Morecambe Bay Academy

Physics

Why study A Level Physics?

Have you ever wondered . . .

- Why the universe behaves the way it does?
- How ultrasound can create a picture?
- How fast you would have to travel to fool a speed camera?
- What force would be necessary to stop a formula one car?
- What are CERN looking for?

Physics A Level is one of the most universally accepted qualifications for progression to university. The course content covers the basis of how things work, from the constituent parts of atoms out to the extent of the universe. You will integrate the concepts studied with a range of practical experiments throughout each topic giving the course both an academic and practical focus. You will learn to apply your knowledge of the key concepts to solve problems in a range of different contexts and applications.

Key features

- OCR Physics A is a well-established course built on many years of experience, covering the knowledge and understanding necessary to progress to STEM degrees and careers.
- Incorporates both Astrophysics and Medical Imaging.
- Physics is one of the top three A Levels in terms of eligibility for degree entry.

A level physics is a good subject to study with any other science subject and/ or maths.
Many students have also combined physics with computing and business studies.

Where can A Level Physics take me?

STEM degrees, varieties of Physics, Maths and Engineering.

Advanced apprenticeships in industry, at present aerospace, nuclear power generation and electrical power distribution.

Physics is essential for access to physics and engineering courses. It is highly regarded for other subjects such as medicine, law and economics because of the thinking skills and problem solving involved. .

Physics A: Course Content

PHYSICS A – AS (H156) / A LEVEL (H556)

Module 1 – Development of practical skills in physics

Skills of planning, implementing, analysis and evaluation

Module 2 – Foundations of Physics

Includes:

- Physical quantities and units
- Making measurements and analysing data
- Nature of quantities.

Module 3 – Forces and motion

Includes:

- Motion
- Forces in action
- Work, energy and power
- Materials
- Newton's laws of motion and momentum.

Module 4 – Electrons, waves and photons

Includes:

- Charge and current
- Energy, power and resistance
- Electrical circuits
- Waves
- Quantum physics.

Module 5 – Newtonian world and astrophysics (A level only)

Includes:

- Thermal physics
- Circular motion
- Oscillations
- Gravitational fields
- Astrophysics.

Module 6 – Particles and medical physics (A level only)

Includes:

- Capacitors
- Electric fields
- Electromagnetism
- Nuclear and particle physics
- Medical imaging.

Emphasis throughout the course is on developing knowledge, competence and confidence in practical skills and problem solving.

Physics: Year 12

Scheme of Learning	Assessments
Half Term One: Teacher 1 • Forces and Motion Teacher 2 • Electrons, Waves and Photons Outcomes: Teacher 1: The term force is generally used to indicate a push or a pull. It is difficult to give a proper definition for a force, but in physics we can easily describe what a force can do. A resultant force acting on an object can accelerate the object in a specific direction. The subsequent motion of the object can be analysed using equations of motion. Several forces acting on an object can prevent the object from either moving or rotating. Forces can also change the shape of an object. There are many other things that forces can do. In this module, learners will learn how to model the motion of objects using mathematics, understand the effect forces have on objects, learn about the important connection between force and energy, appreciate how forces cause deformation and understand the importance of Newton's laws of motion. The aim of this module is to introduce important conventions and ideas that permeate the fabric of physics. Understanding of physical quantities, S.I. units, scalars and vectors helps physicists to effectively communicate their ideas with in the scientific community (HSW8, 11). 3.1 Motion This section provides knowledge and understanding of key ideas used to describe and analyse the motion of objects in both one-dimension and in two-dimensions. It also	Teacher 1 Assessed Homework 1 Chapter End Questions 3.1 Assessed homework 3 Chapter End Questions 3.2 PAG1.1 PAG1.2 Teacher 2 Assessed Homework 2 Chapter End Questions 4.1 Assessed Homework 4 Chapter End Questions 4.2 PAG 3.1 PAG3.2 October Exam

provides learners with opportunities to develop their analytical and experimental skills. The motion of a variety of objects can be analysed using ICT or data-logging techniques (HSW3). Learners also have the opportunity to analyse and interpret experimental data by recognising relationships between physical quantities (HSW5). The analysis of motion gives many opportunities to link to How Science Works. Examples relate to detecting the speed of moving vehicles, stopping distances and freefall (HSW2, 9, 10, 11, 12). 3.2 Forces in action This section provides knowledge and understanding of the motion of an object when it experiences several forces and also the equilibrium of an object. Learners will also learn how pressure differences give rise to an upthrust on an object in a fluid. There are opportunities to consider contemporary applications of terminal velocity, moments, couples, pressure, and Archimedes principle (HSW6, 7, 9, 11, 12). Experimental work must play a pivotal role in the acquisition of key concepts and skills (HSW4). Teacher 2: The aim of this module is to ultimately introduce key ideas of quantum physics. Electromagnetic waves (e.g. light) have a dual nature. They exhibit both wave and particle-like behaviour. The wave–particle dual nature is also found to be characteristic of all particles (e.g. electrons). Before any sophisticated work can be done on quantum physics, learners need to appreciate what electrons are and how they behave in electrical circuits. A basic understanding of wave properties is also required. In this module, learners will learn about electrons, electric current, electrical circuits, wave properties, electromagnetic waves and, of course, quantum physics. Learners have the opportunity to appreciate	

how scientific ideas of quantum physics developed over time (HSW7) and their validity rested on the foundations of experimental work (HSW1 and HSW2) 4.1 Charge and current This short section introduces the ideas of charge and current. Understanding electric current is essential when dealing with electrical circuits. This section does not lend itself to practical work but to introducing important ideas. The continuity equation (I = Anev) is developed using these key ideas. This section concludes with categorising all materials in terms of their ability to conduct. 4.2 Energy, power and resistance This section provides knowledge and understanding of electrical symbols, electromotive force, potential difference, resistivity and power. The scientific vocabulary developed here is a prerequisite for understanding electrical circuits in 4.3. There is a desire to use energy saving devices, such as LED lamps, in homes. Learners have the opportunity to understand the link between environmental damage from power stations and the impetus to use energy saving devices in the home (HSW10) and how customers can make informed decisions when buying domestic appliances (HSW12). There are many opportunities for learners to use spreadsheets in the analysis and presentation of data (HSW3), to carry out practical activities to understand concepts (HSW4) and to analyse data to find relationships between physical quantities (HSW5).	
Half Term Three: Teacher 1: • Forces and Motion Teacher 2: • Electrons, Waves and Photons Outcomes: Teacher 1 3.4 Materials This section examines the physical properties	Teacher 1 Assessed Homework 9 Chapter end questions 3.4 PAG2.1 PAG2.2 Teacher 2 Assessed Homework 10 Chapter end questions 4.4 PAG 5.1

of springs and materials. Learners can carry out a range of experimental work to enhance their knowledge and skills, including the management of risks and analysis of data to provide evidence for relationships between physical quantities. There are opportunities to consider the selection o appropriate materials for practical applications (HSW5, 6, 8, 9, 12). Teacher 2 4.4 Waves This section provides knowledge and understanding of wave properties, electromagnetic waves, superposition and stationary waves. The wavelength of visible light is too small to be measured directly using a ruler. However, superposition experiments can be done in the laboratory to determine wavelength of visible light using a laser and a double slit. There are opportunities to discuss how the double-slit experiment demonstrated the wave-like behaviour of light (HSW7). The breadth of the topic covering sound waves and the electromagnetic spectrum provides scope for learners to appreciate the wide ranging applications of waves and their properties. (HSW1, 2, 5, 8, 9, 12)	January Exam
Half Term Four: Teacher 1: • Forces and Motion Teacher 2: • Electrons, Waves and Photons Outcomes: Teacher 1 3.5 Newton's laws of motion and momentum This section provides knowledge and understanding of Newton's laws – fundamental laws that can be used to predict the motion of all colliding or interacting objects in applications such as sport (HSW1, 2). Newton's law can also be used to understand some of the safety features in cars, such as air bags, and to evaluate the	Teacher 1 Assessed Homework 11 Chapter end questions 3.5 Teacher 2 Assessed Homework 12 Chapter end questions 4.5 PAG6.1 PAG 6.2

benefits and risks of such features (HSW9). Learners should be aware that the introduction of mandatory safety features in cars is a consequence of the scientific community analysing the forces involved in collisions and investigating potential solutions to reduce the likelihood of personal injury (HSW10, 11, 12). There are many opportunities for learners to carry out experimental work and analyse data using ICT techniques (HSW3). Teacher 2 4.5 Quantum physics This section provides knowledge and understanding of photons, the photoelectric effect, de Broglie waves and wave–particle duality. In the photoelectric effect experiment, electromagnetic waves are used to eject surface electrons from metals. The electrons are ejected instantaneously and their energy is independent of the intensity of the radiation. The wave model is unable to explain the interaction of these waves with matter. This single experiment led to the development of the photon model and was the cornerstone of quantum physics. Learners have the opportunity to carry out internet research into how the ideas of quantum physics developed (HSW1, 2, 7) and how scientific community validates the integrity of new knowledge before its acceptance (HSW11).	
Half Term Five: Teacher 1: • Newtonian World and Astrophysics Teacher 2: • Particle and medical Physics Outcomes: Teacher 1 The aim of this module is to show the impact Newtonian mechanics has on physics. The microscopic motion of atoms can be modelled using Newton's laws and hence provide us with an understanding of	Teacher 1 Assessed Homework 13 Past exam Questions Assessed 15 Chapter end questions 5.1 PAG8.1 PAG8.2 Teacher 2 Assessed Homework 14 Past exam Questions

macroscopic quantities such as pressure and temperature. Newton's law of gravitation can be used to predict the motion of planets and distant galaxies. In the final section we explore the intricacies of stars and the expansion of the Universe by analysing the electromagnetic radiation from space. As such, it lends itself to the consideration of how the development of the scientific model is improved based on the advances in the means of observation (HSW1, 2, 5, 6, 7, 8, 9, 11). In this module, learners will learn about thermal physics, circular motion, oscillations, gravitational field, astrophysics and cosmology 5.1 Thermal physics This section provides knowledge and understanding of temperature, matter, specific heat capacity and specific latent heat with contexts involving heat transfer and change of phase (HSW1, 2, 5, 7). Experimental work can be carried out to safely investigate specific heat capacity of materials (HSW4). It also provides an opportunity to discuss how Newton's laws can be used to model the behaviou of gases (HSW1) and significant opportunities for t analysis and interpretation of data (HSW5). Teacher 2 In this module, learners will learn about capacitors, electric field, electromagnetism, nuclear physics, particle physics and medical imaging. 6.1 Capacitors This section introduces the basic properties of capacitors and how they are used in electrical circuits. The use of capacitors as a source of electrical energy is then developed. This section introduces the mathematics of exponential decay, which is also required for the decay of radioactive nuclei in 6.4. This section provides knowledge and understanding of capacitors and exponential decay. Experimental work provides an excellent way to understand the behaviour of capacitors in	Assessed 16 Chapter end questions 6.1 PAG9.1 PAG9.2

electrical circuits and the management of safety and risks when using power supplies (HSW4). There are many opportunities for learners to use spreadsheets in the analysis and presentation of data (HSW3). The varied uses of capacitors give the opportunity for the consideration of their use in many practical applications (HSW2, 5, 6, 9)	
Half Term Six: Teacher 1 : • Newtonian World and Astrophysics Teacher 2 : • Particle and medical Physics Outcomes: Teacher 1 5.2 Circular motion There are many examples of objects travelling at constant speed in circles, e.g. planets, artificial satellites, charged particles in a magnetic field, etc. The physics in all these cases can be described and analysed using the ideas developed by Newton. The concepts in this section have applications in many contexts present in other sections of this specification, such as planetary motion in section 5.4.3 (HSW1, 2, 5, 9). This section provides knowledge and understanding of circular motion and important concepts such as centripetal force and acceleration. Teacher 2 6.2 Electric fields This section provides knowledge and understanding of Coulomb's law, uniform electric fields, electric potential and energy.	Teacher 1 Assessed Homework 17 Past exam Questions Assessed 19 Chapter end questions 5.2 Teacher 2 Assessed Homework 18 Past exam Questions Assessed 20 Chapter end questions 6.2 Year 12 May Exam

Assessment Objectives:

	Assessment Objective
AO1	Demonstrate knowledge and understanding of scientific ideas, processes, techniques and procedures.
AO2	Apply knowledge and understanding of scientific ideas, processes, techniques and procedures: • in a theoretical context • in a practical context • when handling qualitative data • when handling quantitative data.
AO3	Analyse, interpret and evaluate scientific information, ideas and evidence, including in relation to issues, to: • make judgements and reach conclusions • develop and refine practical design and procedures.

AO weightings in A Level in Physics A

The relationship between the assessment objectives and the components are shown in the following table:

Component	% of A level Physics A (H556)		
	AO1	AO2	AO3
Modelling physics (H556/01)	13–14	15–16	8–9
Exploring physics (H556/02)	13–14	15–16	8–9
Unified physics (H556/03)	5–6	10–11	9–10
Practical endorsement in physics (H556/04)*	N/A	N/A	N/A
Total	**31–34**	**40–43**	**25–28**

Physics:Year 13

Scheme of Learning	Assessments
Half Term One: Teacher 1 : • Newtonian World and Astrophysics Teacher 2 : • Particle and medical Physics Outcomes: Teacher 1 5.3 Oscillations Oscillatory motion is all around us, with examples including atoms vibrating in a solid, a bridge swaying in the wind, the motion of pistons of a car and the motion of tides. (HSW1, 2, 3, 5, 6, 8, 9, 10, 12) This section provides knowledge and understanding of simple harmonic motion, forced oscillations and resonance. Teacher 2 6.3 Electromagnetism This section provides knowledge and understanding of magnetic fields, motion of charged particles in magnetic fields, Lenz's law and Faraday's law. The application of Faraday's law may be used to demonstrate how science has benefited society with important devices such as generators and transformers. Transformers are used in the transmission of electrical energy using the national grid and are an integral part of many electrical devices in our homes. The application of Lenz's law allows discussion of the use of scientific knowledge to present a scientific argument (HSW1, 2, 3, 5, 6, 7, 8, 9, 11, 12).	Teacher 1 Assessed Homework 1 Past exam questions Assessed Homework 3 Chapter end questions 5.3 PAG 10.1 PAG10.2 Teacher 2 Assessed Homework 2 Past Exam questions Assessed Homework 4 Chapter end questions 6.3 PAG11.1 PAG11.2
Half Term Two: Teacher 1 : • Newtonian World and Astrophysics Teacher 2 : • Particle and medical Physics	Teacher 1 Assessed Homework 5 Past exam questions Assessed Homework 7 Past exam questions PAG12.1

Outcomes: Teacher 1 5.4 Gravitational fields This section provides knowledge and understanding of Newton's law of gravitation, planetary motion and gravitational potential and energy. Newton's law of gravitation can be used to predict the motion of orbiting satellites, planets and even why some objects in our Solar system have very little atmosphere with the opportunity to analyse evidence and look at causal relationships (HSW1, 2, 5, 7). Geostationary satellites have done much to improve telecommunications around the world. They are expensive; governments and industry have to make difficult decisions when building new ones. Learners have the opportunity to discuss the societal benefits of satellites and the risks they pose when accidents do occur (HSW9, 10). Teacher 2 6.4 Nuclear and particle physics This section provides knowledge and understanding of the atom, nucleus, fundamental particles, radioactivity, fission and fusion. Nuclear power stations provide a significant fraction of the energy needs of many countries. They are expensive; governments have to make difficult decisions when building new ones. The building of nuclear power stations can be used to evaluate the benefits and risks to society (HSW9). Ethical, environmental and decision making issues may also be discussed (HSW10 and HSW12). The development of the atomic model also addresses issues of scientific development and validation (HSW7, 11).	Teacher 2 Assessed Homework 6 Past Exam questions Assessed Homework 8 Past exam questions
Half Term Three: Teacher 1: • Newtonian World and Astrophysics Teacher 2: • Particle and medical Physics Outcomes: Teacher 1 5.4 Gravitational fields This section provides knowledge and understanding of Newton's law of gravitation,	Teacher 1 Assessed Homework 9 Chapter end questions 5.4 Teacher 2 Assessed Homework 10 Chapter end questions 6.4 PAG7.1 PAG7.2 Year 13 January Exam

planetary motion and gravitational potential and energy. Newton's law of gravitation can be used to predict the motion of orbiting satellites, planets and even why some objects in our Solar system have very little atmosphere with the opportunity to analyse evidence and look at causal relationships (HSW1, 2, 5, 7). Geostationary satellites have done much to improve telecommunications around the world. They are expensive; governments and industry have to make difficult decisions when building new ones. Learners have the opportunity to discuss the societal benefits of satellites and the risks they pose when accidents do occur (HSW9, 10). Teacher 2 6.4 Nuclear and particle physics This section provides knowledge and understanding of the atom, nucleus, fundamental particles, radioactivity, fission and fusion. Nuclear power stations provide a significant fraction of the energy needs of many countries. They are expensive; governments have to make difficult decisions when building new ones. The building of nuclear power stations can be used to evaluate the benefits and risks to society (HSW9). Ethical, environmental and decision making issues may also be discussed (HSW10 and HSW12). The development of the atomic model also addresses issues of scientific development and validation (HSW7, 11).	
Half Term Four: Teacher 1 : • Newtonian World and Astrophysics Teacher 2 : • Particle and medical Physics Outcomes: Teacher 1 5.5 Astrophysics and cosmology This section provides knowledge and understanding of stars, Wien's displacement law, Stefan's law, Hubble's law and the Big Bang. Learners have the opportunity to appreciate how scientific ideas of the Big Bang developed	Teacher 1 Assessed Homework 11 Chapter end questions 5.5 Assessed homework 13 Past Exam Questions Teacher 2 Assessed Homework 12 Chapter end questions 6.5 Assessed Homework 14 Past Exam Questions.

over time and how its validity is supported by research and experimental work carried out by the scientific community (HSW2, 7, 8, 11). Teacher 2 6.5 Medical imaging This section provides knowledge and understanding of X-rays, CAT scans, PET scans and ultrasound scans. This section shows how the developments in medical imaging have led to a number of valuable non-invasive techniques used in hospitals. Not all hospitals in this country are equipped with complex scanners. Learners have the chance to discuss the ethical issues in the treatment of humans and the ways in which society uses science to inform decision making (HSW10 and 12).	March Exam
Half Term Five: Revision Outcomes: Cover all above	Past exam Questions
Half Term Six: Revision Outcomes: Cover all above	Past exam Questions

Assessment Objectives:

	Assessment Objective
AO1	Demonstrate knowledge and understanding of scientific ideas, processes, techniques and procedures.
AO2	Apply knowledge and understanding of scientific ideas, processes, techniques and procedures: • in a theoretical context • in a practical context • when handling qualitative data • when handling quantitative data.
AO3	Analyse, interpret and evaluate scientific information, ideas and evidence, including in relation to issues, to: • make judgements and reach conclusions • develop and refine practical design and procedures.

AO weightings in A Level in Physics A

The relationship between the assessment objectives and the components are shown in the following table:

Component	% of A level Physics A (H556)		
	AO1	AO2	AO3
Modelling physics (H556/01)	13–14	15–16	8–9
Exploring physics (H556/02)	13–14	15–16	8–9
Unified physics (H556/03)	5–6	10–11	9–10
Practical endorsement in physics (H556/04)*	N/A	N/A	N/A
Total	**31–34**	**40–43**	**25–28**

Expectations

In order to achieve your potential in biology, there are a number of key areas which you must put in place. These include:-

- Personal organisation. You will need to bring a pen, pencil, ruler and calculator to each lesson. Your teacher will also use the textbook in lessons so you will need to bring this as well. You will also be using a file to store all your work in and this must be kept well organised.

- Time management. You need to organise your time so that reading, revision and homework tasks are completed by the required time.

- The types of homework tasks which are set include reading, revision, questions from textbooks, past exam papers etc. Year 12 will have approximately 3 to 4 hours of homework per week. Year 13 will have 5 to 6 hours of independent learning / homework a week.

- Safe and responsible conduct during practical lessons and full cooperation with safety procedures.

- You will need to be determined, focused and willing to put in the time and effort to learn and understand the different topics.

- You will also be expected to undertake independent learning which will be based around the PAGs, exam questions for each module and wider reading

Help and Support from Teachers

Year 12 – Mr Chapman and Mr Stevenson
Year 13 – Mr Chapman and Mr Lentell

- This can start now if you wish. It is no secret that there is a big jump in the demand and level of work from GCSE. If you wish to do some preparation for the AS course, you can purchase a booklet entitled, 'Head Start to AS level Physics', which will make the jump easier to manage.

- The physics department has a tradition of being available to help sixth formers when they are either stuck with homework, or just want some extra support.

- You will be provided with textbooks at the beginning of the course.

PHYSICS A: ASSESSMENT OVERVIEW

AS LEVEL PHYSICS A (H156) – FIRST EXAM JUNE 2016

Paper		Marks	Duration	Weighting
Paper 1	**Breadth in physics** Content – Modules 1, 2, 3, 4	**70**	1 hr 30 mins	50%
	Section A – Multiple choice	20		
	Section B – Structured questions, covering theory and practical skills	50		
Paper 2	**Depth in physics** Content – Modules 1, 2, 3, 4	**70**	1 hr 30 mins	50%
	Structured questions and extended response questions covering theory and practical skills	70		

A LEVEL PHYSICS A (H556) – FIRST EXAM JUNE 2017

Paper		Marks	Duration	Weighting
Paper 1	**Modelling physics** Content – Modules 1, 2, 3, 5	**100**	2 hr 15 mins	37%
	Section A – Multiple choice	15		
	Section B – Structured questions, covering theory and practical skills	85		
Paper 2	**Exploring physics** Content – Modules 1, 2, 4, 6	**100**	2 hr 15 mins	37%
	Section A – Multiple choice	15		
	Section B – Structured questions, covering theory and practical skills	85		
Paper 3	**Unified physics** Content – all modules	**70**	1 hr 30 mins	26%
	Structured questions and extended response questions covering theory and practical skills	70		
Non-exam assessment	**Practical endorsement for physics**	Pass/Fail	Non-exam assessment	Reported separately
	See pages 28-29. Teacher-assessed component common to Physics A and Physics B (Advancing Physics). Candidates complete a minimum of 12 practical activities to demonstrate practical competence. Performance reported separately to the A Level grade. Moderation details still to be confirmed by Ofqual at the time of going to press	Reported separately		

Specification

http://www.ocr.org.uk/Images/171726-specification-accredited-a-level-gce-physics-a-h556.pdf

Useful Websites

There are hundreds out there! Here are a few.

www.ocr.org.uk
www.rsc.org.uk
http://www.cyberphysics.co.uk/index.html

Past Paper Exam Question Examples

1(a). A light spring of unextended length 2.0 cm is hung from a fixed point. An object of weight 3.0 N is hung from the other end of the spring. Fig. 7.1 shows the length of the spring when the object is in equilibrium.

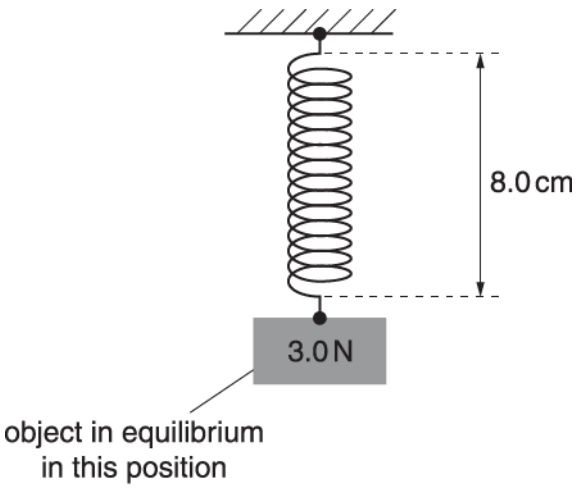

Fig. 7.1

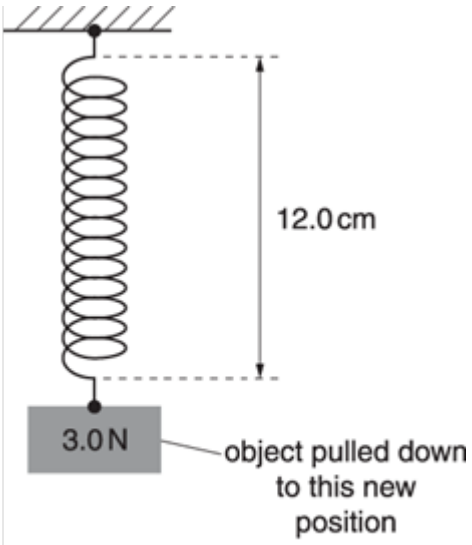

Fig. 7.2

Show that the force constant of the spring is 50 N m^{-1}.

[1]

(b). The object is pulled vertically downwards. Fig. 7.2 shows the new length of the spring.

i. Calculate the change in the elastic potential energy ΔE in the spring.

ΔE = ... J [3]

ii. The object is released from its position shown in Fig. 7.2. Calculate the initial upward acceleration a of the object.

a = ... $m\ s^{-2}$ [3]

2(a). Fig. 3 shows a swimmer of mass 65 kg, weight 640 N, being lifted vertically upwards from the sea by a cable of negligible mass compared to the swimmer.

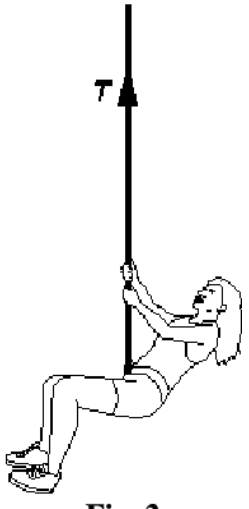

Fig. 3

The tension T in the cable from the time that she leaves the water at t = 0 until t = 1.5 s is 670 N.
At t = 1.5 s T reduces to and remains constant at 640 N.

i. Use Newton's laws to describe qualitatively the motion of the swimmer for the first 4.0 s of her ascent.

[2]

ii. Show that at t = 4.0 s her height h above the water is more than 2 m and that she is rising at about 0.7 m s^{-1}.

speed = ... m s^{-1}

h = ... m

[4]

2(b). The cable is attached to a winch rotated by an electric motor in a rescue helicopter.
The electric supply to the motor has an e.m.f. of 28 V. The circuit has a total resistance of 0.11 Ω. When theswimmer is rising at 0.70 m s^{-1} the motor draws a current of 30 A from the supply.

Under these conditions calculate:

i. the power lost in the electrical circuit

power lost = ... W

[2]

ii. the efficiency of the motor

efficiency = ...

[4]

3. This question is about a photoelectric cell, which is an electronic device that detects photons.

Fig. 6 shows a cross-section through a simple photocell.

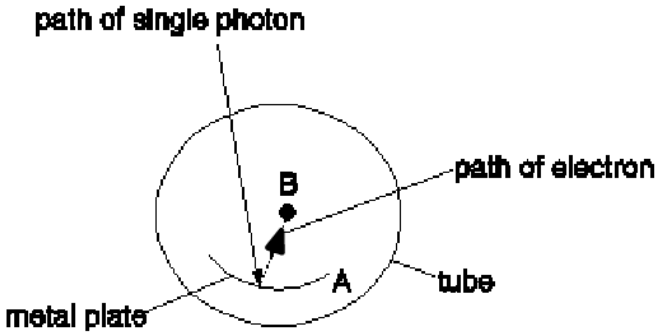

Fig. 6

A metal plate **A** is coated with potassium in an evacuated transparent tube. A photon of high enough energy, incident on the plate, can cause an electron to be released from the surface towards the collector rod **B**.

There is a potential difference of 12 V between plate **A** and rod **B** so that released electrons are accelerated towards and collected by rod **B**. **B** is 5.0 mm from **A.** Light of wavelength 570 nm is incident on plate **A**.

i. Calculate the speed v of electrons arriving at rod **B**.

v = ... ms^{-1}

[4]

ii. Estimate the response time of the photocell, that is the time it takes for electrons to travel from **A** to **B**.

response time = ... s

[2]

Literacy
See glossary at the back of the AS and the A2 text book for all keywords and definitions.