KESTEVEN AND SLEAFORD HIGH SCHOOL
Physics Scheme of Learning

P9: Motion

Intent – Rationale

This topic will develop the learners understanding of how motion can be quantified numerically and represented graphically. The concepts of displacement, velocity and acceleration will be represented in displacement-time, velocity-time and acceleration-time graphs. Learners should develop the ability to understand how to interpret these graphs including the analysis of gradients to represent the rate of change.

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 KS3 Year 7 Topic 6 – Motion GCSE P8 – Forces in balance	GCSE: P10 Force and motion A-Level: Mechanics
What are the links with other subjects in the curriculum?	**What are the links to SMSC, British Values and Careers?**
Maths: Living graphs	GB4b&e – Students develop confidence moving between rates of change graphs leading ultimately towards calculus
What are the opportunities for developing literacy skills and developing learner confidence and enjoyment in reading?	**What are the opportunities for developing mathematical skills?**

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FROM THE LIBRARY *Designs in Science:Movement-530* *Force and Motion-531*	• Make calculations using ratios and proportional reasoning to convert units and to compute rates (1c, 3c). • Relate changes and differences in motion to appropriate distance-time, and velocity-time graphs, and interpret lines and slopes (4a, 4b, 4c, 4d). • Interpret enclosed areas in velocity-time graphs (4a, 4b, 4c, 4d, 4f). • Apply formulae relating distance, time and speed, for uniform motion, and for motion with uniform acceleration, and calculate average speed for non-uniform motion (1a, 1c, 3c). • Estimate how the distances required for road vehicles to stop in an emergency, varies over a range of typical speeds (1c, 1d, 2c, 2h, 3b, 3c). • Apply formulae relating force, mass and relevant physical constants, including gravitational field strength, to explore how changes in these are inter-related (1c, 3b, 3c). • Apply formulae relating force, mass, velocity and acceleration to explain how the changes involved are inter-related (3b, 3c, 3d). • Estimate, for everyday road transport, the speed, accelerations and forces involved in large accelerations (1d, 2b, 2h, 3c).

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Intent – Concepts

What knowledge will students gain and what skills will they develop as a consequence of this topic?	
Know State that the gradient of a distance-time graph represents the speed. Estimate typical speeds for walking, running, and cycling. Describe the difference between speed and velocity using an appropriate example. Measure the acceleration of an object as it moves down a ramp. Identify changes in speed on a distance-time graph using change in gradient. **Apply** Use the gradients of distance–time graphs to compare the speeds of objects. Calculate the speed of an object and the time taken to travel a given distance using the speed equation. Calculate the change in velocity for an object under constant acceleration for a given period of time. Calculate the distance travelled using information taken from a velocity-time graph for one section of motion. **Extend** Compare and contrast the features of a distance–time, displacement-time, and velocity-time graph. Extract data from a distance-time graph to calculate the speed of an object at various points in its motion. Combine equations relating to velocity and acceleration in multi-step calculations. Apply transformations of the equation v2 − u2 = 2as in calculations involving change in velocity and acceleration where both velocities are non-zero.	
What subject specific language will be used and developed in this topic?	**What opportunities are available for assessing the progress of students?**
acceleration change of velocity per second (in metres per second per second, m/s^2) **deceleration** change of velocity per second when an object slows down **displacement** distance in a given direction **gradient (of a straight line graph)**	P9 L5 End of topic Test Past exam question assessed homework “Parachute Jump” Teams assignment

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change of the quantity plotted on the *y*-axis divided by the change of the quantity plotted on the *x*-axis **tangent** a straight line drawn to touch a point on a curve so it has the same gradient as the curve at that point **velocity** speed in a given direction (in metres/second, m/s)	

Intent – Concepts

Lesson title	Learning challenge	Higher level challenge	Suggested activities and resources
1. Speed and Distance-Time Graphs	I can explain how to calculate speed using the equation: speed = distance / time I can interpret information from a distance-time graph	I can extract data from a distance-time graph to calculate the speed of an object at various points in its motion. I can perform calculations of speed, distance, and time which involve conversion to and from SI base units.	Demo (data logger and ultrasound distance sensor) Link
2. Velocity and Acceleration	I can explain the difference between speed and velocity I can explain how to calculate acceleration	I can compare and contrast the features of a distance–time, displacement-time, and velocity-time graph. I can combine equations relating to velocity and acceleration in multi-step calculations.	Demo (data logger, light gate and double mask) Link
3. Velocity-time graphs	I can explain how to calculate acceleration and distance from a velocity-time graph	I can calculate the acceleration of an object from values taken from a velocity-time graph.	Demo (data logger and ultrasound distance sensor) Link

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		I can calculate the total distance travelled from a multi-phase velocity-time graph.	
4. Analysing motion graphs	I can explain how to calculate speed from a v-t graph when speed is not constant I can explain how to use the equation v2=u2+2as	I can use the gradient of a velocity-time graph to determine the acceleration of an object. I can apply transformations of the equation v2 − u2 = 2as in calculations involving change in velocity and acceleration where both velocities are non-zero.	Link
5. End of topic test			