Sample Teaching Plan
Unit G626: The Physics of Sport

Suggested teaching time	Plan is based on 12 weeks at 5 hours per week (4 hours contact time + 1 hour directed study).

The learning activities are suggestions only. Teachers may wish to develop alternative strategies. The plan should be read alongside the G626 Specification and, in particular, the Assessment Evidence Grid (attached for your reference).

Week number	Specification Unit Reference and Assessment Objectives	Suggested Learning Activities	Resources
1 – 2	**3.7.1:** Measurement **- AO1** • Know the SI units of mass, length, time, temperature, pressure, force, and weight, and their multiples and submultiples, the practical units used for measurement in sport, such as mm Hg, °C, calories, and how they relate to the SI units and carry out calculations and conversions using SI and other units. • Know about devices and techniques for making measurements in sport and explain the need for calibration and the limitation of: - manual clockwork and electronic clocks/stopwatches - mechanical and optical timing gates - rules and tape measures - manometers and pressure cells - mercury/glass thermometers & thermistors - clip-on pulse monitors - radar - data logging.	Circus of measurement activities recording measurement of each type, for example: • mass of shot for shot putting. • length of long jump. • time to run 100 m. • using light gates compared to stopwatch. • air temperature. • force and pressure under blade of ice skate. • weight of body. • air pressure. • investigation of calories in breakfast cereals and sports drinks. • use of clip-on pulse monitor. • microwave simulation of radar speed measurement. • data logging of physiological measurement e.g. pulse rate, blood pressure.	balance. measuring tape. stopwatch. light gates and electronic timer. thermometer/temperature sensor for datalogger. newton meter. ice skate blade or metal imitation blade. manometer. barometer. cereal packets/sports drink containers. computer with datalogging software and interface, e.g. Data Studio software with PASCO Scientific. interface and transducers. physiological sensors.

Week number	Specification Unit Reference and Assessment Objectives	Suggested Learning Activities	Resources
	• carry out and record measurements using sports equipment or laboratory equivalent.	**Assessment** Research and write first leaflet. Guidance leaflet 1, '*Measurement in Sport*' which will include the units, devices and techniques used for making measurements of **four** different quantities in specified sports of the candidate's choice.	Tables of Physical and Chemical Constants, Kaye and Laby, definitions of units, internet and library access.
3 – 4	**3.7.2:** Physics of the Body **and** **3.7.4:** Practical Techniques and Procedures - **AO1 & AO3** • describe the formation of a real image with a convex lens and relate this to the eye. • describe the optical function of each of the parts of the eye listed above. • describe the effects of colour filters on white/day/flood light and explain how the use of coloured contact/spectacle lenses may help sports players, e.g. tennis, aviation. • describe how eye defects can be corrected with the use of lenses and perform calculations to determine the focal length of such lenses and perform calculations to determine the focal length of such lenses.	Use convex lens to form real image on screen. Simulate focusing of eye by investigation forming image at fixed distance from lens (simulating position of retina) with a variety of object distances by substituting a range of lenses with various focal lengths. Investigate ray diagrams for convex lens on computer. Draw diagram of eye from model. Investigate effects of coloured filters using diffraction grating to produce spectrum. **Assessment:** Research and write second guidance leaflet, '*Seeing in Sport'* that will include the structure of the eye and how it forms an image, related to **one** chosen sport where good vision is of critical importance. **Assessment:** Obtaining information by experimental investigation - **part 1:** design and carry out a safe experiment to determine the focal length of a convex lens.	set of lenses. lens holder screen. lamp as object. software to draw ray diagrams. model of eye. coloured filters. diffraction grating. white light source. Internet and library access. optical bench. light source/object screen. convex lens. metre rule. partial blackout.

Week number	Specification Unit Reference and Assessment Objectives	Suggested Learning Activities	Resources
		Plan and carry out experiment: • identify hazards and carry out a risk assessment. • plan and follow procedures. • make and record any observations or measurements. • process and evaluate the results. • carry out any relevant calculations.	
5 – 6	**3.7.2:** Physics of the Body - **AO1** • State the principle of conservation of energy. • state that muscles are not very efficient at converting chemical energy to mechanical work done. • apply the principle of moments to bone/muscle joints, calculate in/output forces, mechanical advantage, velocity ratio, and show how the angle between the bone and the muscle affects the forces involved. • explain why exercise produces heat and its implications in endurance events such as marathon running.	Discussion of energy transfer chain in sports context. (Breakfast – chemical changes in body – work done by muscles – heat kinetic/potential energy gained etc.). Practical exercise with model arm and leg. Research on respiration in muscle tissues. **Assessment:** Research and write third guidance leaflet, '*Movement in Sport',* that will include an account of how chemical energy is most efficiently converted into useful mechanical work using the muscles, bones and joints of **one** or more limbs and related to **one** chosen sport where efficient movement is of critical importance.	Model may consist of beams and strings, force meters, masses, protractor. Internet and library access.

Week number	Specification Unit Reference and Assessment Objectives	Suggested Learning Activities	Resources
7	**3.7.1:** Measurement **and** **3.7.3:** Physics of Equipment and Technique - **AO2** • use formulae and equations to solve problems involving force, mass, acceleration, momentum, work, energy and power. • use vectors to solve problems involving velocities or forces. • know what is meant by the coefficient of restitution. • calculate the energy and momentum involved in sports. • apply conservation of energy and momentum to simple sporting examples such as the collision of snooker balls, rugby players, bats and balls.	Carry out set of calculations of progressively increasing complexity. **Assessment:** evidence that the candidate has completed a number of calculations related to the physics of sport. Note that to achieve Mark Bands 2 and 3 students must use data they have researched. This may be linked to other assignments.	Teacher-produced worksheet of questions. calculator.
8	**3.7.3:** Physics of Equipment and Technique - **AO2** • Describe the typical properties of metals, ceramics, polymers and 'old' composites such as wood and leather. • explain what is meant by a composite material.	Research and presentation to group by class members. Construction and testing of GRP model.	source material to assist presentations. glass fibre. resin. force meter and masses to test.

Week number	Specification Unit Reference and Assessment Objectives	Suggested Learning Activities	Resources
9	**3.7.3:** Physics of Equipment and Technique **and** **3.7.4:** Practical Techniques and procedures - **AO2 and AO3** • Research the use of new materials in a range of sporting applications and show why a particular material was used for a particular a job and explain the advantage to the player.	Candidates select examples from sports of their choice and obtain manufacturers specifications and sports governing body rules governing equipment. **Assessment:** Obtaining information by experimental investigation - **part 2:** design and carry out a safe experiment to determine the coefficient of restitution for a ball of your choice. Plan and carry out experiment: • identify hazards and carry out a risk assessment. • plan and follow procedures. • make and record any observations or measurements. • process and evaluate the results. • carry out any relevant calculations.	internet. sports shops. letters to manufacturers. selection of balls and surfaces. metre rule.
10		**Assessment:** Research and produce an *'Equipment in Sport'* presentation that will discuss the required material properties and how these are achieved in sports equipment. Portfolio evidence may include presenter's notes, PowerPoint slides, teacher's assessment score sheet, feedback from other students. Where joint presentations are given, the contributions of individual members of the group in research and presentation should be identified and marked individually.	

Week number	Specification Unit Reference and Assessment Objectives	Suggested Learning Activities	Resources
11	**3.7.3:** Physics of Equipment and Technique • Explain the effects of spin on the trajectory and bounce of a ball. • show that rotating objects have both kinetic energy and momentum, explain how a change in shape may lead to a change in rate of rotation, and apply this to various sporting examples. • explain how sails and wings produce forces for motion and lift.	'A' stands on turntable platform and extends arms. 'B' standing on floor pushes 'A' to start rotation. 'A' drops arms. Rate of rotation increases. Test models near blower.	tennis racket and ball. credit card sized CD *The Physics of Spin,* Cambridge University Cavendish Laboratory, sponsored by IOP. turntable. model wing and sail. air blower.
12		**Assessment** Research and write fourth guidance leaflet, a '*Technique in Sport'* leaflet that will include **one** example related to a specified sport of their choice of either collisions, trajectories of moving objects or lift, e.g. in aerofoils.	Internet and library access.

Unit G626 - Assessment Evidence Grid

Unit G626: The Physics of Sport

What the candidate needs to do:

The candidate needs to produce evidence of their investigation into the physics of sport [**50** marks].

This evidence needs to include**:**

AO1: a series of four short guidance leaflets for the coaches at a sport and recreation centre to help them answer questions of a technical nature from their trainees:

- a *'Measurement in Sport'* leaflet which will include the units, devices and techniques used for making measurements of **four** different quantities in specified sports of the candidate's choice;
- a '*Seeing in Sport'* leaflet which will include the structure of the eye and how it forms an image, related to **one** chosen sport where good vision is of critical importance;
- a '*Movement in Sport'* leaflet which will include an account of how chemical energy is most efficiently converted into useful mechanical work using the muscles, bones and joints of **one** or more limbs and related to **one** chosen sport where efficient movement is of critical importance;
- a '*Technique in Sport'* leaflet which will include **one** example related to a specified sport of their choice of either collisions, trajectories of moving objects or lift, e.g. in aerofoils [**21**];

AO2: a presentation which will discuss the required material properties and how these are achieved in sports equipment; evidence that the candidate has completed a number of calculations related to the physics of sport [**10**];

AO3: evidence that the candidate has obtained information by experimental investigation relating to the physics of sport [**19**].

How the candidate will be assessed:

Assessment Objective	Mark Band 1	Mark Band 2	Mark Band 3	Mark Awarded
AO1	Candidate will demonstrate some knowledge and understanding of the facts, phenomena and principles involved in the unit in their • *'Measurement in Sport'* leaflet; **[0 1 2]** • '*Seeing in Sport'* leaflet; **[0 1 2]** • '*Movement in Sport'* leaflet; **[0 1 2]** • '*Technique in Sport'* leaflet; **[0 1 2]**	candidate will demonstrate an extensive knowledge and understanding of the facts, phenomena and principles in their leaflets; there may be minor omissions but there are no serious scientific errors in their • *'Measurement in Sport'* leaflet; **[3]** • '*Seeing in Sport'* leaflet; **[3]** • '*Movement in Sport'* leaflet; **[3]** • '*Technique in Sport'* leaflet; **[3 4]**	candidate will demonstrate comprehensive and detailed knowledge and understanding of the facts, phenomena and principles in their • *'Measurement in Sport'* leaflet; **[4 5]** • '*Seeing in Sport'* leaflet; **[4 5]** • '*Movement in Sport'* leaflet; **[4 5]** • '*Technique in Sport'* leaflet. **[5 6]**	**/21**

Unit G626: The Physics of Sport (continued)				
Assessment Objective	**Mark Band 1**	**Mark Band 2**	**Mark Band 3**	**Mark Awarded**
AO2	Candidate will produce an *'Equipment in Sport'* presentation which shows some relevant physical principles relating to the choice of material for specific sports equipment showing corrected spelling, punctuation and grammar; **[0 1 2]**	candidate will produce an *'Equipment in Sport'* presentation which shows that they can identify the relevant physics principles relating to the choice of material for specific sports equipment; although there may be minor errors and omissions, their explanations will be clear and accurate, mainly with correct spelling, punctuation and grammar; **[3 4]**	candidate will produce an *'Equipment in Sport'* presentation that shows that they can accurately identify the underlying physics principles relating to the choice of material for specific sports; candidate will correctly use the principles to give a clear, accurate and logical explanation, spelling, punctuation and grammar is correct. **[5 6]**	
	Candidate will show that they can perform a number of simple calculations using provided data relating to the physics of sport; **[0 1]**	candidate will show that they can perform a number of simple and complex calculations using researched data relating to the physics of sport, and their use of mathematics is generally accurate and correct; **[2 3]**	candidate will show that they can perform a number of simple and complex calculations using researched data, relating to the physics of sport, and use mathematical techniques confidently, accurately and appropriately and where relevant to enhance the explanations in experimental investigations. **[4]**	**/10**
AO3	Candidate will show that they can plan two investigations and provide evidence that they can conduct them safely using risk assessments; candidate will show that they have used a range of equipment; **[0 1 2]**	candidate will show that they can plan two investigations and provide evidence that they can conduct them confidently and safely; candidate will produce and follow risk assessments; candidate will show that they have used a range of equipment and techniques; **[3 4]**	candidate will show that they can plan and conduct two investigations safely, in accordance with their risk assessments, that are comprehensive and use equipment to the appropriate degree of accuracy; candidate will show that they have used a wide range of equipment and techniques. **[5 6]**	
	Candidate has obtained and recorded some valid data; **[0 1 2]**	candidate has obtained adequate valid data and repeat measurements; candidate has recorded data in a suitable form and usually to an appropriate degree of precision; **[3 4]**	candidate has obtained ample valid data and repeat measurements; candidate has recorded data clearly and to an appropriate level of precision. **[5 6]**	
	Candidate has suitably processed and interpreted results and drawn basic conclusions; **[0 1 2]**	candidate has accurately processed and interpreted results drawing conclusions relating to the investigations; **[3 4 5]**	candidate has accurately processed and interpreted all results in detail and drawn logical conclusions, discussing their significance to the investigations, evaluating where appropriate. **[6 7]**	**/19**
			Total mark awarded:	**/50**