Meden School Curriculum Planning							
Subject	Physics	**Year Group**	10	**Sequence No.**	18	**Topic**	Motion

Retrieval	Core Knowledge	Student Thinking
What do teachers need **retrieve** from students before they start teaching **new content**?	What **specific ambitious knowledge** do teachers need teach students in this sequence of learning?	What real life examples can be applied to this sequence of learning to **development of our students thinking, encouraging them to see the inequalities around them** and 'do something about them!'
Y7 Forces If the forces on an object are balanced, the object remains at rest or continues moving at a constant speed. If forces on an object are unbalanced then it will start to move, speed up, slow down or change direction. Y8 Speed and motion Speed is how far something goes in a given time. Distance-time graphs have distance on the y-axis and time on the x-axis. Velocity-time graphs have velocity on the y-axis and time on the x-axis. Acceleration is a measure of how quickly an object changes its speed. Air resistance acts against weight when an object is in free-fall. Terminal velocity is the top speed an object can reach.	**L1: Distance** is how far an object moves. Distance **does not involve direction**. Distance is a **scalar** quantity. **Displacement** includes **both the distance** an object moves, measured in a straight line from the start point to the finish point and **the direction** of that straight line. Displacement is **a vector** quantity. Express a displacement in terms of both the **magnitude and direction**. **L2: Speed does not involve direction**. Speed is a **scalar** quantity. The speed of a moving object is rarely constant. When people walk, run or travel in a car their speed is constantly changing. The speed at which a person can walk, run or cycle depends on many factors including: age, terrain, fitness and distance travelled. **Typical values** may be taken as: walking ~ 1.5 m/s running ~ 3 m/s cycling ~ 6m/s car~25m/s train~55m/s aeroplane~250m/s It is not only moving objects that have varying speed. The **speed of sound** and the speed of the wind also vary. A typical value for the speed of sound in air is **330 m/s.** For an object moving at constant speed the distance travelled in aspecific time can be calculated using the equation: **distance travelled = speed × time** or **s = vt** where distance, s is in metres, m; speed, v is in metres per second m/s; time, t is in seconds, s. The **velocity** of an object is its **speed in a given direction**. Velocity is a **vector** quantity. The vector–scalar distinction applies to displacement, distance, velocity and speed.	Distance students travelled to get to school is different to their displacement.

	(HT only) Explain **qualitatively**, with examples, that **motion in a circle** involves **constant speed** but **changing velocity**. **L3**: The average acceleration of an object can be calculated using the equation: $$\textit{acceleration} = \frac{\textit{change in velocity}}{\textit{time taken}}$$ acceleration, a, in metres per second squared, m/s^2; change in velocity, Δv, in metres per second, m/s; time, t, in seconds, s An object that slows down is **decelerating**. Estimate the magnitude of everyday accelerations **L4**: If an object moves along a straight line, the distance travelled can be represented by a **distance–time graph**. The **speed** of an object can be calculated from **the gradient** of its distance–time graph. (HT only) If an object is accelerating, its speed at any particular time can be determined by drawing a **tangent** and measuring the gradient of the distance–time graph at that time. Draw a distance–time graphs from measurements and extract and interpret lines and slopes of distance–time graphs, **translating** information between **graphical** and **numerical form**. **L5**: The **acceleration** of an object can be calculated from the **gradient** of a **velocity–time graph**. (HT only) The **distance travelled** by an object (or displacement of an object) can be calculated from the **area** under a velocity–time graph. • draw velocity–time graphs from measurements and interpret lines and slopes to determine acceleration • (HT only) interpret enclosed areas in velocity–time graphs to determine distance travelled (or displacement) • (HT only) measure, when appropriate, the area under a velocity–time graph by counting squares. **L6:** The following equation applies to **uniform acceleration**: $$\textit{final velocity}^2 - \textit{initial velocity}^2 = 2 \times \textit{acceleration} \times \textit{distance}$$	

	$v^2 - u^2 = 2as$ final velocity, *v*, in metres per second, m/s initial velocity, *u*, in metres per second, m/s acceleration, *a*, in metres per second squared, m/s^2 distance, *s*, in metres, m Near the Earth's surface any object **falling freely under gravity** has an **acceleration** of about **9.8** $\mathbf{m/s^2}$. An object falling through a **fluid initially accelerates** due to the **force of gravity**. Eventually the **resultant force** will be **zero** and the object will move at its **terminal velocity** **L7**: **Newton's First Law**: If the **resultant force** acting on an object **is zero** and: • the object is **stationary,** the object remains **stationary** • the object is **moving**, the object continues to move at the **same speed** and in **the same direction**. So, the object continues to move at the **same velocity**. So, when a vehicle travels at **a steady speed** the **resistive forces balance the driving force.** So, the **velocity** (speed and/or direction) of an object will **only change** if a **resultant force is acting on the object**. Apply Newton's First Law to explain the motion of objects moving with a uniform velocity and objects where the speed and/or direction changes. (HT only) The tendency of objects to continue in their state of rest or of uniform motion is called **inertia**. **L8: Newton's Second Law:** The **acceleration** of an object **is proportional** to the **resultant force** acting on the object, and **inversely proportional** to the **mass** of the object. ***resultant force = mass × acceleration*** $F = ma$ force, *F*, in newtons, N; mass, *m*, in kilograms, kg; acceleration, *a*, in metres per second squared, m/s^2 (HT only) **Inertial mass** is a measure of how difficult it is to change the velocity of an object and is defined	Felix Baumgartner performed the worlds highest skydive and broke the record for highest terminal velocity speed.

	as the ratio of force over acceleration. Estimate the speed, accelerations and forces involved in large accelerations for everyday road transport. Recognise and use the symbol that indicates an approximate value or approximate answer, ~ Required practical activity 19**:** investigate the effect of varying the force on the acceleration of an object of constant mass, and the effect of varying the mass of an object on the acceleration produced by a constant force **L9 Newton's Third Law**: Whenever two objects interact, the **forces** they exert on each other are **equal** and **opposite**. Apply Newton's Third Law to examples of **equilibrium** situations. **L10** The **stopping distance** of a vehicle is the **sum of the distance** the vehicle travels during the driver's **reaction time (thinking distance**) and the distance it travels under the **braking force (braking distance**). For a given braking force the **greater the speed** of the vehicle, the **greater the stopping distance**. The braking distance of a vehicle can be affected by adverse **road a**nd **weather conditions** and **poor condition of the vehicle**. Adverse road conditions include wet or icy conditions. Poor condition of the vehicle is limited to the vehicle's brakes or tyres. The distance required for road vehicles to stop in an emergency varies over a range of typical speeds. When a force is applied to the brakes of a vehicle, **work don**e by the **friction force** between the brakes and the wheel **reduces the kinetic energy** of the vehicle and the temperature of the brakes increases. The greater the speed of a vehicle the greater the braking force needed to stop the vehicle in a certain distance. The greater the braking force the greater the deceleration of the vehicle. Large decelerations may lead to brakes overheating and/or loss of control. **L11 Reaction times** vary from person to person. Typical values range from 0.2 s to 0.9 s. A driver's reaction time can be affected by **tiredness, drugs and alcohol**. **Distractions** may also affect a driver's ability to react. The **ruler drop test** can be used to measure human reaction times.	Speed limits on roads are set based on stopping distances.

	L12 (HT only) **Momentum** is defined by the equation: ***momentum = mass × velocity*** $\boldsymbol{p = m\,v}$ momentum, *p*, in kilograms metre per second, kg m/s; mass, *m*, in kilograms, kg; velocity, *v*, in metres per second, m/s In a **closed system**, the **total momentum before** an event is **equal** to the **total momentum after** the event. This is called **conservation of momentum**. Use the concept of momentum as a model to describe and explain examples of momentum in an event, such as a collision. . .	