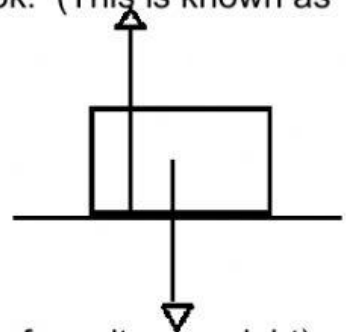


# Newton laws worksheet 19

## Newton's third law:

If object A exerts a force on object B, object B exerts an equal but opposite force on object A.

If a book is resting on a table the book is exerting a force down on the table, but at the same time the table is exerting a force back up on the book. (This is known as the normal force).



Other pairs in the above example are:

The force that the **earth** is exerting **down** on the **book** (force of gravity or weight). And therefore the force that the **book** is exerting back **up** on the book.

The two forces are equal in magnitude (but opposite in direction)

Let's look at more examples

### Examples

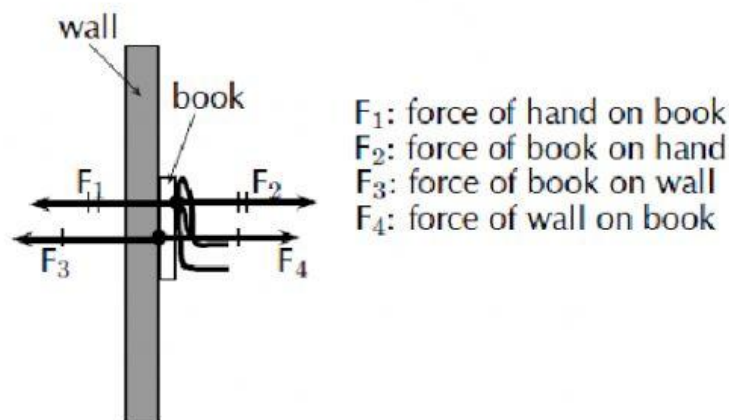
1.



Figure 2.8: Newton's action-reaction pairs.

Newton's third law of Motion deals with the interaction between pairs of objects. For example, if you hold a book up against a wall you are exerting a force on the book (to keep it there) and the book is exerting a force back at you (to keep you from falling through the book). This may sound strange, but if the book was not pushing back at you, your hand would push through the book! These two forces (the force of the hand on the book ( $F_1$ ) and the force of the book on the hand ( $F_2$ )) are called an action-reaction pair of forces. They have the same magnitude, but act in opposite directions and act on different objects (the one force is onto the book and the other is onto your hand).

There is another action-reaction pair of forces present in this situation. The book is pushing against the wall (action force) and the wall is pushing back at the book (reaction). The force of the book on the wall ( $F_3$ ) and the force of the wall on the book ( $F_4$ ) are shown in the diagram.

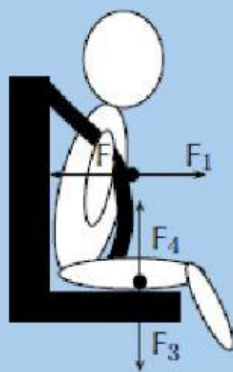


Source: Siyavula gr 11 pg 101

## Eg 2

Dineo is seated in the passenger seat of a car with the seat belt on. The car suddenly stops and he moves forwards (Newton's first law - he continues in his state of motion) until the seat belt stops him. Draw a labelled force diagram identifying two action-reaction pairs in this situation.





$F_1$ : The force of Dineo on the seat belt

$F_2$ : The force of the seat belt on Dineo

$F_3$ : The force of Dineo on the seat (downwards)

$F_4$ : The force of the seat on Dineo (upwards)

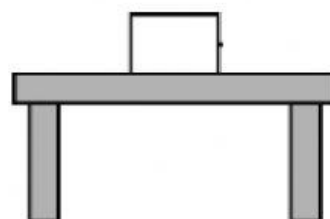
## Exercise

Fill in the missing words

1.

Action: Force of the **book down** on the **table**

Reaction: force of the \_\_\_\_\_ up on the \_\_\_\_\_



Action: force of the **earth down** on the **book** (this is the gravitational force or the weight)

Reaction: force of the \_\_\_\_\_ {direction} on the \_\_\_\_\_

Action: force of the **table legs down** on the **ground**

Reaction: force of the \_\_\_\_\_ {direction} on the \_\_\_\_\_

Action: force of the **earth down** on the **table** (this is the gravitational force or the weight)

Reaction: force of the \_\_\_\_\_ {direction} on the \_\_\_\_\_

2.



Action: Force of the **car wheels down** on the **ground**

Reaction: force of the \_\_\_\_\_ {direction} on the \_\_\_\_\_

Action: Force of the **lady's feet down** on the **ground**

Reaction: force of the \_\_\_\_\_ {direction} on the \_\_\_\_\_

Action: Force of the **guy's feet down** on the **ground**

Reaction: force of the \_\_\_\_\_ {direction} on the \_\_\_\_\_

Action: Force of the **earth down** on the **car (gravity)**

Reaction: force of the \_\_\_\_\_ {direction} on the \_\_\_\_\_

**There are plenty more action-reaction pairs here, but we'll stop there**