**P7.3 and P7.4 Forces summary sheet**

Different forces

Forces are categorised as either **contact** or **non**-**contact** forces. Contact forces must have more than one object touching another object to cause an effect. Examples of contact forces are **Friction, Air resistance, water resistance, and upthrust.** Non-contact forces can exert an effect on something without touching it. Examples of non-contact forces are **gravity, static electricity and magnetism.**

Forces are measure in the unit **Newton (N)**.

Forces have a direction which can be represented by an arrow, the size of which will imply the size of the force.

**Weight** (measured in Newton) is a force calculated by multiplying the mass (measured in grams or Kilograms) of an object by the force of gravity acting upon it.

**Weight = mass x gravity**

Springs and compression

Most springs are made from coils of wire which can be **compressed** (made shorter) or **extended** (made longer). The **extension** of a spring is the difference between the extended length and the original length. The extension of a spring is proportional to the force applied to it, this is known as **Hooke’s law.** After the **limit of proportionality** this no longer applies and will no longer result in the object returning to its original length. Hooke’s law does not apply to all elastic materials though.

Friction

**Friction** is a force which can reduce how far an object is able to move or enable it to stay still. Certain materials produce more friction, such as Rubber. If friction needs to be reduced **lubricants** can be used to allow the objects to move across each other more easily. Friction can wear things away if they are in contact with each other and can produce heat and noise. Air resistance is friction in gases and water resistance is friction in liquids.

Pressure

Pressure is a measure of how much force is applied to a given area. Pressure is calculated using the following equation:

**Pressure [N/m2** also known as **Pascal (Pa)] = Force (N)**

**Area (m2)**

Balanced and Unbalanced forces

When an object is exposed to multiple forces in opposite directions they can cause multiple effects. If the forces are **equal,** the object will **not change** meaning it will either remain still (if not moving) or will continue to travel in the same direction at the same speed.

If the forces are **unbalanced** the object will change speed. If there is more force pushing forwards the object will **accelerate** and get faster. If there is more force pushing backwards the object will **decelerate** or slow down.

Floating and Sinking

Forces must be balanced to allow an object to remain still. **Weight** is the force pulling objects towards the centre of the earth. **Upthrust** is the force pushing against the weight of an object on water. If weight and upthrust are balanced the object will float. If the upthrust is smaller than the weight of an object it will sink.

A calculation can be done to determine if an object will sink. If the density of an object is greater than the density of water it will sink. If the density of an object is less than the density of water it will float.

**Density of water is 1g/dm3**

Drag

**Drag** is the force applied to an object when moving through water or air. Therefore Water resistance and air resistance are both forms of drag. The particles that make up the air or water apply a force in the opposite direction to a moving object. If an object is **streamlined** it will create less drag.

As speed increases drag increases because the object will collide with more particles in a given time.

If a vehicle is moving at a constant speed the forces must be **balanced**.

If a vehicle slows down or speeds up the forces will be **unbalanced**.

**Task: Answer the following questions:**

1. A person has a force of 540N and one of their feet has an area of is 50cm2 . What is the pressure of the person on the ground?
2. What force do you need to extend a spring by 0.3m if the spring constant is 5N/m?
3. A hammer hits a nail with a force of 50N into some wood. The area of the point of the nail is 0.02 cm2 . what is the pressure the nail puts on the wood?
4. When you go to the moon, which becomes less… your mass or your weight?
5. A skydiver jumps out of a plane. At what point have the reached their terminal velocity?
6. What will be the extension of a spring with a spring constant of 3N/m if a 15N force is applied?
7. A skier has a force of 75N and his skis cover an area of 3m2, calculate the pressure of the skier.
8. Calculate the area of a dart which hits the dartboard with a force of 10N and a pressure of 2000 N/ cm2.
9. A bungee jumper has a force of 675 N and the rope extends by 50 m. Calculate the spring constant of the rope.
10. If we hung two identical springs in parallel, would this make the overall spring constant more or less stiff?
11. A student uses a glue stick with an area of 4cm2, putting a pressure of 0.5 N/cm2 on her book. Calculate the force she puts on the glue stick.
12. A 4N weight is hung on a spring and it extends by 0.2m, what is the spring constant?
13. A dog pulls on its lead (spring constant 10N/m), the lead extends by 0.1m. How much force did the dog apply to the rope?
14. Calculate the pressure of a handbag strap that has a weight of 15N and covers an area of 0.5m2.
15. Draw a simple car and label all forces that will act on it when travelling at a constant speed, with arrows to represent the size of each force.

**Task:**

Design an information leaflet for a new aeroplane.

Explain all of the design features that will allow your plane to be the fastest in the world.

Label the forces that will act on the aeroplane and how your design feature is helping to reduce the resistive forces but maximise the accelerating forces.

Your leaflet should use persuasive language to encourage potential clients to buy your aeroplane rather than your competitor.