THEORY AND EXERCISES ON WEIGHT FORCE

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EXERCISE 1

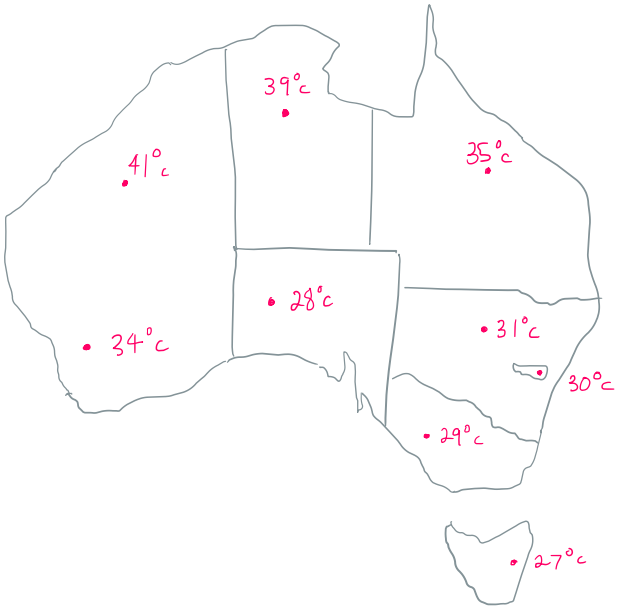
A 'force' is a 'push or pull' on an object, resulting from its interaction with another object, or a field.

1. Can you identify real world examples of the following forces?

	Push	Pull
Interaction with object		
Interaction with field		

A 'field' is a region in space filled with 'points' – where each point in that region is associated with a specific physical quantity.

2. For the field below, where/what is the 'region', where are the points, what are the 'physical quantities', and what might the field be called?



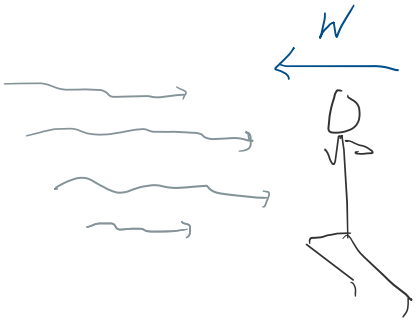
Forces can be categorised as

3. What might each of these categories mean, and can you provide an example of a force associated with each?

Forces are 'vector quantities' – meaning that to describe a force, we need to specify two things:

A vector is a quantity described by a direction and magnitude.

For instance, for a runner running west, how might we describe the force (which is a vector) of a strong headwind – blowing in the exact opposite direction of the runner's movement?



EXERCISE 2

The 'gravitational force' or 'weight force' is a type of field mediated force (recall what field mediated forces are?) .

Weight force is defined as 'force acting on an object due to another object's gravitational field'.

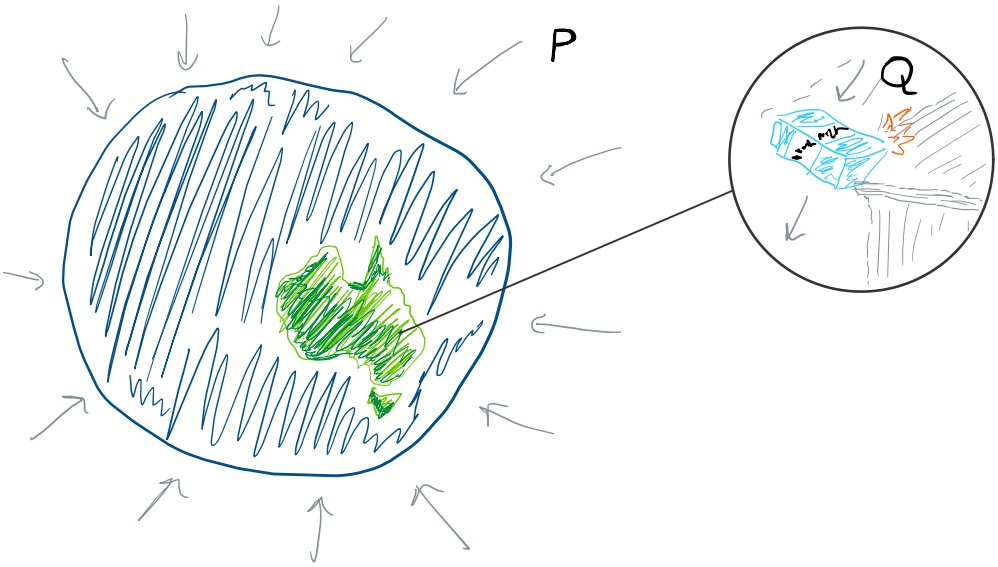


Figure 1. *A milk carton falling from a countertop in New South Wales*

1. For Figure 1,

   A. Can you explain what the gravitational field is, using the definition from Exercise 1 and the content of the Figure as an example?

   B. Of the arrows labelled P and Q, which one represents weight force, and why?

   C. Please complete the following table, with reference to the definition of 'weight force':

The weight force is acting on what object?	
What is the 'another object'?	

D. In the definition for weight force, why do we specify 'another object's gravitational field', rather than simply saying: 'Earth's gravitational field'?

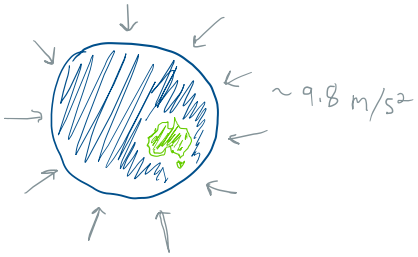
The weight force (in *Newtons*) acting on an object is given by the following equation:

$$F_{weight} = mg$$

(m: object's mass; g: acceleration due to gravity)

2. Given the weight force equation above, how might you explain the difference between an object's weight and an object's mass?

3. Acceleration due to gravity (g) near the Earth's surface is approximately 9.8 $m\ s^{-2}$ towards the centre of the Earth.



A. g is a vector. With reference to the definition of a vector in **Exercise 1**, can you explain why this is the case?

B. What does ms^{-2} mean, and can you explain why ms^{-2} is often written as m/s^2 ?

4. Do you think that a bathroom scale measures an object's weight or mass? Please justify your answer.

   A. g on Mars is about 38% of g on Earth. If bathroom scales measure weight force and divide this force by g on Earth to display a 'scale weight' in kg, if you stepped on a bathroom scale with your Mars weight force, would you appear to be lighter or heavier, and by what amount?

5. A student makes the following claim:

   An object's weight force is 'inversely proportional' to its mass.

   Do you agree with this claim? Please justify your answer (3 marks).