Year 11 Physics Learning Journey

Forces in balance

Autumn Term 1

Core knowledge
1. Identify and describe scalar quantities and vector quantities.
2. Identify and give examples of forces as contact or non-contact forces.
3. Describe the interaction between two objects and the force produced on each as a vector.
4. State Newton's 3rd law of motion.
5. Explain what is meant by 'centre of mass'.
6. Describe a method to find the centre of mass of a symmetrical object.
7. Describe a method to find the centre of mass of an asymmetrical object.
8. Calculate the resultant of two forces that act in a straight line
9. **HT ONLY:** describe examples of the forces acting on an isolated object or system
10. **HT ONLY:** Use free body diagrams to qualitatively describe examples where several forces act on an object and explain how that leads to a single resultant force or no force.
11. **HT ONLY:** Use free body diagrams and accurate vector diagrams to scale, to resolve multiple forces and show magnitude and direction of the resultant.
12. **HT ONLY:** Use vector diagrams to illustrate resolution of forces, equilibrium situations and determine the resultant of two forces, to include both magnitude and direction.

Learning Checkpoints

Learning Checkpoint Title	Attempt 1		Attempt 2/ Extend	
	Mark	RAG	Mark	RAG
Scalar and vector quantities				
Resultant forces				

Key Vocabulary	
Tier 2	Describe, Define, Explain, illustrate , identify
Tier 3	Scalar, vector, magnitude, resultant, mass, contact, non-contact, centre of mass, diagram

Year 11 Physics Learning Journey

Motion

Autumn Term 2

Core knowledge
1. Use the gradients of distance-time graphs to compare the speeds of objects.
2. Estimate typical speeds for walking, running, and cycling.
3. Describe the motion of an object by interpreting distance-time graphs.
4. Calculate the speed of an object and the time taken to travel a given distance.
5. Identify the features of a velocity-time graph.
6. Recall the equation relating velocity, acceleration, and time.
7. Calculate the change in velocity for an object under constant acceleration for a given period of time.
8. Describe sections of velocity-time graphs and compare the acceleration in these sections.
9. Calculate the distance travelled using information taken from a velocity-time graph for one section of motion.
10. Measure the acceleration of an object as it moves down a ramp.
11. Calculate the speed of an object by extracting data from a distance-time graph.
12. Use a tangent to determine the speed of an object from a distance-time graph.
13. Calculate the distance travelled by an object at constant velocity using data extracted from a graph.
14. Use the equation $v^2 - u^2 = 2as$ in calculations where the initial or final velocity is zero.

Learning Checkpoints

Learning Checkpoint Title	Attempt 1		Attempt 2/ Extend	
	Mark	RAG	Mark	RAG
Motion graphs				
Acceleration				

Key Vocabulary	
Tier 2	describe, sketch, explain, calculate, approximate
Tier 3	scalar, vector, gradients, speed, velocity, acceleration, displacement, deceleration, initial, final, tangent

Year 11 Physics Learning Journey

Force and motion

Autumn Term 2

Core knowledge
1. Describe the effect of changing the mass or the force acting on an object on the acceleration of that object.
2. Perform calculations involving the rearrangement of the *F* = *ma* equation.
3. Required practical: Investigate the effect on the acceleration of an object of varying the force on it and of varying its mass.
4. State the difference between the mass of an object and its weight.
5. Calculate the weight of objects using their mass and the gravitational field strength.
6. Apply the concept of balanced forces to explain why an object falling through a fluid will reach a terminal velocity.
7. Investigate the relationship between the mass of an object and the terminal velocity.
8. Categorise factors which affect thinking distance, braking distance and both.
9. Calculate the braking and thinking distance of a car.
10. Describe the relationship between speed and both thinking and braking distance.
11. Apply the equation p = *mv* to find the momentum, velocity or mass of an object.
12. Use the principle of conservation of momentum to find the velocities of objects.
13. Explain how the behaviour of objects during explosions shows the conservation of momentum.
14. State Hooke's law.
15. Explain the limitations of Hooke's law including the limit of proportionally.
16. Calculate the force required to cause a given extension in a spring using the spring constant.
17. Compare materials in terms of elastic and non-elastic behaviour.
18. **Required practical:** Investigate the relationship between force and extension for a spring.

Learning Checkpoints

Learning Checkpoint Title	**Attempt 1**		**Attempt 2/ Extend**	
	Mark	RAG	Mark	RAG
Newton's second law				
Forces and braking				
Key Vocabulary				
Tier 2	describe, categorise, explain, calculate, compare			
Tier 3	terminal velocity, weight, mass, stopping distance, thinking distance, braking distance, momentum, proportionality, extension, elastic			

Year 11 Physics Learning Journey

Wave properties

Spring Term 1

Core knowledge
1. Identify waves as either transverse or longitudinal.
2. Compare transverse and longitudinal waves in terms of direction of vibration and
3. Investigate wave motion through a spring model.
4. Identify waves as either mechanical or electromagnetic.
5. Compare transverse and longitudinal waves in terms of direction of vibration and propagation.
6. Compare electromagnetic and mechanical waves in terms of the need for a medium.
7. Calculate the period of a wave from its frequency.
8. Calculate the wave speed from the frequency and wavelength.
9. Use a wave front model to explain refraction and reflection.
10. Describe the relationship between the angle of incidence and angle of refraction.
11. Explain refraction in terms of changes in the speed of waves when they move between one medium and another.
12. Measure the speed of a wave in water.
13. Measure the speed of a wave in a solid (string).
14. Describe the effect that changing the frequency of a wave has on its wavelength in a medium.
15. Calculate the speed of waves using the wave speed equation.
16. **Required practical:** Investigating plane waves in a ripple tank and waves in a solid.

Learning Checkpoints

Learning Checkpoint Title	Attempt 1		Attempt 2/ Extend	
	Mark	RAG	Mark	RAG
Types of waves				
The wave equation				

Key Vocabulary	
Tier 2	describe, identify, explain, relationship, compare, investigate
Tier 3	transverse wave, longitudinal wave, frequency, amplitude, wavelength, reflection, refraction, echo

Year 11 Physics Learning Journey

Electromagnetic waves

Spring Term 1

Core knowledge
1. Identify the position of EM waves in the spectrum in order of wavelength and frequency.
2. Describe the relationship between the energy being transferred by an electromagnetic wave and the frequency of the wave.
3. Calculate the frequency and the wavelength of an electromagnetic wave.
4. Explain why the range of wavelengths detected by the human eye is limited.
5. Describe how a range of electromagnetic waves are used in a variety of scenarios.
6. List some simple examples of the uses of light, microwaves, and radio waves.
7. Explain why a particular wave is suited to its application.
8. State what radio waves and microwaves are used are used for.
9. Outline the operation of a mobile phone network and the waves used.
10. Discuss the evidence for mobile phone signals causing damage to humans.
11. Compare home improvement features in terms of payback time.
12. Describe the penetrating powers of gamma rays, X-rays, and ultraviolet rays.
13. Describe the uses and dangers of UV radiation.
14. Describe the uses and dangers of X-rays and gamma radiation.
15. Explain how the process of ionisation can lead to cell death or cancer through damage to DNA.
16. Describe the formation of an X-ray photograph in terms of absorption or transmission.

Learning Checkpoints

Learning Checkpoint Title	Attempt 1		Attempt 2/ Extend	
	Mark	RAG	Mark	RAG
The EM spectrum				
Uses of EM waves				

Key Vocabulary	
Tier 2	Describe, risk and benefit, explain, diagnose, compare
Tier 3	transverse wave, longitudinal wave, frequency, amplitude, wavelength, reflection, refraction, echo

Year 11 Physics Learning Journey

Electromagnetism

Spring Term 2

Core knowledge
1. State the names of the poles of a magnet.
2. Describe the interaction of magnetic poles (attraction and repulsion).
3. Describe how the shape of a magnetic field can be investigated.
4. Sketch the shape of a magnetic field around a bar magnet.
5. Explain in detail how a magnetism can be induced in some materials.
6. Describe how the strength of a magnetic field can be investigated.
7. Compare the Earth's magnetic field to that of a bar magnet.
8. Describe the magnetic field produced by a current carrying wire.
9. Use the corkscrew rule to determine the direction of the field around a current carrying wire.
10. Describe the effect of increasing the current on the magnetic field around a wire.
11. Describe the effect of reversing the direction of the current in the wire.
12. Describe the shape of the field produced by a solenoid.
13. Determine the polarity of the ends of a solenoid from the direction of the current.
14. Sketch the shape of the field surrounding a solenoid relating this to the direction of the current through the coil.
15. Describe the operation of a moving-coil loudspeaker.
16. Describe and explain in detail the operation of a d.c. motor.
17. Apply Fleming's left-hand rule to determine the direction of the force acting on a conductor.
18. Perform calculations involving rearrangements of the equation $F = BIl$.
19. Calculate the force acting on a conductor when it is placed in a magnetic field.

Learning Checkpoints

Learning Checkpoint Title	Attempt 1		Attempt 2/ Extend	
	Mark	RAG	Mark	RAG
Magnetic materials				
Solenoids and electromagnets				

Key Vocabulary	
Tier 2	describe, explain, model, re-arrange, sketch, apply
Tier 3	attract, repel, solenoid, induced magnet, magnetic field, electromagnet, polarity, AC, DC, current, conductor