**AQA P5a Forces - the basics**
**Combined Foundation**

**Required Practical for this topic:**
**Hooke's Law**

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| **Gravity, mass and weight** | mass | How much matter something is made of | Measured in kilograms (kg) |
| | weight | The force acting on an object due to gravity | Measured in newtons (N) |
| | gravitational field strength | How much weight is experienced per kilogram of mass | On Earth, this is 9.8 N/kg |
| Weight = mass x gravitational field strength (W = m x g) | | | |

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| **Units and definitions** | unit | For example: newton (N), kilogram (kg), metre (m) | |
| | kilo | For example: kilonewton (kN), kilogram (kg) | 1000 or $1x10^3$ |
| | mega | For example: meganewton (MN) | 1,000,000 or $1x10^6$ |
| | velocity | Speed in a given direction | m/s |
| | distance | How far | m |
| | displacement | Distance in a given direction | e.g. 5 metres east |
| centre of mass = the single point through which the weight of an object acts | | | |

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| **Scalars and vectors** | scalar | A quantity that only has magnitude (size), e.g. mass, time, temperature, energy, speed | Arrows can be used to show vectors:<br>Length of the arrow = size of the vector<br>Direction of the arrow = direction of the vector<br>  |
| | vector | A quantity that has magnitude and direction, e.g. force, velocity, momentum | |

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| **Work done and energy transfer** | work done | When work is done, energy is transferred.<br>Work done = force x distance (W = Fs) |
| 1 joule of work is done when 1 newton of force moves an object 1 metre in the direction of the force | | |
| If the force is at right angles to the direction of movement then no work is done | | |
| If work is done against friction then the thermal energy store of the object will increase | | |

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| **Forces** | A force can be a push or a pull | Examples are stretch, squash and turn |
| | Contact forces are exerted between two objects when they touch | E.g. friction, air resistance and tension |
| | Non-contact forces are exerted between two objects without touching | E.g. gravity, magnetism, electrostatic forces |
| Resultant force = the single force which has the same effect as all the forces on an object | | |
| | Two forces acting in the same direction… | …are added together |
| | Two forces acting in opposite directions… | …are taken away |

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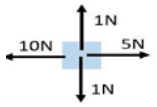
| A free body diagram shows the magnitude and direction of all the forces on an object |  |
| The object in the diagram would experience a force of 5N to the left. | |

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| **Forces and elasticity** | Forces can… | …accelerate or deform an object. |
| | elastic deformation | An object has been stretched but can return to its original length |
| | inelastic deformation | An object is stretched and can't return to its original length |
| | extension = | Current length – original length |
| | Hooke's law | The extension is directly proportional to the force stretching an object |
| | limit of proportionality | The point at which a force-extension graph stops being a straight line and Hooke's law stops being true |
| | elastic potential energy | Energy stored in a stretched spring |
| | work done on a spring | Increases the elastic potential energy store and thermal energy store of the spring |
| Hooke's law: force (*N*) = spring constant (*N/m*) x extension (*m*) (F = k x e) | | |
| elastic potential energy (*J*) = ½ x spring constant (*N/m*) x extension$^2$ ($m^2$) (E = ½ ke$^2$) | | |