**Year 10 Physics – Forces 2**

**Resultant forces (P4.5.1.4)**

1. The resultant force is the one single force which has the same effect as a number of different forces acting at a point.
2. Free body diagrams show all the forces acting on an object
3. A single force can be split into two components at right angles to each other
4. A body in equilibrium has no resultant force acting on it.

**Forces and elasticity (P4.5.3)**

1. More than one force is needed to bend, stretch or squash an object
2. Force is a vector quantity
3. Force is measured in newtons (N)
4. Elastic materials return to their original shape when the force is removed from them.
5. Inelastic (plastic) materials stay stretched, squashed or bent when the force is removed from them
6. The extension of an object is how much it has stretched by.
7. The extension of an elastic object (eg a spring) is directly proportional to the force applied to it as long as the limit of proportionality is not exceeded
8. Force = spring constant x extension   F = k x e    (e is the extension or the compression)
9. The spring constant k has units of N/m  or N/cm
10. A stretched or compressed spring stores elastic potential energy
11. Elastic potential energy = 0.5 x spring constant x (extension)2
12. Elastic potential energy has units of joules (J)

Tasks / questions

1. Write down the unit of force
2. Write down the unit of mass
3. Name 2 non contact forces.
4. Name 3 contact forces.
5. Write down 4 vector quantities.
6. Write down 5 scalar quantities.
7. Now watch and make careful notes on the following youtube clips:

<https://www.youtube.com/watch?v=PL8ATKipoB4> - resultant forces
<https://www.youtube.com/watch?v=PG8wV022Eu0> – resultants of perpendicular force
8. Draw a free body diagram for a helicopter, of weight 2000N, hovering at a constant height.
9. Draw a free body diagram for a person standing on one leg on the floor
10. Draw a free body diagrams for a duck swimming along a canal
11. Draw a free body diagram for a person parachuting from an aircraft, just before the parachute is opened
12. Draw / Calculate the resultant of these forces:

1. Watch the clip and carefully describe and explain what you see in terms of the forces acting on each object. <https://www.youtube.com/watch?v=E43-CfukEgs>
2. Down load the following simulation which will allow you to carry out an experiment about springs
<https://phet.colorado.edu/sims/html/hookes-law/latest/hookes-law_en.html>
Tick the ‘applied force’ , ‘displacement’ and ‘values’ boxes and click the icon so that you get 2 springs on the screen
3. Set one spring constant to 200N/m and the other to 600N/m. Don’t change these values.
4. Draw a table with the following headings, allow enough space for 11 reading of force

|  |  |
| --- | --- |
| 100N/m spring | 600N/m spring |
| Force (N) | Displacement (m) | Force (N) | Displacement (m) |

For each spring, record the displacement (amount of stretch) for forces of 0, 10, 20 🡪 100N

1. Using excel or a suitable graph package, or graph paper! Plot graphs of force vs extension for each spring. Draw lines of best fit.
2. Write a detailed conclusion – what do your results tell you about how the extension is affected by the force? What is the effect of having a larger spring constant?
3. When the force is a negative value, the spring is being squashed. Does it behave the same way when it is squashed. Take and record some data to find out.
4. Research what happens to the graph when the force on a spring keeps getting bigger until it breaks. Sketch the graph and add labels to important parts of the graph
5. Write down Hookes Law
6. Explain what is meant by
a elastic behaviour
b. plastic behaviour
c. limit of proportionality
7. The energy stored in the spring (elastic potential energy) = ½ x spring constant x extension2(the extension is the displacement on the simulation)
Calculate the energy stored in each spring when the force on it is 50N
*Extension – If the energy stored was plotted against the force on the spring, what shape would the graph be. Explain your answer carefully and support with reference to the equations*
8. Watch and summarise <https://www.youtube.com/watch?v=ACDbJ8rsQDo>
9. Watch, make careful notes and diagrams <https://www.youtube.com/watch?v=jQAt3e6Bz7U>

This is a required practical, so you need to know it!