P1: Motion Knowledge Organiser

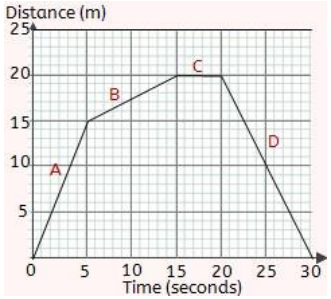
Lesson sequence

1. Vectors and scalars
2. Speed-time graphs
3. Distance-time graphs
4. Acceleration
5. Velocity-time graphs

1. Vectors and scalars	
Magnitude	A scientific word for size.
Scalar quantity	A quantity with magnitude (but no direction).
Scalar examples	Distance – 10 m Speed – 25 m/s Mass – e.g. 50 kg
Vector quantity	A quantity with magnitude and direction.
Vector examples	Displacement – 10 m north Velocity – 25 m/s east Force – 30 N left Acceleration – 3 m/s^2 south Momentum – 400 N m/s right
Vector arrows	Vectors can be represented by arrows, with the length of the arrow representing the magnitude.
Displacement	The distance and direction travelled in a straight line.
Velocity	Your speed in a certain direction.

2. Speed	
Units of speed	Metres per second, m/s.
Speed – word equation	Speed = distance / time Speed = m/s Distance = m Time = s
Speed – symbol equation	v = x/t v = speed x = distance t = time
Instantaneous speed	Speed at a particular point in time.
Average speed	The average speed across the whole of a journey, calculate from v = x/t.
Calculating distance travelled – word equation	Distance = average speed x time x = v x t Distance = m Average speed = m/s Time = s
Measuring speed	Measure the distance between two points and time how long an object takes to pass, then calculate using v = x/t.
Light gates	Equipment that can be used for measuring time accurately with fast-moving objects to help find their speed.
Some typical speeds	Walking – 1-2 m/s Running – 3-8 m/s Cycling – 5-20 m/s Driving – 10-40 m/s Flying – 250 m/s

3. Distance-time graphs	
Distance-time graph	A graph describing how your distance from the start changes over the course of a journey. Time is on the x-axis and distance on the y-axis.
Distance-time graphs – stationary	Horizontal line
Distance-time graphs – constant speed	Forwards – line sloping up Backwards – line sloping down
Distance-time graphs – line gradient	Steeper line = faster
Calculating speed from a distance-time graph	Speed = change in distance / change in time Speed = change in y / change in x



4. Acceleration	
Acceleration	Changing velocity
You accelerate when…	- You change speed - You change direction
Units of acceleration	Metres per second squared, m/s^2
Positive and negative acceleration	Positive acceleration = speeding up Negative acceleration = slowing down
Deceleration	Slowing down, negative acceleration.
Acceleration – word equation	Acceleration = change in speed / time Acceleration = m/s^2 Change in speed = m/s Time = s
Acceleration – symbol equation	a = (v – u)/ t a = acceleration v = final speed u = initial speed t = time
Linking acceleration and Velocity travelled	Use the equation: x = (v^2 – u^2) / 2a x = Velocity travelled a = acceleration v = final speed u = initial speed
Acceleration during free fall	10 m/s^2

5. Velocity-time graphs	
Velocity-time graph	A graph showing how your velocity (speed) changes over time. Time is on the x-axis, velocity is on the y-axis.
Velocity-time graphs – constant speed	Horizontal line
Velocity-time graphs – acceleration	Speeding up – line sloping up Slowing down – line sloping down
Velocity-time graphs – Stationary	Horizontal line on the x-axis
Velocity-time graphs – line gradient	Steeper line = greater acceleration
Calculating acceleration on a velocity-time graph	Acceleration = change in velocity/ change in time Acceleration = change in y / change in x
Calculating distance travelled from a velocity-time graph	Distance = area under the graph. Divide the graph into rectangles and triangles, find the area of each and add them together.