BIDDULPH HIGH SCHOOL

GCSE PHYSICS REVISION LIST

OCR Gateway Physics (J249) from 2016 Topic P1: Matter

P1.1

- Describe how and why the atomic model has changed over time
- Describe the structure of the atom and discuss the charges and relative sizes of the particles
- State the typical size (order of magnitude) of atoms and small molecules
- Define density
- Explain the differences in density between the different states of matter in terms of the arrangements of the atoms and molecules
- Apply the relationship between density, mass and volume to changes where mass is conserved

P1.2

- Describe how mass is conserved when substances melt, freeze, evaporate, condense or sublimate
- State that physical changes differ from chemical changes because the material recovers its original properties if the change is reversed
- Describe how heating a system will change the energy stored within the system and raise its temperature or produce changes of state
- Define the term specific heat capacity and distinguish between it and the term specific latent heat
- Apply the relationship between change in internal energy of a material and its mass, specific heat capacity and temperature change to calculate the energy change involved
- Apply the relationship between specific latent heat and mass to calculate the energy change involved in a change of state

P1.3

- Explain how the motion of the molecules in a gas is related both to its temperature and its pressure
- Explain the relationship between the temperature of a gas and its pressure at constant volume (qual only)
- Recall that gases can be compressed or expanded by pressure changes and that the pressure produces a net force at right angles to any surface
- PHY ONLY: Explain how increasing the volume in which a gas is contained, at constant temperature can lead to a decrease in pressure
- PHY & HT ONLY: Explain how work done on a gas can lead to an increase in its temperature
- PHY ONLY: Describe a simple model of the Earth's atmosphere and of atmospheric pressure
- PHY ONLY: Explain why atmospheric pressure varies with height above the surface of the planet
- PHY & HT ONLY: Describe the factors which influence floating and sinking
- PHY & HT ONLY: Explain why pressure in a liquid varies with depth and density and how this leads to an upwards force on a partially submerged object
- PHY & HT ONLY: Calculate differences in pressure at different depths in a liquid

OCR Gateway Physics (J249) from 2016 Topic P2: Forces

P2.1

- Describe how to measure distance and time in a range of scenarios
- Describe how to measure distance and time and use these to calculate speed
- Recall how to make calculations using ratios and proportional reasoning to convert units and to compute rates
- Explain the vector–scalar distinction as it applies to displacement and distance, velocity and speed
- Relate changes and differences in motion to appropriate distance-time, and velocity-time graphs; interpret lines and slopes
- Recall how to interpret enclosed area in velocity-time graphs
- Recall how to calculate average speed for non-uniform motion
- Recall how to apply formulae relating distance, time and speed, for uniform motion, and for motion with uniform acceleration

P2.2

- Recall examples of ways in which objects interact and describe how such examples involve interactions between pairs of objects which produce a force on each object
- Recall how to represent such forces as vectors
- Recall and apply Newton's First Law to explain the motion of an object moving with uniform velocity and also an object where the speed and/or direction change
- HT ONLY: Recall how to use vector diagrams to illustrate resolution of forces, a net force (resultant force), and equilibrium situations
- HT ONLY: Describe examples of the forces acting on an isolated solid object or system
- HT ONLY: Describe, using free body diagrams, examples where two or more forces lead to a resultant force on an object
- HT ONLY: Describe, using free body diagrams, examples of the special case where forces balance to produce a resultant force of zero (qualitative only)
- Recall and apply Newton's second law in calculations relating forces, masses and accelerations
- HT ONLY: Explain that inertia is a measure of how difficult it is to change the velocity of an object and that the mass is defined as the ratio of force over acceleration
- HT ONLY: Define momentum and describe examples of momentum in collisions
- PHY ONLY: Apply formulae relating force, mass, velocity and acceleration to explain how the changes involved are inter-related
- Recall how to use the relationship between work done, force, and distance moved along the line of action of the force and describe the energy transfer involved
- Calculate relevant values of stored energy and energy transfers; convert between newton-metres and joules
- Explain, with reference to examples, the definition of power as the rate at which energy is transferred
- Recall and apply Newton's third law
- HT ONLY: Explain why an object moving in a circle with a constant speed has a changing velocity (qualitative only)

P2.3

- Explain that to stretch, bend or compress an object, more than one force has to be applied
- Describe the difference between elastic and plastic deformation caused by stretching forces
- Describe the relationship between force and extension for a spring and other simple systems
- Describe the difference between linear and non-linear relationships between force and extension
- Recall how to calculate a spring constant in linear cases
- Recall how to calculate the work done in stretching
- Describe that all matter has a gravitational field that causes attraction, and the field strength is much greater for massive objects
- Define weight and describe how it is measured
- Describe the relationship between the weight of an object and the gravitational field strength (g) (and) has a value of 10N/kg at the Earth's surface
- Recall the acceleration in free fall
- PHY ONLY: Apply formulae relating force, mass and relevant physical constants, including gravitational field strength (g), to explore how changes in these are inter-related
- PHY ONLY: Describe examples in which forces cause rotation
- PHY ONLY: Define and calculate the moment of the force in such examples
- PHY ONLY: Explain how levers and gears transmit the rotational effects of forces
- PHY ONLY: Recall that the pressure in fluids (gases and liquids) causes a net force at right angles to any surface
- PHY ONLY: Recall how to use the relationship between the force, the pressure and the area in contact

OCR Gateway Physics (J249) from 2016 Topic P3: Electricity

P3.1

- Describe that charge is a property of all matter, that there are positive and negative charges, and that the effects of charges are not seen inc how they cancel each other out
- Describe the production of static electricity, and sparking, by the rubbing of insulating surfaces
- Describe evidence that charged objects exert forces of attraction or repulsion on one another when not in contact
- Explain how transfer of electrons between objects can explain the phenomena of static electricity

- PHY ONLY: Explain the concept of an electric field and how it helps to explain the phenomena of static electricity
- Recall that current is a rate of flow of charge (electrons) and the conditions needed for charge to flow
- Recall that current has the same value at any point in a single closed loop
- Recall and use the relationship between quantity of charge, current and time

P3.2

- Describe the differences between series and parallel circuits
- Recall how to represent d.c. circuits with the conventions of positive and negative terminals, and the symbols that represent common circuit elements
- Recall that current depends on both resistance and potential difference and the units in which these are measured
- Recall and apply the relationship between I, R and V, and that for some resistors the value of R remains constant but that in others it can change as the current changes
- Explain that for some resistors the value of R remains constant but that in others it can change as the current changes
- Explain the design and use of circuits to explore such effects
- Recall how to use graphs to explore whether circuit elements are linear or non-linear
- Recall how to use graphs and relate the curves produced to the function and properties of circuit elements
- Explain why, if two resistors are in series the net resistance is increased, whereas with two in parallel the net resistance is decreased
- Recall how to calculate the currents, potential differences and resistances in d.c. series and parallel circuits
- Explain the design and use of such circuits for measurement and testing purposes
- Explain how the power transfer in any circuit device is related to the potential difference across it and the current, and to the energy changes over a given time
- Apply the equations relating potential difference, current, quantity of charge, resistance, power, energy, and time, and solve problems for circuits

OCR Gateway Physics (J249) from 2016 Topic P4: Magnetism and magnetic fields

P4.1

- Describe the attraction and repulsion between unlike and like poles for permanent magnets
- Describe the difference between permanent and induced magnets
- Describe the characteristics of the magnetic field of a magnet, showing how strength and direction change from one point to another
- Explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic
- Describe how to show that a current can create a magnetic effect and describe the directions of the magnetic field around a conducting wire
- Recall that the strength of the field depends on the current and the distance from the conductor
- Explain how solenoid arrangements can enhance the magnetic effect

P4.2

- HT ONLY: Describe how a magnet and a current-carrying conductor exert a force on one another
- HT ONLY: Recall how to show that Fleming's left-hand rule represents the relative orientations of the force, the current and the magnetic field
- HT ONLY: Apply the equation that links the force on a conductor to the magnetic flux density, the current and the length of conductor to calculate the forces involved
- HT ONLY: Explain how the force exerted from a magnet and a current-carrying conductor is used to cause rotation in electric motors
- PHY & HT ONLY: Recall that a change in the magnetic field around a conductor can give rise to an induced potential difference across its ends, generating a magnetic field that would oppose the original change
- PHY & HT ONLY: Explain how this effect is used in an alternator to generate a.c., and in a dynamo to generate d.c.
- PHY & HT ONLY: Explain how the effect of an alternating current in one circuit, in inducing a current in another, is used in transformers
- PHY & HT ONLY: Explain how the ratio of the potential differences across the two coils depends on the ratio of the number of turns on each, and so distinguish a step-up from a step-down transformer

- PHY & HT ONLY: Apply the equation linking the potential differences and number of turns in the two coils of a transformer
- PHY & HT ONLY: Explain the action of the microphone in converting the pressure variations in sound waves into variations in current in electrical circuits and reverse for loudspeakers and headphones

OCR Gateway Physics (J249) from 2016 Topic P5: Waves in matter

P5.1
- Describe wave motion in terms of amplitude, wavelength, frequency and period
- Define wavelength and frequency
- Describe and apply the relationship between these and the wave velocity
- Apply formulae relating velocity, frequency and wavelength
- Describe differences between transverse and longitudinal waves
- Explain how changes, in velocity, frequency and wavelength, in transmission of sound waves from one medium to another, are inter-related
- PHY ONLY: Describe the effects of reflection, transmission, and absorption of waves at material interface
- PHY & HT ONLY: Describe, with examples, processes which convert wave disturbances between sound waves and vibrations in solids
- PHY & HT ONLY: Explain why such processes only work over a limited frequency range, and the relevance of this to human hearing
- Describe how ripples on water surfaces are used to model transverse waves whilst sound waves in air are longitudinal waves, and how the speed of each may be measured
- Describe evidence that in both cases it is the wave and not the water or air itself that travels

P5.2
- Recall that electromagnetic waves are transverse and are transmitted through space where all have the same velocity
- Explain that electromagnetic waves transfer energy from source to absorber
- Apply the relationships between frequency and wavelength across the electromagnetic spectrum
- Describe the main groupings of the electromagnetic spectrum and that these groupings range from long to short wavelengths and from low to high frequencies
- Describe that our eyes can only detect a limited range of the electromagnetic spectrum
- Recall that light is an electromagnetic wave
- State examples of some practical uses of electromagnetic waves in the radio, micro-wave, infra-red, visible, ultra-violet, X-ray and gamma-ray regions
- Describe how ultra-violet waves, X-rays and gamma-rays can have hazardous effects, notably on human bodily tissues
- PHY & HT ONLY: Explain how the differences in velocity, absorption and reflection between different types of waves in solids and liquids can be used both for detection and for exploration of structures
- HT ONLY: Recall that radio waves can be produced by, or can themselves induce, oscillations in electrical circuit

P5.3
- HT ONLY: Recall that different substances may absorb, transmit, refract, or reflect electromagnetic waves in ways that vary with wavelength
- HT ONLY: Explain how some effects are related to differences in the velocity of electromagnetic waves in different substances
- PHY ONLY: Use ray diagrams to illustrate reflection, refraction and the similarities and differences between convex and concave lenses
- PHY ONLY: Recall how to construct two-dimensional ray diagrams to illustrate reflection and refraction
- PHY ONLY: Explain how colour is related to differential absorption, transmission and reflection

OCR Gateway Physics (J249) from 2016 Topic P6: Radioactivity

P6.1
- Recall that atomic nuclei are composed of both protons and neutrons, that the nucleus of each element has a characteristic positive charge
- Recall that atoms of the same elements can differ in nuclear mass by having different numbers of neutrons

- Use the conventional representation for nuclei to relate the differences between isotopes
- Recall that some nuclei are unstable and may emit alpha particles, beta particles, or neutrons, and electromagnetic radiation as gamma rays
- Relate these emissions to possible changes in the mass or the charge of the nucleus, or both
- Recall how to use names and symbols of common nuclei and particles to write balanced equations that represent radioactive decay
- Recall how to balance equations representing the emission of alpha-, beta- or gamma-radiation in terms of the masses, and charges of the atoms involved
- Recall that in each atom its electrons are arranged at different distances from the nucleus and that such arrangements may change with absorption or emission of electromagnetic radiation
- Recall that atoms can become ions by loss of outer electrons
- Recall that changes in atoms and nuclei can also generate and absorb radiations over a wide frequency range
- Explain the concept of half-life and how this is related to the random nature of radioactive decay
- HT ONLY: Recall how to calculate the net decline, expressed as a ratio, during radioactive emission after a given (integral) number of half-lives
- Recall the differences in the penetration properties of alpha-particles, beta-particles and gamma-rays

P6.2

- Recall the differences between contamination and irradiation effects and compare the hazards associated with these two
- PHY ONLY: Explain why the hazards associated with radioactive material differ according to the half-life involved
- PHY ONLY: Describe the different uses of nuclear radiations for exploration of internal organs, and for control or destruction of unwanted tissue
- PHY ONLY: Recall that some nuclei are unstable and may split, and relate such effects to radiation which might emerge, to transfer of energy to other particles and to the possibility of chain reactions
- PHY ONLY: Describe the process of nuclear fusion

OCR Gateway Physics (J249) from 2016 Topic P7: Energy

P7.1

- Describe that, in situations where there are energy transfers in a system, there is no net change to the total energy of a closed system
- Describe all the changes involved in the way energy is stored when a system changes for common situations
- Describe the changes in energy involved when a system is changed by heating, by work done by forces, and by work done when a current flows
- Recall how to make calculations of the energy changes associated with changes in a system, recalling or selecting the relevant equations for mechanical, electrical, and thermal processes
- Calculate the amounts of energy associated with a moving body, a stretched spring and an object raised above ground level

P7.2

- Describe, with examples, the process by which energy is dissipated, so that it is stored in less useful ways
- Describe how, in different domestic devices, energy is transferred from batteries or the a.c. from the mains
- Describe, with examples, the power ratings for domestic electrical appliances and how these are linked to the changes in stored energy when they are in use
- Calculate energy efficiency for any energy transfer
- HT ONLY: Describe ways to increase efficiency
- Explain ways of reducing unwanted energy transfer
- Describe how the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls

OCR Gateway Physics (J249) from 2016 Topic P8: Global challenges

P8.1

- Recall typical speeds encountered in everyday experience for wind and sound, and for walking, running, cycling and other transportation systems
- Estimate the magnitudes of everyday accelerations
- Recall how to make calculations using ratios and proportional reasoning to convert units and to compute rates

- Explain methods of measuring human reaction times and recall typical results
- Explain the factors which affect the distance required for road transport vehicles to come to rest in emergencies and the implications for safety
- PHY ONLY: Estimate how the distances required for road vehicles to stop in an emergency, varies over a range of typical speeds
- Explain the dangers caused by large decelerations
- PHY & HT ONLY: Estimate the forces involved in typical situations on a public road
- PHY ONLY: Estimate, for everyday road transport, the speed, accelerations and forces involved in large accelerations

P8.2

- Describe the main energy sources available for use on Earth, compare the ways in which they are used and distinguish between renewable and non-renewable sources
- Explain patterns and trends in the use of energy resources
- Recall that, in the national grid, electrical power is transferred at high voltages from power stations, and then transferred at lower voltages in each locality for domestic use
- Describe how step-up and step-down transformers are used to change the potential difference as power is transferred from power stations
- Explain how the national grid is an efficient way to transfer energy
- PHY & HT ONLY: Use simple calculations to link the potential differences and numbers of turns of a transformer to the power transfer involved, and relate this to the advantages of power transmission at high voltages
- Recall that the domestic supply in the UK is a.c. At 50Hz and about 230 volts
- Explain the difference between direct and alternating voltage
- Recall the differences in function between the live, neutral and earth mains wires, and the potential differences between these wires
- Explain that a live wire may be dangerous even when a switch in the mains circuit is open, by explaining the danger of providing any connection between the live wire and earth

P8.3

- PHY ONLY: Explain the red-shift of light from galaxies that are receding, and how this red-shift changes with the distance of the galaxy from Earth
- PHY ONLY: Explain how red shift and other evidence can be linked to the Big-Bang model
- PHY ONLY: Recall that our Sun was formed from dust and gas drawn together by gravity and explain how this caused fusion reactions
- PHY ONLY: Explain that all bodies emit radiation, and that the intensity and wavelength distribution of any emission depends on the temperature of the body
- PHY ONLY: Recall the main features of our solar system, including the similarities and distinctions between the planets, their moons, and artificial satellites
- PHY & HT ONLY: Explain that, for circular orbits, the force of gravity leads to a constantly changing velocity but unchanged speed
- PHY & HT ONLY: Explain that, for a stable orbit, the radius must change if the speed changes
- PHY & HT ONLY: Explain, using everyday examples, how the temperature of a body is related to the balance between incoming radiation absorbed and radiation emitted
- PHY & HT ONLY: Explain how the differences in velocity, absorption and reflection between different types of waves in solids and liquids can be used both for detection and exploration