

Practice Problem Set $F=ma$ \Rightarrow FORCE = MASS x ACCELERATION

Plug in the given values for Force/Mass/Acceleration to solve.

Remember, **mass is in kg** - - **force in in N** (newtons) - - **acceleration is in m/s²**

1. How much force is needed to accelerate a 66 kg skier at 2 m/sec²?
2. What is the force on a 1000 kg elevator that is falling freely at 9.8 m/sec²?
3. What is the acceleration of a 50 kg object pushed with a force of 500 newtons?
4. The mass of a large car is 1000 kg. How much force would be required to accelerate the car at a rate of 3 m/sec²?
5. A 50 kg skater pushed by a friend accelerates 5 m/sec². How much force did the friend apply?
6. A force of 250 N is applied to an object that accelerates at a rate of 5 m/sec². What is the mass of the object?
7. A bowling ball rolled with a force of 15 N accelerates at a rate of 3 m/sec²; a second ball rolled with the same force accelerates 4 m/sec². What are the masses of the two balls?
8. If a 60 kg person on a 15 kg sled is pushed with a force of 300 N, what will be person's acceleration?
9. A force of 20 N acts upon a 5 kg block. Calculate the acceleration of the object.
10. An object of mass 300 kg is observed to accelerate at the rate of 4 m/s². Calculate the force required to produce this acceleration.
11. 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. Calculate the acceleration of the object.
12. An object of mass 30 kg is in free fall in a vacuum where there is no air resistance. Determine the acceleration of the object.
13. 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
 - b. calculate the acceleration of the object.

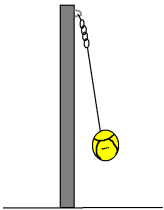
Friction

- 14.) A car parked at the top of a hill does not move down the hill due to what type of friction?
- 15.) A skateboard coasts to a stop after landing at the bottom of a staircase on flat ground. What type of friction slowed the skateboard down?
- 16.) A student pushes their backpack across the table. What type of friction is acting against the motion of the backpack?

Freebody Diagrams: For the following problems, draw the freebody diagram that best describes the forces.

17. A cat accelerating straight down through the the air after jumping from a fence.

18. A tetherball hanging motionless from the pole.



19. A bicycle pedaling to the right at a constant velocity.

20. A person pushes on their car that has run out of gas. They forgot to take the e brake off so the car is not moving.

SOLUTIONS TO 1-13 FORCE PROBLEMS

1. How much force is needed to accelerate a 66 kg skier at 2 m/sec^2 ?

$$f=ma \quad f= 66 \times 2 \quad f= 132 \text{ N}$$

2. What is the force on a 1000 kg elevator that is falling freely at 9.8 m/sec^2 ?

$$F= ma \quad f= 1000 \times 9.8 \quad f=9,800 \text{ n}$$

3. What is the acceleration of a 50 kg object pushed with a force of 500 newtons?

$$F= ma \quad 500 = 50(a) \quad a= 10 \text{ m/s}^2$$

4. The mass of a large car is 1000 kg. How much force would be required to accelerate the car at a rate of 3 m/sec^2 ?

$$F= ma \quad f= 1000 \times 3 \quad f= 3000 \text{ N}$$

5. A 50 kg skater pushed by a friend accelerates 5 m/sec^2 . How much force did the friend apply?

$$F = ma \quad f= 50 \times 5 \quad f= 250 \text{ N}$$

6. A force of 250 N is applied to an object that accelerates at a rate of 5 m/sec^2 . What is the mass of the object?

$$F = ma \quad 250\text{N}=(m)5 \quad m= 50\text{kg}$$

7. A bowling ball rolled with a force of 15 N accelerates at a rate of 3 m/sec^2 ; a second ball rolled with the same force accelerates 4 m/sec^2 . What are the masses of the two balls?

$$F= ma \quad 15\text{N}= (m)3 \quad m=5\text{kg} \quad 15\text{N} = (m)4 \quad m=3.75\text{kg}$$

8. If a 60 kg person on a 15 kg sled is pushed with a force of 300 N, what will be person's acceleration?

$$F=ma \quad 300\text{N}=(60+15)(a) \quad a=4 \text{ m/s}^2$$

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

$$F=ma \quad 20\text{N}=5(a) \quad a=4 \text{ m/s}^2$$

10. An object of mass 300 kg is observed to accelerate at the rate of 4 m/s^2 . Calculate the force required to produce this acceleration.

$$F=ma \quad F=300 \times 4 \quad f= 1200\text{N}$$

11. 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. Calculate the acceleration of the object.

$$F=ma \quad 40\text{N}-8\text{N}=32\text{N of force in a direction} \quad 32\text{N}=5(a) \quad a=6.4 \text{ m/s}^2$$

12. An object of mass 30 kg is in free fall in a vacuum where there is no air resistance. Determine the acceleration of the object.

Since it is in free fall and is falling due to the force of gravity.....the acceleration will always be 9.8 m/s^2

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

Determine the net force acting on the object and

$$f=ma \quad f=30 \times 9.8 \quad f=294\text{N} \quad \text{Net force is } 294-50 = 244\text{N}$$

calculate the acceleration of the object.

$$F= ma \quad 244\text{N}=30 (a) \quad a=8.13 \text{ m/s}^2$$

Friction

14.) A car parked at the top of a hill does not move down the hill due to what type of friction?

Static

15.) A skateboard coasts to a stop after landing at the bottom of a staircase on flat ground. What type of friction slowed the skateboard down?

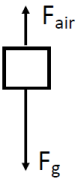
Rolling

16.) A student pushes their backpack across the table. What type of friction is acting against the motion of the backpack?

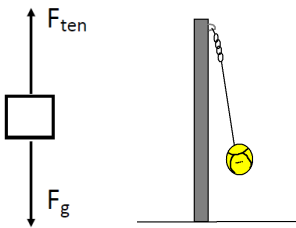
Sliding

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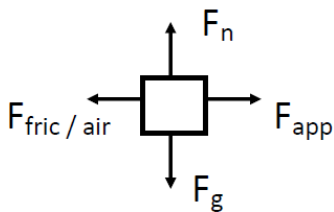
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