

# Pressure

## 11SCI - Mechanics

Finn LeSueur

2019

### Starter

Calculate the **net** force acting upon these objects:

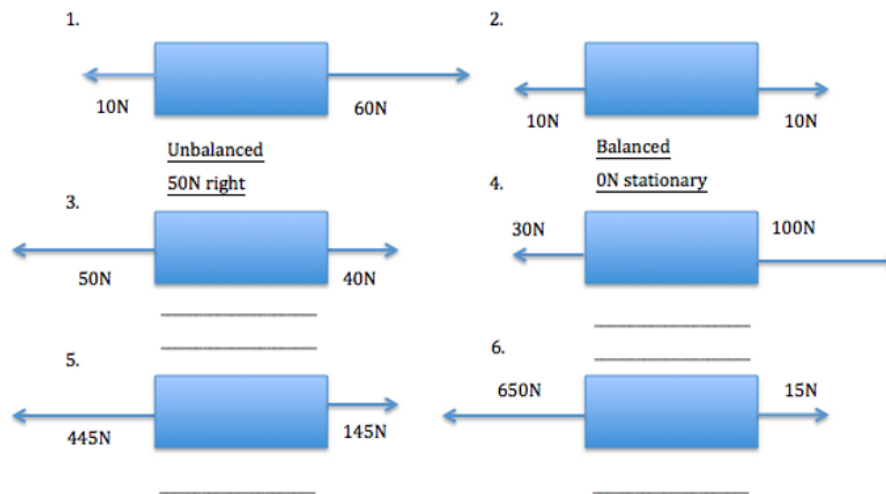


Figure 1: Unbalanced Forces

### Question 1

What does an unbalanced force do to the motion of an object?

### Answer 1

It causes the object to accelerate (or deaccelerate).

We know this because of the equation

$$\begin{aligned} \text{force} &= \text{mass} \times \text{acceleration} \\ F &= m \times a \end{aligned}$$

---

### Question 2

For the equation

$$F = m \times a$$

give the **name** and **unit** for each variable in the equation.

### Answer 2

- F stands for **force** and has units **Newtons (N)**
  - m stands for **mass** and has units **kilograms (kg)**
  - a stands for **acceleration** and has units **meters per second squared**  
( $ms^{-2}$ )
- 

### Question 3

- What do you think of when you think of pressure?
  - What affects the pressure exerted by an object?
- 

### Question 4

The most classic case of pressure is sharpening a knife. Why do we sharpen knives? What does sharpening a knife change about the knife?

---

## Pressure

Pressure is defined as: *the amount of force per unit area.*

$$pressure = \frac{force}{area}$$

$$P = \frac{F}{A}$$

- Force is measured in **Newtons (N)**
  - Area is measured in **meters squared ( $m^2$ )**
- 

## Pressure Continued

$$P = \frac{F}{A}$$

- Therefore, pressure is measured in Newtons / meters squared ( $\frac{N}{m^2}$  OR  $Nm^{-2}$ )
  - This is also known as a Pascal (Pa)
- 

## Starter (2018 Exam)

Jacob bikes down The Flying Nun. He and his bike have a mass of  $82kg$  and he accelerates at  $0.8ms^{-2}$ .

1. Calculate the **net force** acting upon Jacob and his bike to cause this acceleration
  2. Draw a force diagram showing the forces acting upon Jacob as he accelerates
  3. Describe the size and direction of the forces compared to each other (horizontal and vertical)
- 

## Calculating Pressure

$$P = \frac{F}{A}$$

1. Calculate the **pressure** created by a force of  $3N$  with an area of  $0.5m^2$
  2. Calculate the **pressure** created by a force of  $3N$  with an area of  $0.25m^2$
  3. Calculate the **pressure** created by a force of  $3N$  with an area of  $0.125m^2$
-

### Answers

$$P = \frac{F}{A}$$

$$1. P = \frac{3}{0.5} = 6Pa$$

$$2. P = \frac{3}{0.25} = 12Pa$$

$$3. P = \frac{3}{0.125} = 24Pa$$

---

### Calculating Area

$$P = \frac{F}{A}$$

4. Calculate the **area** that a force (5N) is acting through if it has a pressure of 7Pa
  5. Calculate the **area** that a force (7N) is acting through if it has a pressure of 3Pa
  6. Calculate the **area** that a force (10N) is acting through if it has a pressure of 3Nm<sup>-2</sup>
- 

### Answers

$$A = \frac{F}{P}$$

$$4. A = \frac{5}{7} = 0.71m^2$$

$$5. A = \frac{7}{3} = 2.33m^2$$

$$6. A = \frac{10}{3} = 3.33m^2$$

---

### Calculating Force

$$P = \frac{F}{A}$$

7. Calculate the **force** of an object with area 0.25m<sup>2</sup> and pressure 5Pa
  8. Calculate the **force** of an object with area 0.5m<sup>2</sup> and pressure 7Pa
  9. Calculate the **force** of an object with area 0.75m<sup>2</sup> and pressure 10Pa
-

## Answers

$$F = P \times A$$

$$7. F = 0.25 \times 5 = 1.25N$$

$$8. F = 0.5 \times 7 = 3.5N$$

$$9. F = 0.75 \times 10 = 7.5N$$

---

## Exam Question (2018)

Giovanni is running a 100m sprint. Each of his feet have a surface area of  $200\text{cm}^2$  ( $0.0200\text{m}^2$ ), which sink into the track. Together, his feet exert a pressure of  $13000\text{Pa}$ . Calculate Giovanni's weight.

---

## Answer

Because **weight** is a force, we know that we are looking for  $F$ .

$$P = 13000\text{Pa}$$

$$A = 0.02\text{m}^2 \times 2 = 0.04\text{m}^2$$

$$F = P \times A$$

$$F = 13000 \times 0.04$$

$$F = 520N$$

---

## Extra Work

- **Homework:** Education Perfect due Monday 29th 11:25am
- sciPAD Page 46