Name……………………

Physics

Bridging the Gap

Welcome to Physics!

This pack has been designed to help you bridge the gap from GCSE to AS Level to ensure that you understand what you've let yourself in for and that you are ready for your new course in September.

You will start by looking at the topics covered in Year 12 and 13 in the Physics OCR A course and give you an idea of how the course will be structured and what resources are available and when you will be doing tests, exams and practical assessments.

Then you will review what you already know and be given some work to do to make sure you're all ready to start in September to give yourself the best chance of success.

You will find this booklet and all resources described in this booklet on Mr Baker's website written specifically for this course:

www.science-spark.co.uk

click on key stage 5 for all relevant stuff for you

Follow sciencespark on twitter to find out updates and assessment dates etc.

Check out sciencespark clips on YouTube

Requirements for studying AS Physics at Plymstock

You need a minimum of grade BB at GCSE Science (from Core/Additional/ Further or Separate Sciences) and a minimum recommendation of grade B at GCSE Maths

The Mathematical content and difficulty has increased and those students not taking A Level Maths will find the course more difficult

Students who do not gain a B in English will struggle with the question style at A level and my fail to gain a grade

You must have a strong work ethic and lots of time available to study.

Benchmark Assessments

Within the 1st 2 weeks you will be assessed to see if you have the aptitude to carry on. The following assessments will assess your knowledge, understanding and practical skills:

1 Homework included in this booklet
2 Knowledge tests taken over the first 2 weeks
3 Practical skills test taken in lessons in the first 2 weeks

Y12 Physics – course outline

Module 1 Development of Practical Skills
Module 2 Foundations of Physics
Module 3 Forces and Motion
Module 4 Electrons, Waves and Photons
2 exam papers end of year 12 – can assess any content from modules 1 - 4

Y13 Physics – course outline

Module 1 Development of Practical Skills
Module 2 Foundations of Physics
Module 3 Forces and Motion
Module 4 Electrons, Waves and Photons
Module 5 Newtonian World and Astrophysics
Module 6 Particles and Medical Physics
3 exam papers end of year 13
- Paper 1 – modules 1, 2, 3, 5
- Paper 2 – modules 1, 2, 4, 6
- Paper 3 – any content modules 1 - 6

Important change from previous A Level Physics course:

If you take Physics to the full A level you take all of your exams in year 13.

Nothing before then counts.

How hard is this physics course going to be?

Physics is one of the toughest A Levels you could have chosen!
The students who work the hardest do the best.

Over the course you will have 5 hours of lessons a week that will cover all the theory and practical skills you will need.
You will be given homework questions nearly every lesson and these will be expected to be completed by the next lesson in most cases.

At A Level you are expected to be spending 5 hours per week out of class completing homework, reviewing your work and reading around the subject.

In addition to the lessons you will receive, there is plenty of support available:

- Teachers: Your teacher is you first point of call as they are the experts – you will have 2 teachers who will always offer their time when they are available to help you in and out of lessons.
- Notes and differentiated questions: We have produced a full set of notes that accompany each lesson. These notes are targeted to the lesson objectives that we have written and have HW questions that tie into the learning outcomes. You will be expected to print these off or ask us to, to organise these in a folder and add any extra notes that you write in or out of lessons and bring these along to lessons where we will check these regularly.
- Website: www.science-spark.co.uk has been written specifically for the course you will be studying and has lessons, notes, questions, answers and links to other resources on the web.
- Physics Clinic: The Physics clinic will run after school when needed and you are invited to come along with specific questions about physics. You will get help with homework or revision here so you aren't stuck at home for hours on something that somebody may be able to help you with in seconds. In the first term, these sessions will also specifically focus on the mathematical requirements of the course and deal with any issues regarding the practical skills assessments.
- Textbook: You will be given a textbook. It has notes, questions and revision tips and quizzes so make sure you.
- Revision Guides: We will order some revision guides in the Autumn term and we would encourage you to buy one.
- Specification and past papers: Download the New OCR Physics A specification from: www.ocr.org.uk (H156 H556 – From 2015)

Do I need to be good at Maths?

The simple answer to this is that yes.

The course has changed to include more difficult maths content and without a good grasp of this you will struggle to achieve a good grade at A Level Physics.

At A2 some more difficult maths is necessary to help explain concepts and analyse data but these skills will be developed as you study.

If you have chosen to do maths as one of your AS level courses then you will have a massive advantage.

Bridging the Gap

Everything at A Level builds on your GCSE knowledge, skills and understanding and so you will first need to review everything you have done in Core and Additional GCSE.

Some have you have an advantage in that you have also done Further Physics – you will also have to review this work.

For those of you that didn't do Further, you will have to look over this content for the first time.

Use the revision guides provided

We will start with a 2 week Bridging Course to get everybody up to speed before we start the AS course. The course will revise some of your KS4 knowledge but it will mostly be developing new skills and understanding and culminates in an assessment that tests the content on the following pages and how quickly you pick up new information that you will be taught in these first 2 weeks.

On the following pages you will find checklists that include everything you need to know before we start the AS course. It will be your Homework over the Summer to ensure that you have revised it all thoroughly. Tick off the statements as you revise them.

At the back of this booklet is a quiz that you must bring to your first Physics lesson in September and hand it in to your teacher. They will mark it and give it back to you.

Make sure you visit www.science-spark.co.uk as this has all the information in this booklet plus review powerpoints to help you revise and more details of what will be taught in the first 2 weeks' Bridging Course.

Core Physics

Heat Transfer

Are you able…

- ❑ To evaluate ways in which heat is transferred in and out of bodies and ways in which the rates of these transfers can be reduced.

Do you understand…

- ❑ Thermal (infra red) radiation is the transfer of energy by electromagnetic waves.
- ❑ All bodies emit and absorb thermal radiation.
- ❑ The hotter a body is the more energy it radiates.
- ❑ Dark, matt surfaces are good absorbers and good emitters of radiation.
- ❑ Light, shiny surfaces are poor absorbers and poor emitters of radiation.
- ❑ The transfer of energy by conduction and convection involves particles and how this transfer takes place.
- ❑ Under similar conditions different materials transfer heat at different rates.
- ❑ The shape and dimensions of a body affect the rate at which it transfers heat.
- ❑ The bigger the temperature difference between a body and its surroundings, the faster the rate at which heat is transferred.

Energy efficiency

Are you able…

- ❑ To describe the intended energy transfers/transformations and the main energy wastages that occur with a range of devices
- ❑ To calculate the efficiency of a device using:
  $$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$
- ❑ To evaluate the effectiveness and cost effectiveness of methods used to reduce energy consumption.

Do you understand…

- ❑ Energy cannot be created or destroyed. It can only be transformed from one form to another form.
- ❑ When energy is transferred and/or transformed only part of it may be usefully transferred/transformed.
- ❑ Energy which is not transferred/transformed in a useful way is wasted.
- ❑ Both wasted energy and the energy which is usefully transferred/transformed are eventually transferred to their surroundings which become warmer.

- ❑ Energy becomes increasingly spread out and becomes increasingly more difficult to use for further energy transformations.

- ❑ The greater the percentage of the energy that is usefully transformed in a device, the more efficient the device is.

Electrical energy

Are you able…

- ❑ To compare and contrast the particular advantages and disadvantages of using different electrical devices for a particular application

- ❑ To calculate the amount of energy transferred from the mains using:
  energy transferred = power × time
  (kilowatt-hour, kWh) (kilowatt, kW) (hour, h)

- ❑ To calculate the cost of energy transferred from the mains using:
  total cost = number of kilowatt-hours × cost per kilowatt-hour

Do you understand…

- ❑ Examples of energy transformations that everyday electrical devices are designed to bring about.

- ❑ Examples of everyday electrical devices designed to bring about particular energy transformations.

- ❑ The amount of electrical energy a device transforms depends on how long the appliance is switched on and the rate at which the device transforms energy.

- ❑ The power of an appliance is measured in watts (W) or kilowatts (kW).

- ❑ Energy is normally measured in joules (J).

- ❑ Electricity is transferred from power station to consumers along the National Grid.

- ❑ The uses of step-up and step-down transformers in the National Grid.

- ❑ Increasing voltage (potential difference) reduces current, and hence reduces energy losses in the cables.

Generating electricity

Are you able…

- ❑ To compare and contrast the particular advantages and disadvantages of using different energy sources to generate electricity.

Do you understand…

- ❑ In most power stations an energy source is used to heat water. The steam produced drives a turbine which is coupled to an electrical generator.

- ❑ Common energy sources include coal, oil and gas, which are burned to produce heat and uranium/plutonium, in which nuclear fission produces heat.

- ❑ Energy from renewable energy sources can be used to drive turbines directly.

- ❑ Renewable energy sources used in this way include wind, the rise and fall of water due to waves and tides, and the falling of water in hydroelectric schemes.

- ❑ Electricity can be produced directly from the Sun's radiation using solar cells.

- ❑ In some volcanic areas hot water and steam rise to the surface. The steam can be tapped and used to drive turbines. This is known as geothermal energy.

- ❑ Using different energy resources has different effects on the environment. These effects include the release of substances into the atmosphere, noise and visual pollution, and the destruction of wildlife habitats.

- ❑ The advantages and disadvantages of using fossil fuels, nuclear fuels and renewable energy sources to generate electricity. These include the cost of building power stations, the start-up time of power stations, the reliability of the energy source, the relative cost of energy generated and the location in which the energy is needed.

<u>Electromagnetic spectrum</u>

Are you able…

- ❑ To evaluate the possible hazards associated with the use of different types of electromagnetic radiation

- ❑ To evaluate methods to reduce exposure to different types of electromagnetic radiation.

Do you understand…

- ❑ Electromagnetic radiation travels as waves and moves energy from one place to another.

- ❑ All types of electromagnetic waves travel at the same speed through a vacuum (space).

- ❑ The electromagnetic spectrum is continuous but the wavelengths within it can be grouped into types of increasing wavelength and decreasing frequency:
  gamma rays, X-rays, ultraviolet rays, visible light, infra red rays, microwaves and radio waves.

- ❑ Different wavelengths of electromagnetic radiation are reflected, absorbed or transmitted differently by different substances and types of surface.

- ❑ When radiation is absorbed the energy it carries makes the substance which absorbs it hotter and may create an alternating current with the same frequency as the radiation itself.

- ❑ Different wavelengths of electromagnetic radiation have different effects on living cells. Some radiations mostly pass through soft tissue without being absorbed, some produce heat, some may cause cancerous changes and some may kill cells. These effects depend on the type of radiation and the size of the dose.

- ❑ The uses and the hazards associated with the use of each type of radiation in the electromagnetic spectrum.

- ❑ Radio waves, microwaves, infra red and visible light can be used for communication.

- ❑ Microwaves can pass through the Earth's atmosphere and are used to send information to and from satellites and within mobile phone networks.

- ❑ Infra red and visible light can be used to send signals along optical fibres and so travel in curved paths.

- ❑ Communication signals may be analogue (continuously varying) or digital (discrete values only, generally on and off). Digital signals are less prone to interference than analogue and can be easily processed by computers.

- ❑ Electromagnetic waves obey the wave formula:
  wave speed = frequency × wavelength
  (metre/second, m/s) (hertz, Hz) (metre, m)

Radioactivity

Are you able…

- ❑ To evaluate the possible hazards associated with the use of different types of nuclear radiation

- ❑ To evaluate measures that can be taken to reduce exposure to nuclear radiations

- ❑ To evaluate the appropriateness of radioactive sources for particular uses, including as tracers, in terms of the type(s) of radiation emitted and their half-lives.

Do you understand…

- ❑ The basic structure of an atom is a small central nucleus composed of protons and neutrons surrounded by electrons.

- ❑ The atoms of an element always have the same number of protons, but have a different number of neutrons for each isotope.

- ❑ Some substances give out radiation from the nuclei of their atoms all the time, whatever is done to them. These substances are said to be radioactive.

- ❑ Identification of an alpha particle as a helium nucleus, a beta particle as an electron from the nucleus and gamma radiation as electromagnetic radiation.

- ❑ Properties of the alpha, beta and gamma radiations limited to their relative ionising power, their penetration through materials and their range in air.

- ❑ Alpha and beta radiations are deflected by both electric and magnetic fields but gamma radiation is not.

- ❑ The uses of and the dangers associated with each type of nuclear radiation.

- ❑ The half-life of a radioactive isotope is defined as the time it takes for the number of nuclei of the isotope in a sample to halve or the time it takes for the count rate from a sample containing the isotope to fall to half its initial level.

Origins of the universe

Are you able…

- ❑ To compare and contrast the particular advantages and disadvantages of using different types of telescope on Earth and in space to make observations on and deductions about the universe.

Do you understand…

- ❑ If a wave source is moving relative to an observer there will be a change in the observed wavelength and frequency.
- ❑ There is a red-shift in light observed from most distant galaxies.
- ❑ The further away galaxies are the bigger the red-shift.
- ❑ How the observed red-shift provides evidence that the universe is expanding and supports the big bang theory (that the universe began from a very small initial point).
- ❑ Observations of the solar system and the galaxies in the universe can be carried out on the Earth or from space.
- ❑ Observations are made with telescopes that may detect visible light or other electromagnetic radiations such as radio waves or X-rays

Additional Physics

Describing Movement

Are you able:

- ❑ To construct distance-time graphs for a body moving in a straight line when the body is stationary or moving with a constant speed
- ❑ To construct velocity-time graphs for a body moving with a constant velocity or a constant acceleration
- ❑ *To calculate the speed of a body from the slope of a distance-time graph*
- ❑ *To calculate the acceleration of a body from the slope of a velocity-time graph*
- ❑ *To calculate the distance travelled by a body from a velocity-time graph*

Do you understand that:

- ❑ The slope of a distance-time graph represents speed
- ❑ The velocity of a body is its speed in a given direction
- ❑ The acceleration of a body is given by:

$$\text{acceleration} = \frac{\text{change in velocity (metre/second, m/s)}}{\text{time taken for change (second, s)}}$$

(metre/second^2 m/s^2)

- ❑ The slope of a velocity-time graph represents acceleration.
- ❑ The area under a velocity-time graph represents distance travelled.

Force and acceleration

Are you able:

- ❑ to draw and interpret velocity-time graphs for bodies that reach terminal velocity, including a consideration of the forces acting on the body
- ❑ to calculate the weight of a body using:

weight = mass × gravitational field strength
(newton, N) (kilogram, kg) (newton/kilogram, N/kg)

Do you understand that:

- ❑ Whenever two bodies interact, the forces they exert on each other are equal and opposite
- ❑ A number of forces acting on a body may be replaced by a single force which has the same effect on the body as the original forces all acting together. The force is called the resultant force
- ❑ If the resultant force acting on a stationary body is zero the body will remain stationary

- ❑ If the resultant force acting on a stationary body is not zero the body will accelerate in the direction of the resultant force

- ❑ If the resultant force acting on a moving body is zero the body will continue to move at the same speed and in the same direction

- ❑ If the resultant force acting on a moving body is not zero the body will accelerate in the direction of the resultant force

- ❑ Force, mass and acceleration are related by the equation:
  resultant force = mass × acceleration
  (newton, N) (kilogram, kg) (metre/second^2, m/s^2)

- ❑ When a vehicle travels at a steady speed the frictional forces balance the driving force

- ❑ The greater the speed of a vehicle the greater the braking force needed to stop it in a certain distance

- ❑ The stopping distance of a vehicle depends on the distance the vehicle travels during the driver's reaction time and the distance it travels under the braking force

- ❑ A driver's reaction time can be affected by tiredness, drugs and alcohol

- ❑ A vehicle's braking distance can be affected by adverse road and weather conditions and poor condition of the vehicle

- ❑ The faster a body moves through a fluid the greater the frictional force which acts on it

- ❑ A body falling through a fluid will initially accelerate due to the force of gravity. Eventually the resultant force on the body will be zero and it will fall at its terminal velocity.

<u>Work and energy</u>

Are you able:

- ❑ to discuss the transformation of kinetic energy to other forms of energy in particular situations.

Do you understand that:

- ❑ When a force causes a body to move through a distance, energy is transferred and work is done

- ❑ Work done = energy transferred

- ❑ The amount of work done, force and distance are related by the equation:
  work done = force applied × distance moved in direction of force
  (joule, J) (newton, N) (metre, m)

- ❑ Work done against frictional forces is mainly transformed into heat

- ❑ For an object that is able to recover its original shape, elastic potential is the energy stored in the object when work is done on the object to change its shape

- ❑ The kinetic energy of a body depends on its mass and its speed

❑ *Calculate the kinetic energy of a body using the equation:*

kinetic energy = ½ × mass × speed²
(joule, J) (kilogram, kg) ((metre/second)², (m/s)²)

Momentum

Are you able:

❑ to use the conservation of momentum (in one dimension) to calculate the mass, velocity or momentum of a body involved in a collision or explosion

❑ to use the ideas of momentum to explain safety features.

Do you understand that:

❑ Momentum, mass and velocity are related by the equation:

momentum = mass × velocity
(kilogram metre/second, kg m/s) (kilogram, kg) (metre/second, m/s)

❑ Momentum has both magnitude and direction

❑ When a force acts on a body that is moving, or able to move, a change in momentum occurs

❑ Momentum is conserved in any collision/explosion provided no external forces act on the colliding/exploding bodies

❑ *Force, change in momentum and time taken for the change are related by the equation:*

force = change in momentum (kilogram metre/second, kg(m/s))
(newton, N) time taken for the change (second, s)

Static electricity

Are you able:

❑ to explain why static electricity is dangerous in some situations and how precautions can be taken to ensure that the electrostatic charge is discharged safely

❑ to explain how static electricity can be useful.

Do you understand that:

❑ When certain insulating materials are rubbed against each other they become electrically charged. Negatively charged electrons are rubbed off one material onto the other

❑ The material that gains electrons becomes negatively charged. The material that loses electrons is left with an equal positive charge

❑ When two electrically charged bodies are brought together they exert a force on each other

❑ Two bodies that carry the same type of charge repel. Two bodies that carry different types of charge attract

❑ Electrical charges can move easily through some substances, eg metals

❑ The rate of flow of electrical charge is called the current

- ❑ A charged body can be discharged by connecting it to earth with a conductor. Charge then flows through the conductor

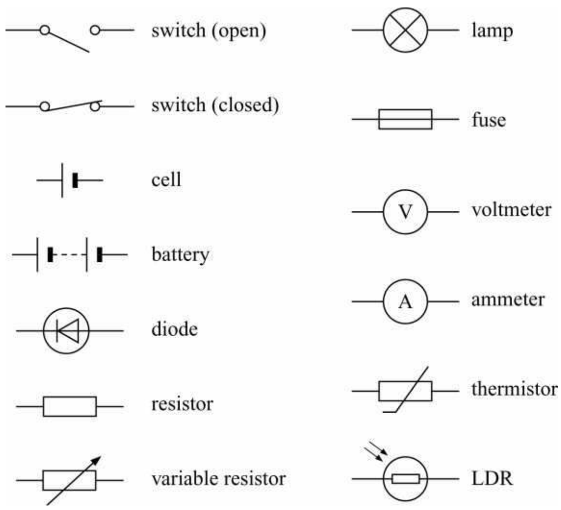
- ❑ *The greater the charge on an isolated body the greater the potential difference between the body and earth. If the potential difference becomes high enough a spark may jump across the gap between the body and any earthed conductor which is brought near it*

- ❑ Electrostatic charges can be useful, for example in photocopiers and smoke precipitators and the basic operation of these devices

<u>Current electricity</u>

Are you able:

- ❑ to interpret and draw circuit diagrams using standard symbols. The following standard symbols should be known:

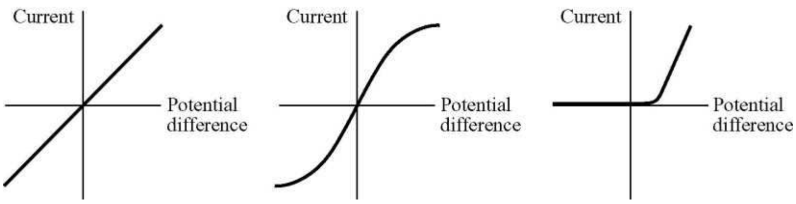


- ❑ to apply the principles of basic electrical circuits to practical situations.

Do you understand that:

- ❑ Current-potential difference graphs are used to show how the current through a component varies with the potential difference across it.

A resistor at constant temperature | A filament lamp | A diode



- ❑ The current through a resistor (at a constant temperature) is directly proportional to the potential difference across the resistor

- ❑ Potential difference, current and resistance are related by the equation:

potential difference = current × resistance
(volt, V) (ampere, A) (ohm, Ω)

- ❑ The resistance of a component can be found by measuring the current through, and potential difference across, the component

- ❑ The resistance of a filament lamp increases as the temperature of the filament increases

- ❑ The current through a diode flows in one direction only. The diode has a very high resistance in the reverse direction

- ❑ The resistance of a light-dependent resistor (LDR) decreases as light intensity increases

- ❑ The resistance of a thermistor decreases as the temperature increases (ie knowledge of negative temperature coefficient thermistor only is required)

- ❑ The current through a component depends on its resistance. The greater the resistance the smaller the current for a given potential difference across the component

- ❑ The potential difference provided by cells connected in series is the sum of the potential difference of each cell (depending on the direction in which they are connected).

- ❑ For components connected in series:
  - the total resistance is the sum of the resistance of each component
  - there is the same current through each component
  - the total potential difference of the supply is shared between the components.

- ❑ For components connected in parallel:
  - the potential difference across each component is the same
  - the total current through the whole circuit is the sum of the currents through the separate components.

<u>Mains electricity</u>

Are you able:

- ❑ to recognise errors in the wiring of a three-pin plug

- ❑ to recognise dangerous practice in the use of mains electricity

- ❑ to compare potential differences of d.c. supplies and the peak potential differences of a.c. supplies from diagrams of oscilloscope traces

- ❑ *to determine the period and hence the frequency of a supply from diagrams of oscilloscope traces.*

Do you understand that:

- ❑ Cells and batteries supply current which always passes in the same direction. This is called direct current (d.c.)

- ❑ An alternating current (a.c.) is one which is constantly changing direction. Mains electricity is an a.c. supply. In the UK it has a frequency of 50 cycles per second (50 hertz)

- ❑ UK mains supply is about 230 volts

- ❑ Most electrical appliances are connected to the mains using cable and a three-pin plug
- ❑ The structure of electrical cable
- ❑ The structure of a three-pin plug
- ❑ Correct wiring of a three-pin plug
- ❑ If an electrical fault causes too great a current the circuit should be switched off by a fuse or a circuit breaker
- ❑ When the current in a fuse wire exceeds the rating of the fuse it will melt, breaking the circuit
- ❑ Appliances with metal cases are usually earthed
- ❑ The earth wire and fuse together protect the appliance and the user.
- ❑ *The live terminal of the mains supply alternates between positive and negative potential with respect to the neutral terminal*
- ❑ *The neutral terminal stays at a potential close to zero with respect to earth*

<u>Electrical energy and power</u>

Are you able:

- ❑ to calculate the current through an appliance from its power and the potential difference of the supply and from this determine the size of fuse needed.

Do you understand that:

- ❑ Electric current is the rate of flow of charge
- ❑ When an electrical charge flows through a resistor, electrical energy is transformed into heat energy
- ❑ The rate at which energy is transformed in a device is called the power

$$\text{power (watt, W)} = \frac{\text{energy transformed (joule, J)}}{\text{time } (second, s)}$$

- ❑ Power, potential difference and current are related by the equation:

power = current × potential difference
(watt, W) (ampere, A) (volt, V)

- ❑ *Energy transformed, potential difference and charge are related by the equation:*

energy transformed = potential difference × charge
(joule, J) (volt, V) (coulomb, C)

- ❑ *The amount of electrical charge that flows is related to current and time by the equation:*

charge = current × time
(coulomb, C) (ampere, A) (second, s)

Nuclear decay

Are you able:

- ❑ *to explain how the Rutherford and Marsden scattering experiment led to the plum pudding model of the atom being replaced by the nuclear model.*

Do you understand that:

- ❑ The relative masses and relative electric charges of protons, neutrons and electrons.
- ❑ In an atom the number of electrons is equal to the number of protons in the nucleus. The atom has no net electrical charge.
- ❑ Atoms may lose or gain electrons to form charged particles called ions.
- ❑ All atoms of a particular element have the same number of protons.
- ❑ Atoms of different elements have different numbers of protons.
- ❑ Atoms of the same element which have different numbers of neutrons are called isotopes.
- ❑ The total number of protons in an atom is called its atomic number.
- ❑ The total number of protons and neutrons in an atom is called its mass number.
- ❑ The effect of alpha and beta decay on radioactive nuclei.
- ❑ The origins of background radiation.

Nuclear fission and nuclear fusion

Are you able:

- ❑ to sketch a labelled diagram to illustrate how a chain reaction may occur.

Do you understand that:

- ❑ There are two fissionable substances in common use in nuclear reactors, uranium 235 and plutonium 239.
- ❑ Nuclear fission is the splitting of an atomic nucleus.
- ❑ For fission to occur the uranium 235 or plutonium 239 nucleus must first absorb a neutron
- ❑ The nucleus undergoing fission splits into two smaller nuclei and 2 or 3 neutrons and energy is released.
- ❑ The neutrons may go on to start a chain reaction.
- ❑ Nuclear fusion is the joining of two atomic nuclei to form a larger one.
- ❑ Nuclear fusion is the process by which energy is released in stars.

Further

Title	Objectives	
Moments	The turning effect of a force is called the moment. The size of the moment is given by the equation: moment = force x perpendicular distance from the line of action of the force to the axis of rotation. **HT** to calculate the size of a force, or its distance from an axis of rotation, acting on a body that is balanced	
Principle of moments	**HT** If a body is not turning, the total clockwise moment must be exactly balanced by the total anticlockwise moment about any axis.	
Centre of mass	to describe how to find the centre of mass of a thin sheet of a material The centre of mass of a body is that point at which the mass of the body may be thought to be concentrated. If suspended, a body will come to rest with its centre of mass directly below the point of suspension. The centre of mass of a symmetrical body is along the axis of symmetry.	
Stability	**HT** to analyse the stability of bodies by considering their tendency to topple. **HT** Recognise the factors that affect the stability of a body. **HT** If the line of action of the weight of a body lies outside the base of the body there will be a resultant moment and the body will tend to topple.	
Circular Motion	to identify which force(s) provide(s) the centripetal force in a given situation When a body moves in a circle it continuously accelerates towards the centre of the circle. This acceleration changes the direction of motion of the body, not its speed. The resultant force causing this acceleration is called the centripetal force. The direction of the centripetal force is always towards the centre of the circle.	
Circular motion analysis	to interpret data on bodies moving in circular paths. The centripetal force needed to make a body perform circular motion increases as: the mass of the body increases; the speed of the body increases; the radius of the circle decreases.	
Gravitational Attraction	Gravitational force provides the centripetal force that allows planets and satellites to maintain their circular orbits. The further away an orbiting body is the longer it takes to make a complete orbit. To stay in orbit at a particular distance, smaller bodies, including planets and satellites, must move at a particular speed around larger bodies. The bigger the masses of the bodies the bigger the force of gravity between them. As the distance between two bodies increases the force of gravity between them decreases.	
Satellites	Communications satellites are usually put into a geostationary orbit above the equator. Monitoring satellites are usually put into a low polar orbit.	
Reflection (from plane mirrors)	The normal is a construction-line perpendicular to the reflecting/refracting surface at the point of incidence. The angle of incidence is equal to the angle of reflection. The nature of an image is defined by its size relative to the object,	
Reflection	to construct ray diagrams to show the formation of images by plane, convex and concave mirrors.	
Reflection (concave mirrors)	The nature of the image produced by a convex mirror. The nature of the image produced by a concave mirror for an object placed at different distances from the mirror. to construct ray diagrams to show the formation of images by plane, convex and concave mirrors to calculate the magnification produced by a lens or mirror using the formula: $\text{magnification} = \frac{\text{image height}}{\text{object height}}$	

Refraction	Refraction at an interface.	
Refraction by a prism	Refraction by a prism.	
Diverging Lenses	The nature of the image produced by a diverging lens. to construct ray diagrams to show the formation of images by diverging lenses and converging lenses	
Converging lenses	The nature of the image produced by a converging lens for an object placed at different distances from the lens. The use of a converging lens in a camera to produce an image of an object on a detecting device (eg film). to calculate the magnification produced by a lens or mirror using the formula: $\text{magnification} = \frac{\text{image height}}{\text{object height}}$	
Sound	Sound is caused by mechanical vibrations and travels as a wave. Sound cannot travel through a vacuum.	
Looking at sound	The quality of a note depends upon the waveform. Sound waves can be reflected and refracted. The pitch of a note increases as the frequency increases. The loudness of a note increases as the amplitude of the wave increases. to compare the amplitudes and frequencies of sounds from diagrams of oscilloscope traces.	
Ultrasound	Sounds in the range 20-20 000 Hz can be detected by the human ear. Electronic systems can be used to produce ultrasound waves which have a frequency higher than the upper limit of hearing for humans. Ultrasound waves are partially reflected when they meet a boundary between two different media. The time taken for the reflections to reach a detector is a measure of how far away such a boundary is. Ultrasound waves can be used in industry for cleaning and quality control. Ultrasound waves can be used in medicine for pre-natal scanning. to determine the distance between interfaces in various media from diagrams of oscilloscope traces. to compare the amplitudes and frequencies of ultrasounds from diagrams of oscilloscope traces. **HT** to determine the distance between interfaces in various media from diagrams of oscilloscope traces.	
Motor effect	When a conductor carrying an electric current is placed in a magnetic field, it may experience a force. The size of the force can be increased by: • increasing the strength of the magnetic field • increasing the size of the current. The conductor will not experience a force if it is parallel to the magnetic field. The direction of the force is reversed if either the direction of the current or the direction of the magnetic field is reversed.	
Making motors	to explain how the motor effect is used in simple devices.	
Generator Effect	If an electrical conductor ‘cuts’ through magnetic field lines, an electrical potential difference is induced across the ends of the conductor. If a magnet is moved into a coil of wire, an electrical potential difference is induced across the ends of the coil. If the wire is part of a complete circuit, a current is induced in the wire. If the direction of motion, or the polarity of the magnet, is reversed, the direction of the induced potential difference and the induced current is reversed. The generator effect also occurs if the magnetic field is stationary and the coil is moved. The size of the induced potential difference increases when: • the speed of the movement increases • the strength of the magnetic field increases • the number of turns on the coil increases • the area of the coil is greater.	
AC Generators	**HT** to explain from a diagram how an a.c. generator works, including the purpose of the slip rings and brushes.	

Transformers	The basic structure of the transformer. An alternating current in the primary coil produces a changing magnetic field in the iron core and hence in the secondary coil. This induces an alternating potential difference across the ends of the secondary coil.	
Uses of transformers	to determine which type of transformer should be used for a particular application. **HT** The potential difference (p.d.) across the primary and secondary coils of a transformer are related by the equation: $\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$ In a step-up transformer the potential difference across the secondary coil is greater than the potential difference across the primary coil. In a step-down transformer the potential difference across the secondary coil is less than the potential difference across the primary coil. The uses of step-up and step-down transformers in the National Grid.	
Stars, Galaxies and the Universe	Our Sun is one of the many billions of stars in the Milky Way galaxy. The Universe is made up of billions of galaxies. Stars form when enough dust and gas from space is pulled together by gravitational attraction. Smaller masses may also form and be attracted by a larger mass to become planets. Gravitational forces balance radiation pressure to make a star stable.	
Lifecycle of a star	A star goes through a life cycle (limited to the life cycle of stars of similar size to the Sun and stars much larger than the Sun). Fusion processes in stars produce all naturally occurring elements. These elements may be distributed throughout the Universe by the explosion of a star (supernova) at the end of its life.	
Making elements	to explain how stars are able to maintain their energy output for millions of years to explain why the early Universe contained only hydrogen but now contains a large variety of different elements.	

Name…………………………

Bridging the Gap - HW Quiz

Energy and energy resources

1 Thermal energy can be transferred in different ways.

Match the words in the list with the numbers **1** to **4** in the sentences.

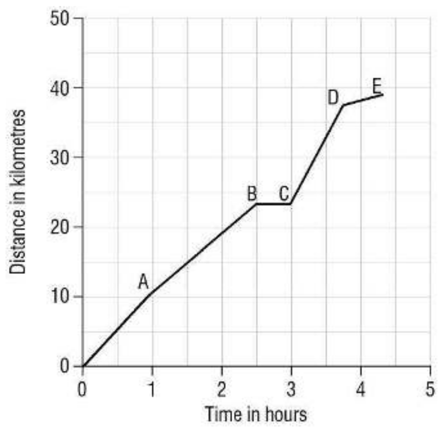
A electrons .... **B** liquids ....

C particles .... **D** solids ....

Conduction occurs mainly in ……**1**…… All metals are good conductors because they have a lot of free ……**2**……. Convection occurs in gases and ……**3**…… Radiation does not involve ……**4**…… *(4 marks)*

Motion

2 The graph shows how far a marathon runner travels during a race.



(a) What was the distance of the race?

.... (1)

(b) How long did it take the runner to complete the race?

.... (1)

(c) What distance did the runner travel during the first 2 hours of the race?

.... (1)

(d) For how long did the runner rest during the race?

.... (1)

(e) Ignoring the time for which the runner was resting, between which two points was the runner moving the slowest?

Give a reason for your answer.

....

.... (2)

Speeding up Slowing down

3 a) When two objects interact, they exert ……………… and ……………… forces on each other.

b) The unit of force is the ……………… (symbol …..).

c) A moving object acted on by a resultant force:

i) in the same direction as the direction of its motion ………………………..,

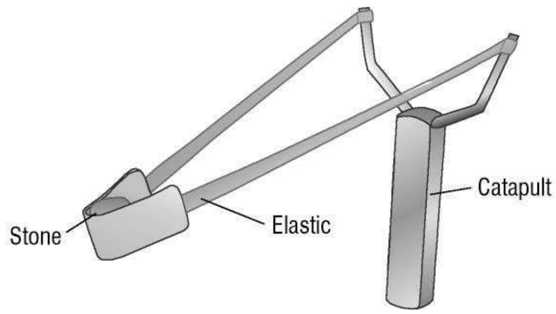
ii) in the opposite direction to its direction of motion ……………………….. .

d) Resultant force = ……………………………………….. × ……………………………………………..
(in ………) (in kg) (in ………)

(11)

Work energy and momentum

4 The picture shows a catapult.



(a) When a force is applied to the stone, work is done in stretching the elastic and the stone moves backwards.

(i) Write down the equation you could use to calculate the work done.

.... (1)

(ii) The average force applied to the stone is 20 N. This moves it backwards 0.15 m. Calculate the work done and give its unit.

....

....

.... (3)

(b) The work done is stored as energy.

(i) What type of energy is stored in the stretched elastic?

.... (1)

(ii) What type of energy does the stone have when it is released?

……………………………………………………………………………………... (1)

Turning forces

5 There are many satellites orbiting the Earth in circular paths.

(a) (i) What force provides the centripetal force that allows satellites to maintain their circular orbits?

.... (1)

(ii) A satellite moving at a steady speed in a circular orbit is continuously accelerating.

Explain why.

....

.... (2)

(b) Some satellites are in *geostationary orbits*.

(i) What is meant by a *geostationary orbit*?

.... (1)

(ii) What is the time period of a geostationary orbit?

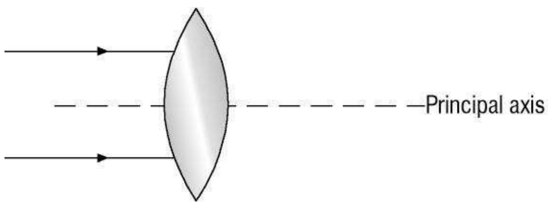
.... (1)

(iii) What type of satellite is usually put into a geostationary orbit?

.... (1)

Light and sound

6 (a) (i) Complete the diagram below to show what happens to the two rays of light after they enter the lens. (2)

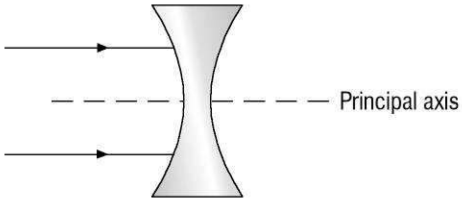


(ii) Put an **F** on the diagram to label the principal focus of the lens. (1)

(iii) What word can be used to describe this type of lens?

.... (1)

(b) (i) Complete the diagram below to show what happens to the two rays of light after they enter the lens. (2)



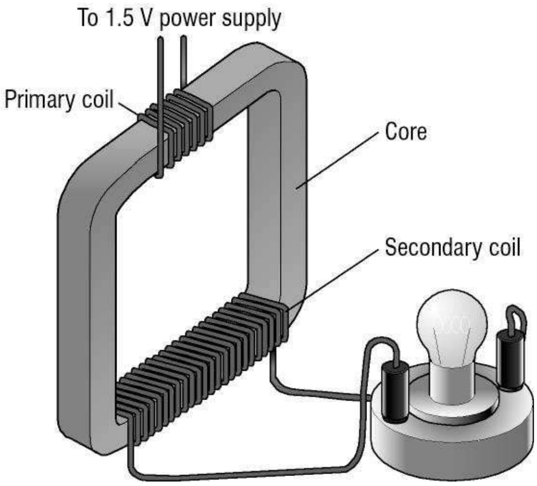
(ii) Put an **F** on the diagram to label the principal focus of the lens. (1)

(iii) What word can be used to describe this type of lens?

.... (1)

Electromagnetism

7 The diagram shows a transformer.



(a) Explain how an alternating current in the primary coil produces an alternating current through the lamp.

....

....

.... (4)

(b) The potential difference across the primary coil is 1.5 V. There are 6 turns on the primary coil and 24 turns on the secondary coil.

Calculate the potential difference across the lamp.

....

....

(4)

Stars and space

8 The sentences below describe the life cycle of a star such as the Sun.

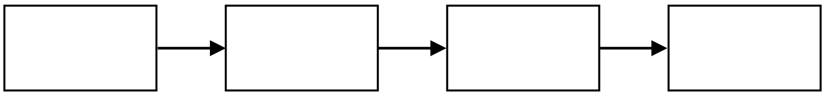
A The star contracts to form a white dwarf.

B The star is in a stable state.

C The star expands to form a red giant.

D Gravitational forces pull dust and gas together and the star is formed.

(a) Put the sentences in the correct order. (3)



(b) At which stage in its life is the Sun, **A**, **B**, **C** or **D**?

.... (1)

(c) What balances the gravitational forces to make a star stable?

....

....

.... (2)