SUBJECT: Physics YEAR: 10 MTP TITLE: Resultant forces HALF TERM: 3 NO. OF LESSONS (approx): 9

Deliberate and specific retrieval of expected prior knowledge	*Academic transformation*	*Personal transformation*
• Basic understanding of forces: From KS3, students should already be familiar with the concept that forces are interactions that can cause objects to move, change speed, or shape. They should know common forces like gravity, friction, and air resistance • Motion: Students have some experience with concepts like speed, distance, and time, and they should be able to relate how forces influence these quantities (e.g., applying force to increase speed). • Friction: They should know that friction is a force that opposes motion and how friction acts on surfaces in contact. • Mass vs. weight: Students should distinguish between mass (the amount of matter in an object) and weight (the force due to gravity acting on an object's mass). • Forces and Motion: Knowledge of basic forces such as gravity, friction, and air resistance. • Speed and Velocity: Understanding the difference between speed and velocity, and the basic relationship between distance, speed, and time. • Contact and Non-contact Forces: Introduction to force types (e.g., gravitational, electrostatic, and magnetic forces). • Balanced and Unbalanced Forces: How balanced forces result in no motion, while unbalanced forces lead to changes in motion.	• Forces as vectors: Students will learn that forces are vector quantities, meaning they have both magnitude and direction. They'll learn to represent forces using arrows (force diagrams).Resultant Force: They will learn how to calculate and resolve forces, understanding the concept of a resultant force and how it affects the motion of objects. • Newton's Laws of Motion: First Law: Object will remain stationary or move with constant velocity unless acted upon by an unbalanced force (inertia). Second Law: F=ma, the relationship between force, mass, and acceleration. Third Law: For every action, there is an equal and opposite reaction (forces always occur in pairs). • Gravitational Force and Weight: Understanding the relationship between gravitational force and weight, including the formula W=mxg. • Hooke's Law and Springs: Students will learn about the extension of springs and how it relates to the force applied, exploring Hooke's Law F=kxF • Types of Forces: Contact forces (e.g., friction, tension, air resistance, normal contact force). Non-contact forces (e.g., gravitational force, electrostatic force, magnetic force). • Free-body Diagrams: How to construct diagrams showing the forces acting on an object and use them to solve problems. • Speed vs Velcoity: students should be able to identify them as scalar or vector quantities. Know the typical values of speed for walking, running and cycling. They need to be able to use the equation: distance travelled = speed x time • Distance-time relationship: Students should be able to represent moving object using a distance-time graph. Interpret data using the graph. Be able to calculate speed using the gradient and acceleration using the tangent.	Real-world applications: • Sports Science: How forces and motion are crucial in sports (e.g., how athletes apply force to run or jump, the physics of collisions in sports like football or rugby). • Vehicle Safety: How forces like friction and air resistance play a role in the design of vehicles, particularly safety features like seatbelts, crumple zones, and airbags (related to Newton's Laws and momentum). • Space Exploration: The role of forces in rocket launches and satellite orbits, explaining the impact of gravitational force and how engineers use force calculations to design space missions. • Engineering Applications: How understanding forces and materials (such as stress and strain in engineering) leads to safer and more effective designs for bridges, buildings, and machinery. Link to Environmental Science: The role of forces in environmental science, such as how forces like wind affect the movement of ocean currents or the design of wind turbines for renewable energy.
Can I Learning Questions **Can I describe forces as scalar or vector quantities?** **Can I use vectors to resolve resultant forces?** **Can I use the resultant force to explain the motion of objects?** **Can I recall Newton's first and third law?** **Can I explain what is meant by terminal velocity?** **Can I calculate spring the spring constant?** **Can I calculate speed?** **Can I describe the relationship between distance and time?**	*Literacy and Oracy* **Website links and resources**: **BBC Bitesize**: Forces - BBC Bitesize – A useful resource for consolidating knowledge about forces and motion. **PhET Simulations**: Forces and Motion Simulations – Interactive tools for visualising the effects of forces on motion, ideal for exploring force diagrams and Newton's Laws. **Tasks for Reports**: **Investigating Hooke's Law**: Students can conduct experiments on the extension of springs under different forces and write a report explaining their findings in terms of Hooke's Law. **Force Diagrams in Practice**: A task where students analyze real-life situations (e.g., a car braking, a person jumping) and draw free-body diagrams to show all the forces involved, followed by a written explanation. **Verbal Discussion**: **Newton's Laws in Everyday Life**: Students could work in pairs or groups to discuss and present real-world examples of each of Newton's Laws (e.g., why we wear seatbelts, why objects keep moving unless acted on by a force). **Debate on Force and Motion in Sports**: Organize a debate where students discuss how forces affect athletic performance (e.g., the role of friction in running speed, the forces involved in pole vaulting).	*Misconceptions* **Misconception: Forces are only present when something is moving**: **Correction**: Forces are present even when objects are stationary, such as the force of gravity acting on a stationary object or the normal force acting upward on an object at rest. **Misconception: An object in motion will eventually stop by itself**: **Correction**: Objects in motion stay in motion unless acted on by an external force (Newton's First Law), meaning that in the absence of friction or other forces, an object will continue moving forever. **Misconception: The weight of an object is the same everywhere**: **Correction**: Weight depends on the local gravitational field strength, so an object will weigh less on the Moon than on Earth due to the difference in gravity. **Misconception: The greater the mass of an object, the greater the force needed to move it**: **Correction**: While mass is related to inertia (resistance to a change in motion), the force required to accelerate an object also depends on the object's acceleration, according to F=ma **Misconception: A stretched spring will always return to its original length**: **Correction**: Springs only obey Hooke's Law (i.e., return to their original length) when the force applied does not exceed the elastic limit. Beyond this point, the spring may deform permanently.