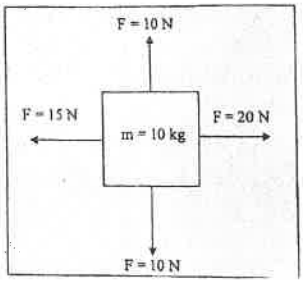
Acceleration & Net Force

Name: KEY Date:_____ Period:_____

Bell Ringer:
Determine the Net Force for the following free-body diagram:



5 N right.

Learning Target:
I can determine the net force on an object.
I can determine the net acceleration on an object.

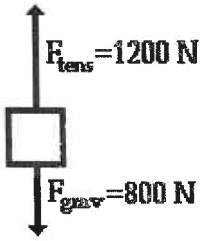


Figure A

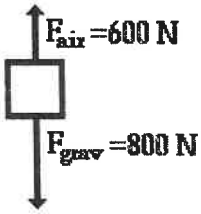


Figure B

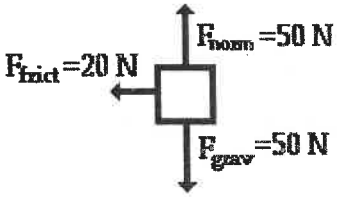


Figure C

1. What is the net force in Figure A?

   400 N up

   a. If the block as a mass of 15 kg, what is the acceleration of the block?

   $a = \frac{F}{m} = \frac{400\ N}{15\ kg} = 26.7\ m/s^2$ up

2. What is the net force in Figure B?

   200 N down

   a. If the block as a mass of 15 kg, what is the acceleration of the block?

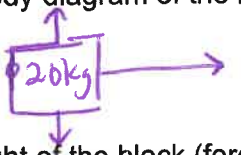
   $a = \frac{F}{m} = \frac{200\ N}{15\ kg} = 13.3\ m/s^2$ down

3. What is the net force in Figure C?

   20 N left

a. If the block as a mass of 15 kg, what is the acceleration of the block? $a = \frac{20N}{15kg} = 1.3 m/s^2$ left

4. 20 kg block is accelerating to the right on a flat horizontal surface. (ignore friction)
   a. Draw the free body diagram of the block



   b. What is the weight of the block (force of gravity)?

$F = ma = (20kg)(9.8 m/s^2) = 196 N$

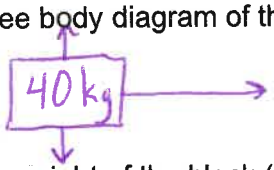
   c. What is the normal Force of the block?

196 N

   d. If the block is accelerating at 3 m/s^2 what is the applied force on the block?

$F = ma = (20kg)(3 m/s^2) = 60 N$ right

5. A 40 kg block is accelerating to the right on a flat horizontal surface. (ignore friction)
   a. Draw the free body diagram of the block



   b. What is the weight of the block (force of gravity)?

$F = ma = (40kg)(9.8 m/s^2) = 392 N$

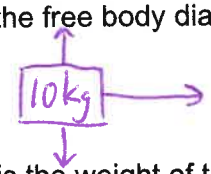
   c. What is the normal weight of the block?

392 N

   d. If the block is accelerating at 2 m/s^2 what is the applied force on the block?

$F = (40kg)(2 m/s^2) = 80 N$ right

6. A 10 kg block is accelerating to the right on a flat horizontal surface. (ignoring friction)
   a. Draw the free body diagram of the block



   b. What is the weight of the block (force of gravity)?

$F = ma = (10kg)(9.8 m/s^2) = 98 N$

   c. What is the normal weight of the block?

98 N

   d. If the applied force if 30 N to the right, what is the block's acceleration?

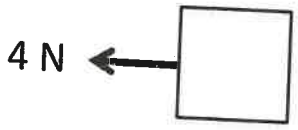
$a = \frac{F}{m} = \frac{30N}{10kg} = 3 m/s^2$ right

Net Force Worksheet

The force that results from all the combined forces acting on the object is called the **net force**. Calculate the net force acting on the box in the following problems.

Be sure to include the direction of the net force (left or right)!

1.

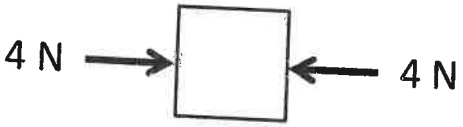


Net Force: 4N left

2.

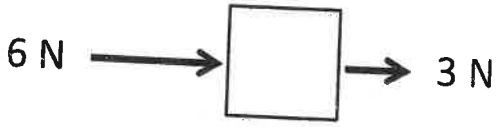
Net Force: 5N Left

3.



Net Force: 0

4.

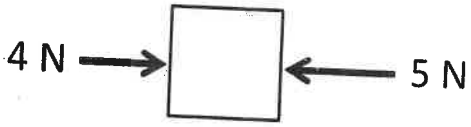


Net Force: 9N right

5.

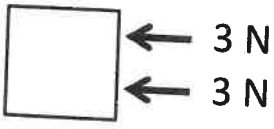
Net Force: 4N left

6.



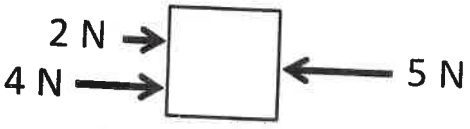
Net Force: 1N left

7.



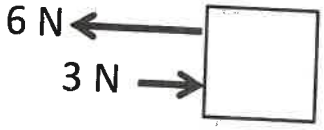
Net Force: 6N left

8.



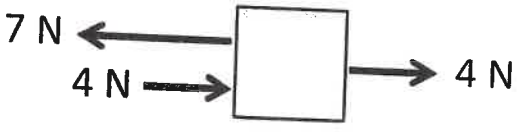
Net Force: 1N right

9.



Net Force: 3N left

10.



Net Force: 1N right

11. What is net force?

The force that is left over when you add or subtract forces on an object.

Show your work on problems 12-14

12. A boy pulls a wagon with a force of 6 N east as another boy pushes it with a force of 4 N east. What is the net force?

6N + 4N = 10N east

13. Mr. Smith and his wife were trying to move their new chair. Mr. Smith pulls with a force of 30 N while Mrs. Smith pushes with a force of 25 N in the same direction. What is the net force?

30N + 25N = 55N

14. The classes are playing tug of war. Mrs. Larson's homeroom pulls with a force of 50 N. Ms. Mitko's homeroom pulls with a force of 45 N in the opposite direction. What is the net force? And who won?

50N - 45N = 5N

Mrs. Larson's homeroom wins!

15. What is a balanced force?

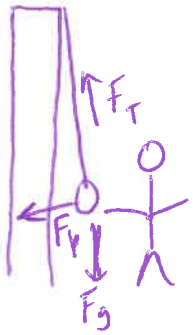
All the forces cancel out, $F_{Net} = 0$.

16. What is an unbalanced force?

The forces don't cancel out, $F_{Net} \neq 0$.

17. Draw a picture below that shows an example of a balanced force (examples: a bird's nest in a tree, a hat on a person's head, or a light hanging from a ceiling). Show the forces acting on the object. In a separate picture show what would happen to the object if the forces became unbalanced.

Tetherball



Name:_____ Date:_____ Period:_____

NET FORCE AND ACCELERATION

Please write ***True*** or ***False*** for each statement

1) T An object at rest has balanced forces on it.

2) T An object at a constant speed has balanced forces on it.

3) F An object accelerating has balanced force on it.

4) F An object decelerating or slowing down has balanced forces on it.

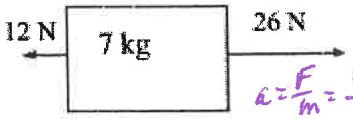
5) F An object in equilibrium must be at rest

Equations and Constants

$F_{net} = ma$ Net force = mass x acceleration
$F_g = mg$ weight = mass x gravitational acceleration, where g = 9.8 m/s^2

For each of the following problems, give the net force on the block, and the acceleration, including units.

1)

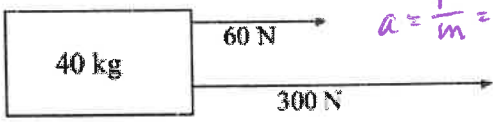


$a = \frac{F}{m} = \frac{14N}{7kg} = 2m/s^2$

Net Force = 14N right a = 2m/s^2 right

Hint: determine the net force. Then use the net force to find acceleration using $F_{net} = ma$

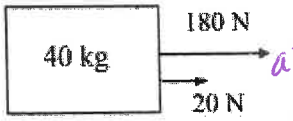
2)



$a = \frac{F}{m} = \frac{360N}{40kg} = 9m/s^2$

Net Force = 360 N right a = 9 m/s^2 right

3)



$a = \frac{F}{m} = \frac{200N}{40kg} = 5m/s^2$

Net Force = 200 N right a = 5m/s^2 right

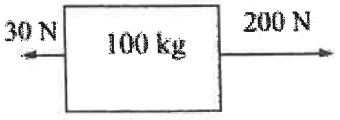
4)

Net Force = 120 N down

a = 6m/s^2

$a = \frac{F}{m} = \frac{120N}{20kg} = 6m/s^2$

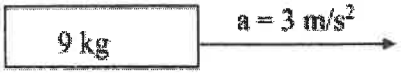
5)



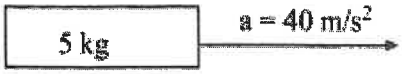
Net Force = 170N left a = 1.7m/s^2 right

$a = \frac{F}{m} = \frac{170N}{100kg} = 1.7m/s^2$

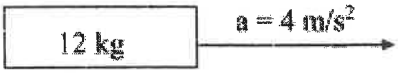
For problems 6-9, using the formula net Force = Mass • Acceleration, calculate the net force on the object.

6) 

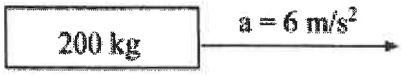
$F_{net} = ma =$ 27 N right

7) 

$F = ma =$ 200 N right

8) 

$F_{net} = ma =$ 48 N right

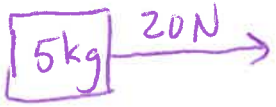
9) 

$F_{net} = ma =$ 1200 N right

Directions: Draw a free body diagram. Determine the Net Force (F_{net}) and use Newton's Second Law (F = ma) to calculate your answer

Section I: Complete 4 of these.

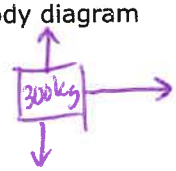
1) A force of 20 N acts upon a 5 kg block. Calculate the acceleration of the object.



$a = \frac{F}{m} = \frac{20N}{5kg} = 4 m/s^2$ right

2) An object of mass 300 kg is observed to accelerate to the right at the rate of 4 m/s².

a. Draw the free body diagram



b. What is the weight of the object (Force of gravity)

$F = ma = (300kg)(9.8 m/s^2) = 2940 N$

c. What is the Normal Force of the object?

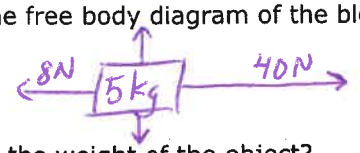
2940 N

d. Calculate the force required to produce this acceleration.

$F = ma = (300kg)(4 m/s^2) = 1200 N$ right

3) A 5 kg block is pulled across a table by a horizontal force of 40 N with a frictional force of 8 N opposing the motion.

a. Draw the free body diagram of the block being pulled?



b. What is the weight of the object?

$F = ma = (5kg)(9.8 m/s^2) = 49.0N$

c. What is the Normal Force of the object?

49.0N

d. What is the Net force?

32 N right

e. What is the object's acceleration?

$a = \frac{F}{m} = \frac{32N}{5kg} = 6.4 m/s^2$

4) An object of mass 30 kg is falling in air and experiences a force due to air resistance of 50 newtons.

a. Determine the net force acting on the object and

$F_g = mg = (30kg)(9.8 m/s^2) = 294N$ $\quad 294N - 50N = 244N$

b. Calculate the acceleration of the object.

$a = \frac{F}{m} = \frac{244N}{30kg} = 8.13 m/s^2$