Name:_____

1. The Greek philosopher Aristotle believed that objects with no net force acting on them would not move. What is incorrect about this?

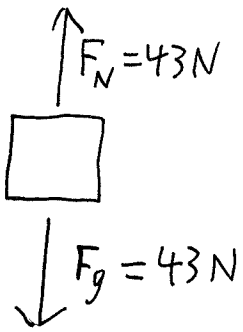
An object can have constant velocity with no force acting on it.

A ball thrown in space will keep moving until it hits something

2. What is the net force on an object being pulled East by a 55 N force and to the West by a 67N force? Draw a FBD of this situation.

F_{net} = winners − losers
= 67 − 55 = 12N West

3. The force of gravity on a book at rest on a table is 43 N down. What is the magnitude and direction of the normal force acting on the book? Draw a FBD of this situation.

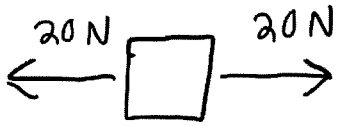


Since it is not accelerating net force must be zero so F_N = 43N upwards

Name:_____

4. Given the FBDs shown determine the net force acting on the object (magnitude and direction), and if the object will be accelerating or not.

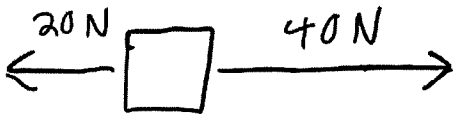
a)



$F_{net} = 0$

Not accelerating

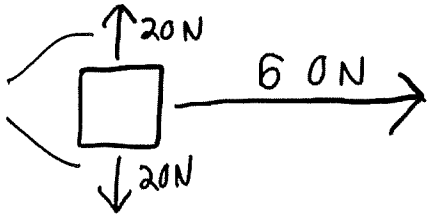
b)



40 − 20 = 20 N right

Accelerating to the right

c)

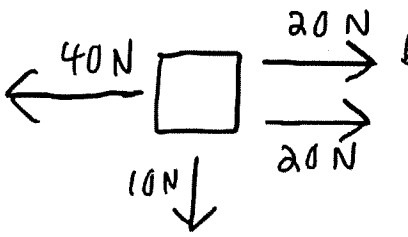


these cancel out

F_{net} = 60 N right

Accelerating to the right

d)



these cancel out 40 N to the left

F_{net} = 10 N down

Accelerating down

5. The net force acting on an object is zero, circle **ALL** of the following which are **possible**:

(A) The object is moving at 3 m/s to the left.

(B) The object is moving at 9 m/s to the right.

(C) The object is stationary.

D: The object is accelerating at 3 m/s^2 to the left. ✗

E: The object is accelerating at 9 m/s^2 to the right. ✗

(F) There are no forces acting on the object

G: The is a single force acting on the object. ✗ ← the force would cause F_{net} to be exactly that force

(H) There are several forces acting on the object.

↑ they can cancel each other out

$F_{net} = 0$ means no acceleration

Name:_____

6. A ball is rolling across the floor, slowing to a stop. Which of the following is why it is slowing?

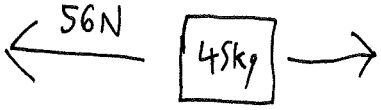
No force is acting on it.

OR

A force is acting on it in the opposite direction of its movement.

friction is the force

7. One person pushes a 45 kg block to the left with a force of 56 N. Another person pushes the block to the right. The net force acting on the block is 12 N to the left. How much force is the person pushing to the right applying?



F_{net} = 12 to the left

Left is winning force

F_{net} = Winners − losers = 12

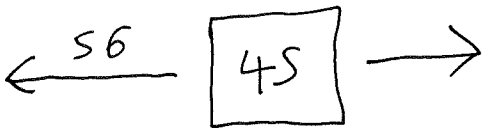
12N = 56N − Force to right

56 − something = 12

56 − 12 = Force to right

44N = Force to right

8. One person pushes a 45 kg block to the left with a force of 56 N. Another person pushes the block to the right. The net force acting on the block is 36 N to the right. How much force is the person pushing to the right applying?



F_{net} = 36N to right

Right is winning force

F_{net} = Winners − losers

36 N = F_{right} − 56

56 + 36 = F_{right}

92 N = Force to right

Name:_____

9. A net force of 100 N acts on an object causing it to accelerate. How would the acceleration of the object change (i.e. will it be twice as much, half as much, a quarter as much) if:

   a. The net force was 200 N rather than 100 N. acceleration doubles

   b. The net force was 50 N rather than 100 N. acceleration halved

   c. The mass of the object was doubled. acceleration halved

   d. The mass of the object was halved. acceleration doubled

10. Someone pushes a truck in neutral causing it to accelerate, they then push a kid's wagon with the same force. Which object, the truck or the wagon will accelerate more? Why?

Wagon because it has less mass

11. A net force of 250 N is applied to a 23 kg object, what will its acceleration be?

$F_{net} = ma \rightarrow \frac{F_{net}}{m} = a$

$\frac{250N}{23kg} = 10.8696 N/kg$

$= 10.8696 m/s^2$

$\approx 11 m/s^2$

Name:_____

12. A 2.5 kg mass accelerates at 2.1 m/s^2. What is the net force acting on it?

$$F_{net} = ma = 2.5\,kg \times 2.1\,\frac{m}{s^2} = 5.25\,\frac{kg \cdot m}{s^2}$$

$$= \boxed{5.3\,N}$$

13. An 874 N net force causes an object to accelerate at 2.5 m/s^2. What is the mass of the object?

$$F_{net} = ma \rightarrow \frac{F_{net}}{a} = m$$

$$\frac{874\,N}{2.5\,m/s^2} = 349.6\,\frac{N \cdot s^2}{m} = 349.6\,\frac{kg \cdot m \cdot s^2}{s^2\,m}$$

$$= \boxed{350\,kg}$$

14. A 2.5 kg object has a net force of 25 N acting on it. What is its acceleration?

$$a = \frac{F_{net}}{m} = \frac{25\,N}{2.5\,kg} = 10\,\frac{m}{s^2} = \boxed{1.0 \times 10^1\,\frac{m}{s^2}}$$

15. A 6.2 kg object has a net force of 5.6 N acting on it. What is its acceleration?

$$a = \frac{F_{net}}{m} = \frac{5.6\,N}{6.2\,kg} = \boxed{0.90\,\frac{m}{s^2}}$$

Name:_____

16. What net force is needed to accelerate a 3.2 kg object at 4.2 m/s^2?

$$F_{net} = ma = 3.2\,kg \times 4.2\frac{m}{s^2} = 13.44\frac{kg \cdot m}{s^2}$$

$$= 13\,N$$

17. What net force is needed to accelerate a 15.2 kg object at 4.2 m/s^2?

$$F_{net} = ma = 15.2\,kg \times 4.2\,m/s^2 = 63.84\frac{kg \cdot m}{s^2}$$

$$= 64\,N$$

18. What is the mass of an object if a 56 N net force accelerates it at 28 m/s^2?

$$\frac{F_{net}}{a} = m$$

$$\frac{56\,N}{28\,m/s^2} = 2.0\frac{N \cdot s^2}{m} = 2.0\,kg$$

19. What is the mass of an object if a 250 N net force accelerates it at 5.0 m/s^2?

$$\frac{F_{net}}{a} = m$$

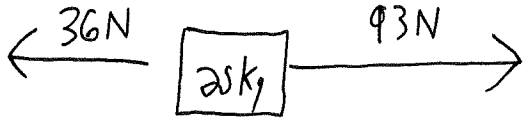
$$\frac{250\,N}{5.0\frac{m}{s^2}} = 50\frac{N \cdot s^2}{m} = 50\,kg \approx 5.0 \times 10^1\,kg$$

Name:_____

20. One person pushes a 25 kg block to the left with a force of 36 N, another person pushes the block to the right with a force of 93 N.

a. What is the net force acting on the block?

Right is winner



F_{net} = Winners − losers
= 93N − 36N
= 57N to the right

b. What is the acceleration of the block?

$F_{net} = ma \rightarrow a = \frac{F_{net}}{m} = \frac{57N}{25kg}$

$= 2.3 \frac{m}{s^2}$ right

21. One person pushes a 45 kg block to the left with a force of 56 N. Another person pushes the block to the right. The block accelerates at 0.30 m/s^2 to the left.

a. What is the net force acting on the block?

$F_{net} = ma = 45kg \times 0.30 m/s^2 = 13.5 N$ left
$= 14N$ left

b. How much force is the person pushing to the right applying?

F_{net} = Winners − losers

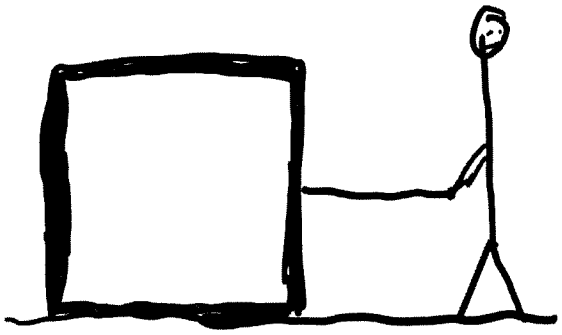
Left is winner so 56 − something = 14N

56 − 14 = 42N

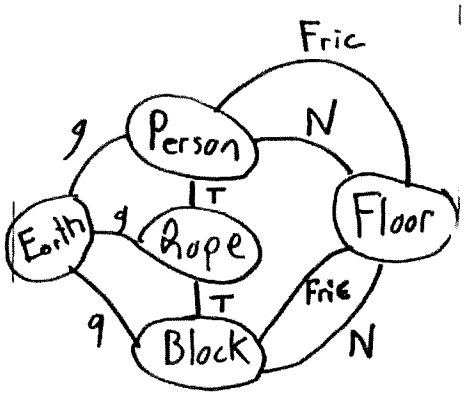
Name:_____

22. Draw a Free Body Diagram for the block and the person with all forces acting on them labelled. Circle any Newton's Third Law force pairs.

Situation: *A person attempts to pull a heavy block along a floor with a rope, but the block does not move.*

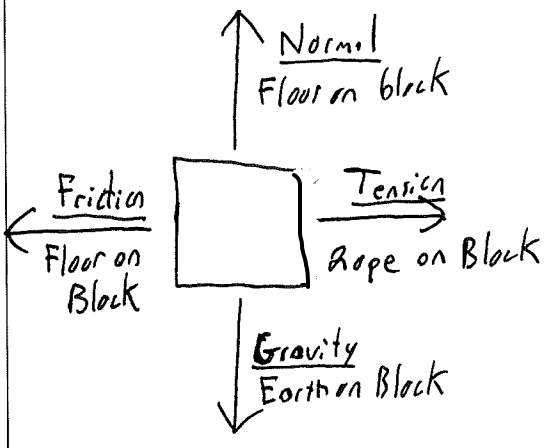


Interaction Diagram



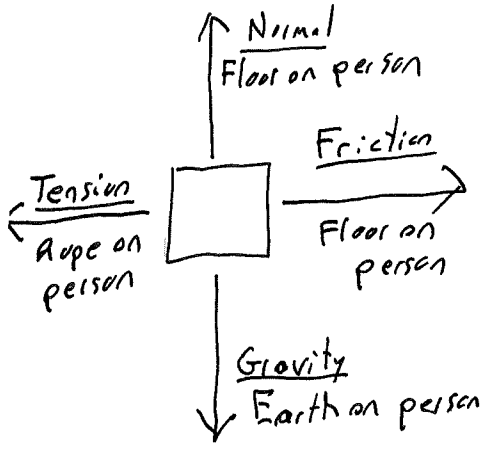
FBD: *Block*

4 forces acting on block



FBD: *Person*

4 forces acting on person

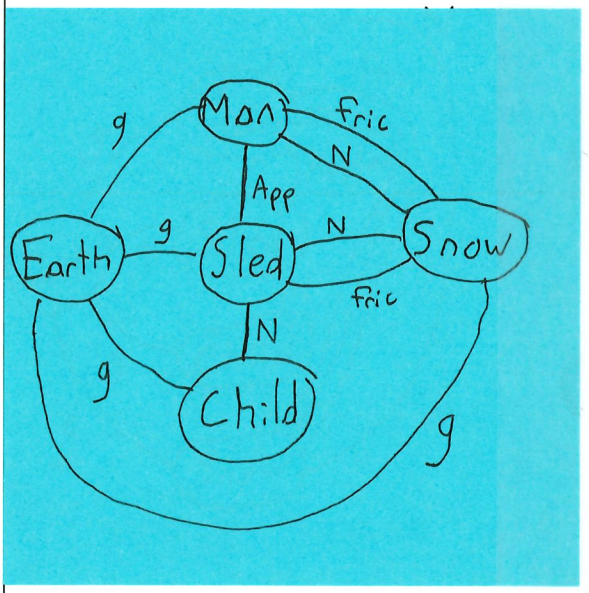


Name:_____

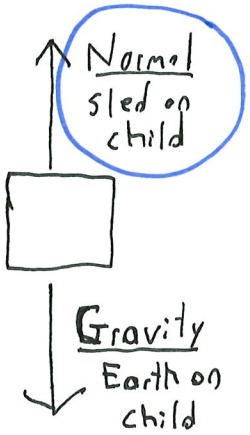
23. Draw an interaction diagram of the forces, then draw free body diagrams for the child, the sled and the man.

Situation: *A man pushes a child sitting on a sled at a constant velocity through the snow.*

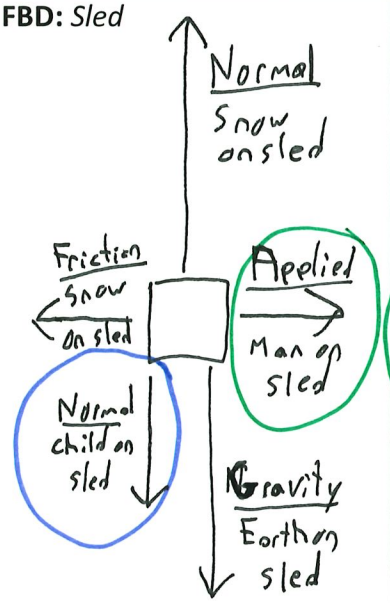
Interaction Diagram



FBD: Child



FBD: *Sled*



FBD: *Man*