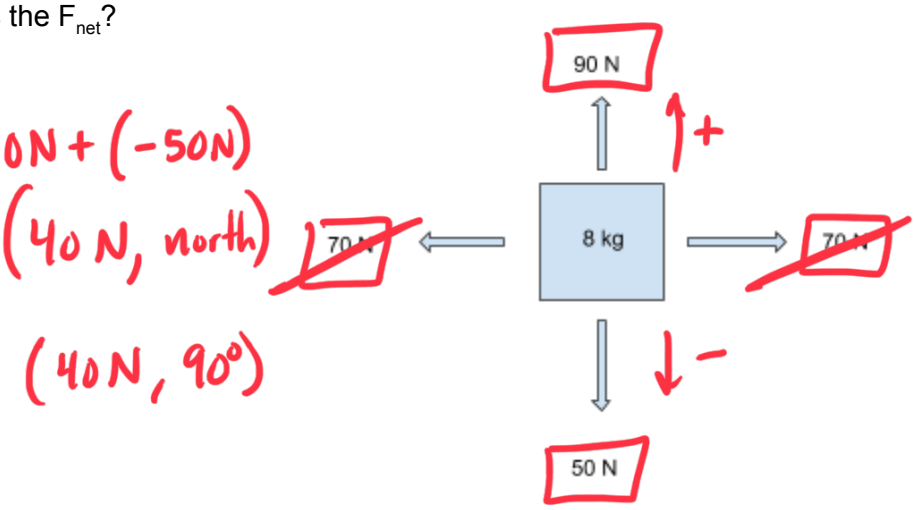


$F_A = -F_f$

$F_A + F_f = 0$

3.) (10 pts total, 5 pts each) Find the net force applied on each of the free body diagrams. **Please make sure to find the resultant and direction.**

a) What is the F_{net}?

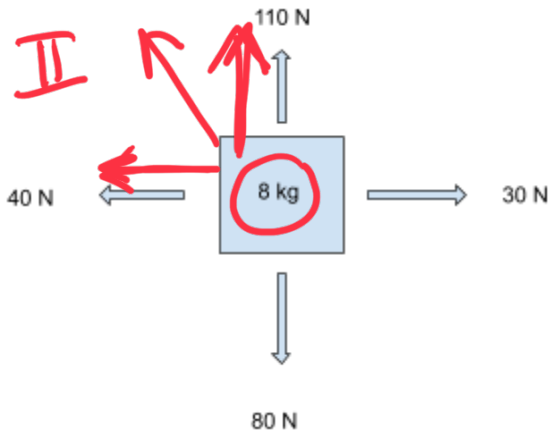


90N + (-50N)

(40 N, north)

(40N, 90°)

b) What is the acceleration?



X direction

$-40N + 30N = -10N$

y direction

$-80N + 110N = 30N$

$r = \sqrt{x^2 + y^2}$

$\sqrt{(-10)^2 + (30)^2} = \sqrt{100 + 900} = \sqrt{1000} = 31.6N$

$\theta = \tan^{-1}\frac{y}{x} = \tan^{-1}\left(\frac{30}{-10}\right) = -71.6°$ $180 - 71.6$ 108.4

$\frac{F}{m} = \frac{ma}{m}$ $a = \frac{F}{m} = \frac{31.6N}{8\ kg} = (3.95\ m/s^2, 108.4°)$