# Physics Form 4 Syllabus - September 2008

**As from September 2008, the unit Pressure (2.2 - 2.5) has been removed from the Form 4 syllabus. The unit Linear Motion (4.1) and the section Alternating Current (13.9) are now part of the Form 4 syllabus.**

| 4.0 | Unit | Content | Notes |
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| 4.1 | Linear Motion | Use $Velocity = \frac{\text{change in displacement}}{\text{change in time}}$ | Use of equation limited to situations where direction of displacement does not change. |
| | | Interpret displacement-time graphs and calculate velocity from such graphs | |
| | | Use $Acceleration = \frac{\text{change in velocity}}{\text{change in time}}$ | Use of equation limited to situations where direction of velocity does not change. |
| | | Interpret velocity-time graphs and calculate displacement and acceleration from such graphs | |
| | | State the factors which affect braking distance and thinking distance | |
| | | Understand that **Stopping distance = Thinking distance + Braking distance** | |
| | | Appreciate that bodies falling freely have the same acceleration | |
| | | Use the equations: **v = u + a.t** **s = {(u + v)/2}.t** **$s = ut + \frac{1}{2}a.t^2$** | The use of the equations is limited to situations where bodies start from rest. |
| | | Describe how to find the acceleration of free fall by timing a falling object | Experimental investigations are required. |

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| **5.0** | **Forces and Motion** | | |
| 5.1 | Kinematics | Understand that objects continue moving with constant velocity or remain at rest when all the forces acting on them balance | Experimental investigations are expected. |
| | | Understand that an unbalanced force acting on an object gives the object an acceleration in the direction of the force | |
| | | Use the equations: **F = m.a** and **W = m.g** | |
| | | Appreciate that when an object A exerts a force on object B, object B exerts an equal force in the opposite direction | |
| | | Understand that for a body moving through a medium, resistive forces depend on body shape and speed | |
| | | Understand that forces acting on a body which has reached terminal speed are balanced | |
| **6.0** | **Momentum** | | |
| 6.1 | Momentum | Define momentum as the product of mass and velocity | State the units of momentum as kg m/s |
| 6.2 | Law of conservation of momentum | Understand that when two objects moving in one direction interact, their total momentum is conserved if there are no external forces acting on them | An experimental approach is expected. |
| | | Use the principle of conservation of momentum in the collision of two objects and the explosion of an object | Calculations involving the principle are expected. |

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| | | Use and apply the equation:<br>$\text{Force} = \frac{\text{Change in Momentum}}{\text{Change in time}}$ | Apply equation to practical situations like the packaging of fragile objects, the action of crumple zones and seat belts |
| **8.0** | **Heat Energy** | | |
| 8.1 | Temperature | Know that temperature is a measure of the degree of hotness and is measured in degrees Celcius or Kelvin. | Conversion from degree Celcius to Kelvin is not expected. |
| 8.2 | Heat | Know that a change in temperature may be caused by energy transfer and that a temperature difference may cause energy transfer called heat<br>Definition of specific heat capacity<br>Use the equation<br>**Energy transfer = mass x specific heat capacity x temperature change**<br>Describe experiments by which the specific heat capacity of a solid and a liquid may be determined, using an electrical heater of known power or joulemeter.<br>Describe one everyday effect due to the relatively large specific heat of water | State that the unit for specific heat is J/kg$^{o}$C. |
| 8.3 | Heat Transfer | Give examples of good and bad conductors | |

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| | | of heat and describe their uses |
| | | Appreciate that convection currents in gases and liquids involve movement of the fluid due to differences in density |
| | | Describe the role of convection in space heating |
| | | Understand that insulation reduces energy transfer by conduction and convection |
| | | Understand that everyday objects radiate energy in the form of waves (infra-red) which form part of the electromagnetic spectrum |
| | | Appreciate that the power radiated increases with increase in temperature |
| | | Describe experiments to show the properties of good and bad emitters and good and bad absorbers of infra-red radiation<br>Identify and explain some of the everyday applications and consequences of heat radiation, including the 'greenhouse effect'. |
| **12.0** | **Electrostatics** | |
| 12.1 | Electric charge | Describe simple experiments to show the production and detection of electric charges |
| | | State that there are positive and negative charges |
| | | State that like charges repel and unlike charges attract |

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| | | Know that charge is measured in coulombs | |
| 12.2 | Conductors and insulators | Distinguish between electrical conductors and insulators and give examples of each<br><br>Appreciate that conductors contain loosely bound electrons while insulators contain strongly bound electrons | Recall that electrons are particles in atoms which carry a negative charge |
| 12.3 | Induced charges | Give an account of charging by induction, including the role of electrons in the process Describe examples of how electrostatic charges are used in everyday life.<br><br>Describe one situation in which static electricity is dangerous and the precautions taken to ensure that static electricity is discharged safely | |
| **13.0** | **Current Electricity** | | |
| 13.1 | Electric currents | Show understanding that an electric current (measured in amperes) is the rate of flow of charge<br><br>Use the equation **I = Q/t** | Sub-multiples of the ampere. |
| 13.2 | Voltage | Know that a cell connected to a closed circuit uses up its chemical energy to push charge through the circuit, and that this chemical energy appears finally as heat<br><br>Know that if a cell uses V joules of energy to drive 1 coulomb through a conductor, than the voltage (p.d.) across the conductor is V volts<br><br>Show understanding that e.m.f. is defined | |

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| | | as the energy supplied by a source in driving 1 C round a complete circuit<br><br>Use the equations<br><br>**Energy, W = I.V.t** | |
| 13.3 | Electrical Power | Use the equation:<br><br>Power, **P = I.V**<br><br>Know that the amount of energy transferred from the mains is measured in kilowatt-hours called units. | |
| 13.4 | Resistance | Know how to use an ammeter and voltmeter<br><br>State that **Resistance** = **Voltage/Current** and use the equation **V** = **I.R**<br><br>Use a variable resistance to control current<br><br>Describe an experiment to determine the resistance using a voltmeter and ammeter<br><br>Relate the resistance of a wire to its length and to its diameter | A digital meter may also be used.<br><br>State that resistance is measured in ohms.<br><br>Multiples of the ohm.<br><br>Qualitative treatment only. No calculations are required. |
| 13.5 | Electric circuits | Draw and interpret circuit diagrams containing sources, switches, resistors (fixed and variable), lamps, ammeters, voltmeters, diodes, LDR's, LED's, and thermistors | |
| 13.6 | Series circuits | Understand that the current at every point in a series circuit is the same<br><br>Understand that the sum of the pd's across | |

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| | | the components in a series circuit is equal to the total pd. across the supply<br>Give the combined resistance of two or more resistors in series | |
| 13.7 | Parallel circuits | Understand that the current from the source is the sum of the currents in the separate branches of a parallel circuit<br>Understand that the voltage is the same across components in parallel | The equation for combining two parallel resistors is not required. |
| 13.8 | V-I characteristic graphs | Describe experiments by which V-I graphs for a metallic conductor kept at constant temperature and a filament lamp can be drawn<br>Interpret V-I graphs for a metallic conductor, filament lamp, diode, and thermistor<br>State how the resistance of an LDR changes with light level and how the resistance of a thermistor changes with temperature | Thermistors with negative temperature coefficient only to be treated |
| 13.9 | Alternating current | Appreciate that an alternating current, unlike a direct current, changes direction<br>Describe how a diode may be used to rectify an alternating current and how an oscilloscope may he used to demonstrate this action of a diode | |
| 13.10 | Domestic supplies | Understand the function of the live, neutral and earth wires in the domestic mains supply<br>Understand that the live wire has to be | |

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| | | insulated from the earth and neutral wires<br>Know why domestic supplies are connected in parallel | |
| 13.11 | Earthing | Know that appliances with metal cases need to be earthed | |
| 13.12 | Fuses | Understand how fuses and circuit breakers prevent fire due to electrical faults<br>Understand why fuses have various ratings<br>Understand why double insulated appliances do not need an earth wire<br>Describe how an appliance may be connected correctly to a 3-pin plug<br>Recognize dangerous practice in the use of mains electricity | Calculations of the correct value for a fuse for various appliances are expected. |