KESTEVEN AND SLEAFORD HIGH SCHOOL
Physics Scheme of Learning

Year 10 – Term 3, Physics 8 - Forces in balance

Intent – Rationale

Engineers analyse forces when designing a great variety of machines and instruments, from road bridges and fairground rides to atomic force microscopes. Anything mechanical can be analysed in this way. Recent developments in artificial limbs use the analysis of forces to make movement possible. Having looked at the nature of matter which makes up objects, we move on to consider the effects of forces. The interaction between objects leads to actions which can be seen by the observer, these actions are caused by forces between the objects in question. Some of the interactions involve contact between the objects, others involve no contact. We will also consider the importance of the direction in which forces act to allow understanding of the importance of vector quantities when trying to predict the action.

Sequencing – what prior learning does this topic build upon?	**Sequencing – what subsequent learning does this topic feed into?**
KS3: Year 7 Topic 2 Forces and Effects, Year 7 Topic 6 Motion	GCSE: P9 Motion GCSE: P10 Forces in Motion GCSE: P11 Force and Pressure
What are the links with other subjects in the curriculum?	**What are the links to SMSC, British Values and Careers?**
• GCSE Technology and PE- Leavers, force multipliers and gears	• GB4e – Lesson 3 problem solving to explain how force and distance multipliers function.
What are the opportunities for developing literacy skills and developing learner confidence and enjoyment in reading?	**What are the opportunities for developing mathematical skills?**

KESTEVEN AND SLEAFORD HIGH SCHOOL

FROM THE LIBRARY *Big Idea: Einstein and Relativity*-509 *Fatal Forces*-500 *Forces and Motion*-531 *Forces and Movement*-531	• Make calculations using ratios and proportional reasoning to convert units and to compute rates (1c, 3c). • Use vector diagrams to illustrate resolution of forces, a net force, and equilibrium situations (scale drawings only) (4a, 5a, 5b).

Physics Scheme of Learning

Year 10 – Term 3, Physics 8 - Forces in balance

Intent – Concepts

What knowledge will students gain and what skills will they develop as a consequence of this topic?	
Know Recognise contact and non-contact forces. Recognise vector and scalar quantities. What a resultant force is and how to calculate it. Explain examples of levers in everyday life. What "the principle of moments" is and how to calculate if moments are balanced. State that gear systems can be used to increase or decrease the size of forces. **Apply** Compare a scalar and similar vector (e.g., distance and displacement or speed and velocity) explaining why these quantities are different. Use scale diagrams to represent the sizes of forces acting on an object. Apply the equation for a moment in a range of novel contexts including rearrangement and changes to and from base units. Describe the action of levers being used as force multipliers including calculation of the size of the forces produced. **Extend** Translate between vector descriptions and vector diagrams and vice versa using a range of appropriate scales. Use a scale diagram to add two or more vectors. Explain why a force multiplier requires the effort force to act through a larger distance than the load. Analyse systems of gears of different ratios to determine if the system will increase rotation speed or the size of rotational forces.	
What subject specific language will be used and developed in this topic?	**What opportunities are available for assessing the progress of students?**

KESTEVEN AND SLEAFORD HIGH SCHOOL

displacement distance in a given direction **driving force** force of a vehicle that makes it move (sometimes referred to as motive force) **effort** the force applied to a device used to raise a weight or move an object **force multiplier** a lever used so that a weight or force can be moved by a smaller force **forces** a force (in newtons, N) can change the motion of an object **free-body force diagram** a diagram that shows the forces acting on an object without any other objects or forces shown **friction** the force opposing the relative motion of two solid surfaces in contact **load** the weight of an object raised by a device used to lift the object, or the force applied by a device when it is used to shift an object **magnitude** the size or amount of a physical quantity **moment** the turning effect of a force defined by the equation: moment of a force (in newton metres, Nm) = force (in newtons, N) x perpendicular distance from the pivot to the line of action of the force (in metres, m) **Newton's first law of motion** if the resultant force on an object is zero, the object stays at rest if it is stationary, or it keeps moving with the same speed in the same direction **Newton's third law of motion** when two objects interact with each other, they exert equal and opposite forces on each other **parallelogram of forces** a geometrical method used to find the resultant of two forces that do not act along the same line **principle of moments**	P8 L9 End of topic Test Past exam question assessed homework "Long jump forces" Teams assignment

KESTEVEN AND SLEAFORD HIGH SCHOOL

for an object in equilibrium, the sum of all the clockwise moments about any point = the sum of all the anti-clockwise moments about that point **resultant force** a single force that has the same effect as all the forces acting on the object **scalar** a physical quantity, such as mass or energy, that has magnitude only (unlike a vector which has magnitude and direction) **vector** a vector is a physical quantity, such as displacement or velocity, that has a magnitude and a direction (unlike a scalar which has magnitude only)	

Intent – Concepts

Lesson title	Learning challenge	Higher level challenge	Suggested activities and resources
1. Forces between objects	I can draw and measure forces I can recognise contact and non-contact forces	I can interpret a scale diagram to determine the magnitude and direction of a vector.	
2. Resultant Force	I can recognise vector and scalar quantities I can explain what a resultant force is and how to calculate it I can explain Newton's 3rd Law	I can explain the pairs of forces acting in a wide range of unfamiliar scenarios, including the nature (contact or non-contact), direction, and magnitude of the forces.	
3. Levers	I can recognise levers and why they are useful to us I can explain examples of levers in everyday life	I can explain why a force multiplier requires the effort force to act through a larger distance than the load. I can apply the equation for a moment in a range of novel contexts including rearrangement and changes to and from base units.	

KESTEVEN AND SLEAFORD HIGH SCHOOL

4. Principle of Moments	I can explain what “the principle of moments” is I can explain how to calculate if moments are balanced	I can explain why a force multiplier requires the effort force to act through a larger distance than the load. I can apply the equation for a moment in a range of novel contexts including rearrangement and changes to and from base units.	
5. Gears	I can explain how gears can give a bigger turning effect or greater distance	I can describe the action of gears relating changes in the size of forces or the speed of rotation and the number of teeth in the gear. I can analyse systems of gears of different ratios to determine if the system will increase rotation speed or the size of rotational forces.	
6. Center of Mass	I can explain the meaning of ‘centre of mass’	I can apply centre of mass to real world situations	
7. Parallelogram of forces	I can explain how to draw a scale diagram of the parallelogram of forces and measure the resultant	I can translate between vector descriptions and vector diagrams and vice versa using a range of appropriate scales. I can use a scale diagram to add two or more vectors.	
8. Resolution of forces	I can resolve forces	I can resolve a pair of forces into the overall perpendicular components using vector diagrams. I can determine the size of an unknown force acting on an object in equilibrium using resolution of forces and a parallelogram technique.	

KESTEVEN AND SLEAFORD HIGH SCHOOL

9. End of topic test			