Rosary School – Marj Elhamam

9Ia Forces and Movement
Study sheet 1

Name: _____ Date: ____ /____ / 2025

Grade: 8 ( ) Subject: Physics

- A **force** is a **push** or a **pull** that acts on an object due to the interaction with another object.
- A Force can change the shape of an object, speed or direction.
- Forces can be big or small. They all have **magnitude (size)** and **direction**. The unit for measuring force is **Newton (N)**. Forces are represented by force arrows. The direction of the arrow shows the direction of the force; a bigger arrow shows a bigger force.
- Forces can either be **contact** forces or **non-contact** forces.
  - **Contact forces**: Forces that are applied on an object by directly touching it.
    e.g. : Drag (air resistance, water resistance), friction, upthrust, tension and reaction forces.
    - **Upthrust**: the upward force applied by a fluid on an object submerged in it.
    - **Tension**: a pulling force that acts on an object hanging from a string, rope or a cable when it's stretched.
      Note: Tension force is always directed away from the body it is acting upon.
  - **Non-contact forces**: Forces that affect an object from a distance, e.g.: weight, static electricity and magnetism.
    - Weight: the force of gravity pulling on an object's mass

      $$W = mg$$

      Where W is the weight, m is the mass of the object, and g is the gravitational acceleration of the planet.

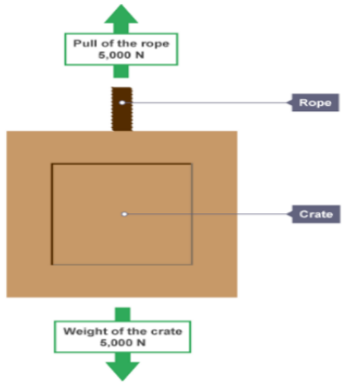
      Note: weight is always directed downward perpendicular to the ground.

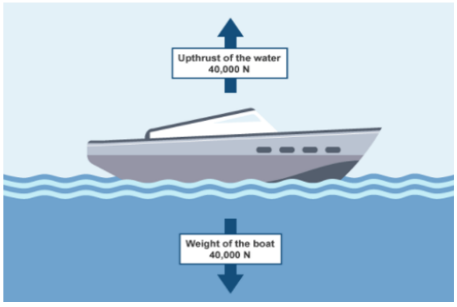
- Multiple Forces that are acting on an object can either be **balanced** or **unbalanced:**

  - **Balanced forces:** When two forces acting on an object are equal in magnitude but act in opposite directions.

  If all the forces on an object are **balanced**, the movement of the object doesn't change:
  - A stationary object stays still.
  - A moving object continues to move at the same speed **(constant speed)** and in the same direction.

The forces on this hanging crate are equal in size but act in opposite directions. The **weight** pulls down and the **tension** in the rope pulls up. The forces are **balanced.**





Objects float in water when their weight is balanced by the **upthrust** from the water.

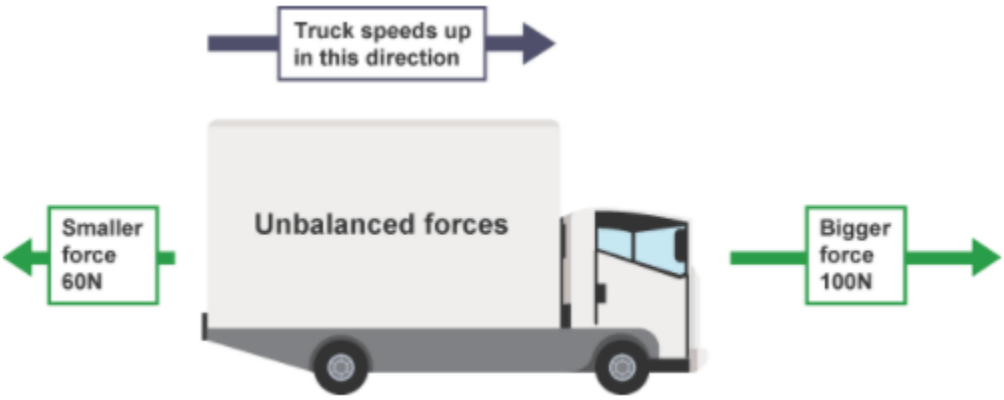
Upthrust is a force that pushes things up in liquids and gases. An object will float when the upthrust balanced its weight.

  - **Unbalanced forces**: When the forces acting on an object are opposite in direction and not equal in size, we say that they are unbalanced forces.
  If the forces on an object are **unbalanced**, this is what happens:
  - A stationary object starts to accelerate in the direction of the net force (resultant force).
  - A moving object **changes speed** (accelerates or decelerates) in the direction of the resultant force.

- The overall force acting on the object is called the **resultant force**.
- The resultant force is calculated as:

  - Start with the **sum** of the forces that are acting in the same direction.
  - Then find the **difference** between the two opposite forces.
  - The resultant force is in the direction of the bigger force

Example:



- Resultant force = 100 – 60 = 40 N (to the right), the truck will accelerate.

The change in the motion of an object depends upon:

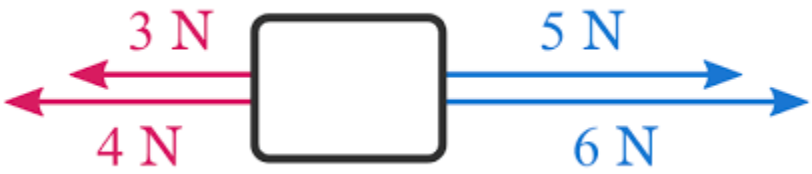
- the size of the resultant force
- the direction of the resultant force
- The greater the **resultant force**, the greater the change in the motion of the object.

The speed of a moving object depends on the size and direction of the resultant force:

- The object **speeds up (accelerates)** if the resultant force acts **in the direction** of movement.
- The object **slows down (decelerates)** if the resultant force acts **opposite** to the direction of movement.

- The object continues to move at a **steady speed** if the resultant force becomes zero.

Example: Find the resultant force acting on this object, will it accelerate?



The right force: 5+6 = 11 N

The left force: 3+4 = 7 N

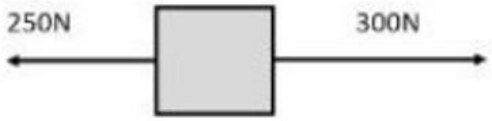
The resultant force: 11 - 7 = 4 N to the right

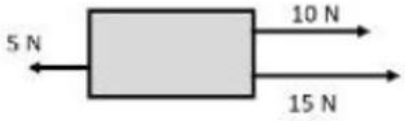
Since the forces acting on the object are unbalanced (the resultant does not equal zero) then the object will accelerate in the direction of the resultant force (to the right)

Exercise:

Calculate the resultant force for the following examples and determine whether it's accelerating, decelerating, moving at a constant speed, or stationary.

a. Stationary objects





b. Moving objects:

What is the force X that will cause this car to move at a constant speed.

- **Water resistance** and **air resistance** are forms of **drag**.
- Drag forces **slow down** objects moving through **fluids**.

- The magnitude of the drag force **increases** as the **speed** of the object **increases** → more fluid to be pushed away.

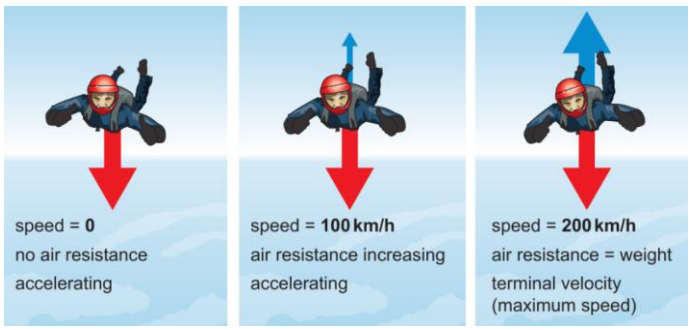
- **Velocity** is speed in a particular **direction**. It is a quantity that has magnitude and direction, e.g. 11 m/s East or 11 m/s at 30° to the horizontal.

What happens to a falling object?

- There are two main forces which affect a falling object at different stages of its fall:

1. The **weight of the object** - this is a force acting downwards, caused by the Earth's **gravitational field** acting on the object's **mass**. This force stays constant throughout the fall.
2. **Drag (air resistance)** - this is a **frictional force** acting in the opposite direction to the movement of the object. Drag increases as the speed increases and as the skydiver opens the parachute.

- When an object is dropped, there are three stages before it hits the ground:



1. At the beginning, there is no air resistance and only the weight is acting on the skydiver. The resultant force is the maximum. The skydiver's speed is **ZERO. He will start to accelerate…**

2. As the skydiver accelerates, he gains speed, the weight stays the same but the air resistance on the skydiver increases. There is a resultant force acting downwards.

3. Eventually, the object's weight will be balanced by the air resistance. The reultant force becomes **ZERO** and the object reaches a **steady speed** (no acceleration) – this is known as the **terminal velocity**.

- **Terminal velocity:** The constant speed at which the weight equals the air resistance and the forces are balanced

Coursebook: pages 110, 111 q.1, 4, 5, 6, 7

Workbook pages 76, 77

Question 1:

The diagram shows the forces acting on a parachutist.

The words in the box can be used to describe forces.

air resistance	balanced	contact	gravity
non-contact	resultant	terminal	weight

Use words from the box to complete each sentence.

Gravity is an example of a ..... force.

The upward force on the parachutist is caused by ..... .

When the parachute reaches terminal velocity the ..... .
force is zero.

(Total for Question 17 = 3 marks)

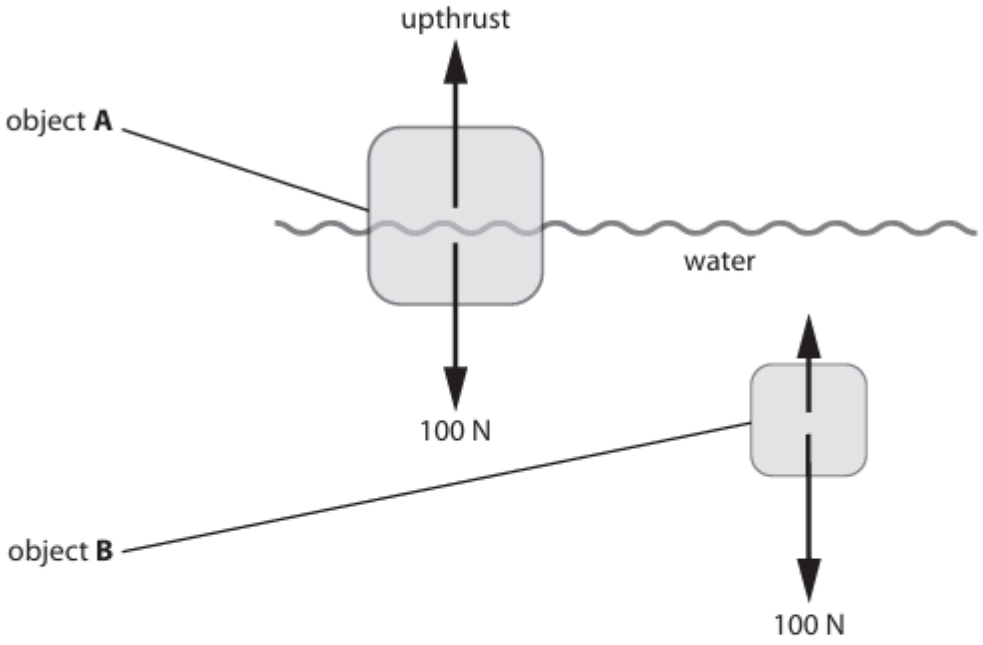
Question 2:

The diagram shows two objects, **A** and **B**, in water.

Object **A** has a bigger volume than object **B**.

The weight of both objects is 100 N.

Object **A** floats on the water but object **B** sinks.



(a) State the size of the upthrust force that acts on object **A**.

(1)

(b) Explain why object **B** sinks.

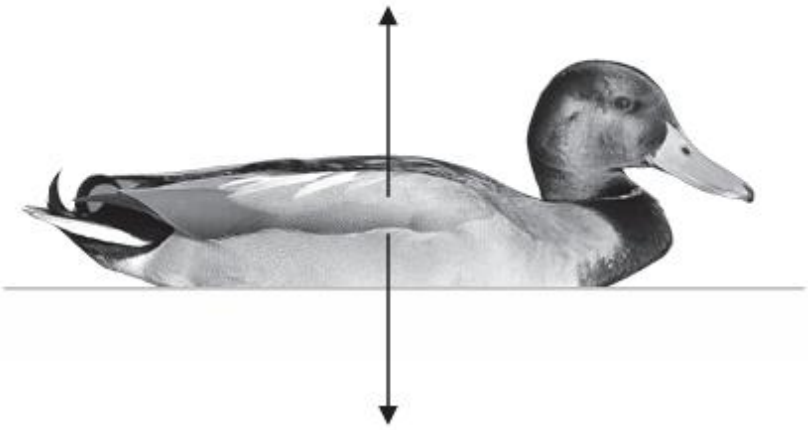
(2)

(Total for Question 21 = 3 marks)

Question 3:

The diagram shows a duck floating on water in a pond.

The duck is not moving.



(Source: © Pearson Asset Library)

(a) The arrows show two of the forces acting on the duck.

The names of different forces are listed in the box.

air resistance	drag	friction	upthrust	weight

Choose forces from the box to complete these sentences.

(1)

The upwards force is called .....

The downwards force is called .....

(b) Explain, in terms of forces, why the duck is floating on the water.

(2)

.....

.....

.....

.....

(Total for Question 7 = 3 marks)

Question 4:

The bullet train in Japan is designed to travel fast.

(Source: All Canada Photos / Alamy Stock Photo)

Explain how the shape of the train helps it achieve a high speed.

(Total for Question 31 = 2 marks)