

**DAWOOD PUBLIC SCHOOL**  
**Course Outline for the year 2011-2012**  
**Physics**  
**Class-IX**

**Course Book:**

Pople, S. 2001. *Explaining Physics*, GCSE edition, Oxford University Press

Chew, C. et al. 2000. *GCE 'O' Level Physics* (2 ed), Singapore; Marshal Cavendish Education

**Cambridge O Level Physics**

**Syllabus code 5054**

All candidates enter for three papers – Papers 1 and 2 and 4.

**Paper: 1**

**Multiple**

**Choice 1 hour**

40 compulsory multiple choice questions of the direct choice type. The questions involve four response items. 40 marks

**Paper 2**

**Theory**

**1 hour 45 minutes**

This paper has two sections:

Section A has a small number of compulsory, structured questions of variable mark value. 45 marks in total are available for this section.

Section B has three questions. Each question is worth 15 marks. Candidates must answer two questions from this section.

There is no compulsory question on Section 25 of the syllabus (Electronics systems). Questions set on topics within Section 25 appear only in Paper 2 and are always set as an alternative within a question. Candidates will answer on the question paper. 75 marks.

**Paper 4**

**Alternative to Practical**

**1 hour**

A written paper of compulsory short-answer and structured questions designed to test familiarity with laboratory practical procedures.

Candidates will answer on the question paper. 30 marks

**Syllabus Aims and Assessment:**

**AIMS:**

The aims of the science curricula are the same for all students. These are set out below and describe the educational purposes of an O Level/School Certificate course in Physics. They are not listed in order of priority.

The aims are to:

- Acquire a systematic body of scientific knowledge, and the skills needed to apply this in new and changing situations in a range of domestic, industrial and environmental contexts;
- Acquire an understanding of scientific ideas, how they develop, the factors which may affect their development and their power and limitations;
- Plan and carry out a range of investigations, considering and evaluating critically their own data and that obtained from other sources;
- Evaluate in terms of their scientific knowledge and understanding, the benefits and drawbacks of scientific and technological developments, including those related to the environment, personal health and quality of life, considering ethical issues where appropriate;
- Select, organize and present information clearly and logically, using appropriate scientific terms and conventions,
- Stimulate interest in and care for the local and global environment.
- promote an awareness that:

\* The study and practice of science are co-operative and cumulative activities, which are subject to social, economic, technological, ethical and cultural influences and limitations;

\* The applications of sciences may be both beneficial and detrimental to the individual, the community and the environment.

**Assessment Objective:**

The skills appropriate to Physics may, for convenience, be broadly categorized as follows:

A description of each of these categories is given below:

**Knowledge and understanding:**

Students must be able to:

- Recognize, recall and show understanding of specific scientific facts, terminology, principles, concepts and practical techniques;
- Demonstrate understanding of the power and limitations of scientific ideas and factors affecting how these ideas develop;

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- Draw on existing knowledge to show understanding of the benefits and drawbacks of applications of science;
- Select, organize and present relevant information.

**Application of knowledge and understanding, analysis and evaluation:**

Students must be able to:

- Describe, explain and interpret phenomena, effects and ideas in terms of scientific principles and concepts, presenting arguments and ideas clearly and logically;
- Interpret and translate, from one form into another, data presented as continuous prose or in tables, diagrams and graphs;
- Carry out relevant calculations;
- Apply principles and concepts to unfamiliar situations, including those related to applications of science in a range of domestic, industrial and environmental contexts;
- Evaluate scientific information and make informed judgments from it.

**Investigative skills:**

Students must be able to:

- Devise and plan investigations, drawing on scientific knowledge and understanding in selecting appropriate strategies;
- Demonstrate appropriate investigative methods, including safe and skilful practical techniques, obtaining data which are sufficient and of appropriate precision, recording these methodically;
- Interpret data to draw conclusions which are consistent with the evidence, using scientific knowledge and understanding, whenever possible, in explaining their findings;
- Evaluate data and methods.

**Monthly Syllabus:**

August 2011	<ul style="list-style-type: none"> <li>• Physical Quantities, Units and Measurement</li> <li>• Vectors and Scalars</li> <li>• Kinematics</li> </ul>
September 2011	<ul style="list-style-type: none"> <li>• Kinematics</li> <li>• Dynamics</li> <li>• Mass, Weight and Density</li> </ul>
October 2011	<ul style="list-style-type: none"> <li>• Turning Effect of Forces</li> <li>• Deformation</li> <li>• Energy</li> </ul>
November 2011	<ul style="list-style-type: none"> <li>• REVISION FOR MID TERM EXAMS</li> </ul>
December 2011	<ul style="list-style-type: none"> <li>• MID TERM EXAMS</li> </ul>
January 2012	<ul style="list-style-type: none"> <li>• Energy Sources and Transfer of Energy</li> <li>• Kinetic Model of Matter (Gas Laws)</li> <li>• Pressure</li> </ul>
February 2012	<ul style="list-style-type: none"> <li>• Pressure</li> <li>• Temperature</li> </ul>
March 2012	<ul style="list-style-type: none"> <li>• Temperature</li> </ul>
April 2012	<ul style="list-style-type: none"> <li>• REVISION FOR FINAL TERM EXAMS</li> </ul>
May 2012	<ul style="list-style-type: none"> <li>• FINAL TERM EXAMS</li> </ul>

**Syllabus Content:**

**1. Physical Quantities, Units and Measurement:**

GCE O Level Physics by Charles Chew , Unit 1, Pg No.(1-14)

Explaining Physics by Stephen Pople, Unit 1.1, Pg No.(8 - 11)

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**Content:**

- 1.1 Scalars and vectors
- 1.2 Measurement techniques
- 1.3 Units and symbols

**Learning Objectives:**

Students should be able to:

- (a) Define the terms scalar and vector.
- (b) Determine the resultant of two vectors by a graphical method.
- (c) List the vectors and scalars from distance, displacement, length, speed, velocity, time, acceleration, mass and force.
- (d) Describe how to measure a variety of lengths with appropriate accuracy using tapes, rules, micrometers, and calipers using a vernier as necessary.
- (e) Describe how to measure a variety of time intervals using clocks and stopwatches.
- (f) Recognize and use the conventions and symbols contained in 'Signs, Symbols.

**2. Kinematics:**

GCE O Level Physics by Charles Chew ,Unit 2, Pg No.(16-33)

Explaining Physics by Stephen Pople, Unit1.2-1.4, Pg No.(12 -20 )

**Content:**

- 2.1 Speed, velocity and acceleration
- 2.2 Graphical analysis of motion
- 2.3 Free-fall

**Learning Objectives:**

Students should be able to:

- (a) State what is meant by speed and velocity.
- (b) Calculate average speed using distance travelled/time taken.
- (c) State what is meant by uniform acceleration and calculate the value of an acceleration using change in velocity/time taken.
- (d) Discuss non-uniform acceleration.
- (e) \*plot and \*interpret speed-time and distance-time graphs.
- (f) \*recognize from the shape of a speed-time graph when a body is
  - (1) At rest,
  - (2) Moving with uniform speed,
  - (3) Moving with uniform acceleration,
  - (4) Moving with non-uniform acceleration.
- (g) Calculate the area under a speed-time graph to determine the distance travelled for motion with uniform speed or uniform acceleration.
- (h) State that the acceleration of free-fall for a body near to the Earth is constant and is approximately  $10 \text{ m/s}^2$ .
- (i) Describe qualitatively the motion of bodies with constant weight falling with and without air resistance (including reference to terminal velocity).

**3. Dynamics:**

GCE O Level Physics by Charles Chew, Unit 3, Pg No. (36-52)

Explaining Physics by Stephen Pople, Unit 1.5-1.9, Pg No.(21 - 36 )

**Content:**

- 3.1 Balanced and unbalanced forces
- 3.2 Friction
- 3.3 Circular motion

**Learning Objectives:**

Students should be able to:

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- (a) State Newton's third law.
- (b) Describe the effect of balanced and unbalanced forces on a body.
- (c) Describe the ways in which a force may change the motion of a body.
- (d) Do calculations using the equation force = mass × acceleration.
- (e) Explain the effects of friction on the motion of a body.
- (f) Discuss the effect of friction on the motion of a vehicle in the context of tyre surface, road conditions (including skidding), braking force, and braking distance, thinking distance and stopping distance.
- (g) Describe qualitatively motion in a circular path due to a constant perpendicular force, including electrostatic forces on an electron in an atom and gravitational forces on a satellite.  
( $F = mv^2/r$  is not required.)
- (h) Discuss how ideas of circular motion are related to the motion of planets in the solar system.

#### **4. Mass, Weight and Density:**

GCE O Level Physics by Charles Chew , Unit 4, Pg No.(54-64)

Explaining Physics by Stephen Pople, Unit 1.1, 1.6, 3.1, Pg No.(9, 24 -27, 90-93 )

##### **Content:**

- 4.1 Mass and weight
- 4.2 Gravitational fields
- 4.3 Density

##### **Learning Objectives:**

Students should be able to:

- (a) State that mass is a measure of the amount of substance in a body.
- (b) State that mass of a body resists change from its state of rest or motion.
- (c) State that a gravitational field is a region in which a mass experiences a force due to gravitational attraction.
- (d) Calculate weight from the equation weight = mass × gravitational field strength.
- (e) Explain that weights, and therefore masses, may be compared using a balance.
- (f) Describe how to measure mass and weight by using appropriate balances.
- (g) Describe how to use a measuring cylinder to measure the volume of a liquid or solid.
- (h) Describe how to determine the density of a liquid, of a regularly shaped solid and of an irregularly shaped solid which sinks in water (volume by displacement).
- (i) Make calculations using the formula density = mass/volume.

#### **5. Turning Effect of Forces:**

GCE O Level Physics by Charles Chew , Unit 5, Pg No.(65-77)

Explaining Physics by Stephen Pople, Unit 2.1-2.3, Pg No. (50 - 60 )

##### **Content:**

- 5.1 Moments
- 5.2 Centre of mass
- 5.3 Stability

##### **Learning Objectives:**

Students should be able to:

- (a) Describe the moment of a force in terms of its turning effect and relate this to everyday examples.
- (b) State the principle of moments for a body in equilibrium.
- (c) Make calculations using moment of a force = force × perpendicular distance from the pivot and the principle of moments.
- (d) Describe how to verify the principle of moments.
- (e) Describe how to determine the position of the centre of mass of a plane lamina.
- (f) Describe qualitatively the effect of the position of the centre of mass on the stability of simple objects.

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**6. Deformation:**

GCE O Level Physics by Charles Chew, Unit 1, Pg No. (1-14)  
Explaining Physics by Stephen Pople, Unit 2.4, Pg No. (61 -63 )

**Content:**

6.1 Elastic deformation

**Learning Objectives:**

Students should be able to:

- (a) State that a force may produce a change in size and shape of a body.
- (b) \*plot, draw and interpret extension-load graphs for an elastic solid and describe the associated experimental procedure.
- (c) \*recognize the significance of the term “limit of proportionality” for an elastic solid.
- (d) Calculate extensions for an elastic solid using proportionality.

**7. Pressure:**

GCE O Level Physics by Charles Chew, Unit 7, Pg No.(98-111)  
Explaining Physics by Stephen Pople, Unit 3.2 – 3.4, Pg No.( 94 – 103,105,110 )

**Content**

7.1 Pressure  
7.2 Pressure changes

**Learning Objectives:**

Students should be able to:

- (a) Define the term pressure in terms of force and area, and do calculations using the equation Pressure = force/area.
- (b) Explain how pressure varies with force and area in the context of everyday examples.
- (c) Describe how the height of a liquid column may be used to measure the atmospheric pressure.
- (d) Explain quantitatively how the pressure beneath a liquid surface changes with depth and density of the liquid in appropriate examples.
- (e) Do calculations using the equation for hydrostatic pressure  $p = \rho gh$ .
- (f) Describe the use of a manometer in the measurement of pressure difference.
- (g) Describe and explain the transmission of pressure in hydraulic systems with particular reference to the hydraulic press and hydraulic brakes on vehicles.
- (h) Describe how a change in volume of a fixed mass of gas at constant temperature is caused by a change in pressure applied to the gas.
- (i) Do calculations using  $p_1V_1 = p_2V_2$ .

**8. Energy Sources and Transfer of Energy:**

GCE O Level Physics by Charles Chew, Unit 6, Pg No.(79-95)  
Explaining Physics by Stephen Pople, Unit 2.5- 2.8 , Pg No.(64 – 75, 77-79 )

**Content:**

8.1 Energy forms  
8.2 Major sources of energy  
8.3 Work  
8.4 Efficiency  
8.5 Power

**Learning Objectives:**

Students should be able to:

- (a) List the different forms of energy with examples in which each form occurs.

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- (b) State the principle of the conservation of energy and apply this principle to the conversion of energy from one form to another.
- (c) State that kinetic energy  $E_k = \frac{1}{2}mv^2$  and that potential energy  $E_p = mgh$  and use these equations in calculations.
- (d) List renewable and non-renewable energy sources.
- (e) Describe the processes by which energy is converted from one form to another, including reference to
  - (1) Chemical/fuel energy (a re-grouping of atoms),
  - (2) Hydroelectric generation (emphasizing the mechanical energies involved),
  - (3) Solar energy (nuclei of atoms in the Sun),
  - (4) Nuclear energy,
  - (5) Geothermal energy,
  - (6) Wind energy.
- (f) Explain nuclear fusion and fission in terms of energy releasing processes.
- (g) Do calculations using the mass-energy equation  $E = mc^2$ .
- (h) Describe the process of electricity generation and draw a block diagram of the process from fuel input to electricity output.
- (i) Discuss the environmental issues associated with power generation.
- (j) Calculate work done from the formula work = force  $\times$  distance moved in the line of action of the force.
- (k) Calculate the efficiency of an energy conversion using the formula efficiency = energy converted to the required form/total energy input.
- (l) Discuss the efficiency of energy conversions in common use, particularly those giving electrical output.
- (m) Discuss the usefulness of energy output from a number of energy conversions.
- (n) Calculate power from the formula power = work done/time taken.

**9. Temperature:**

GCE O Level Physics by Charles Chew, Unit 8, Pg No.(114-128)

Explaining Physics by Stephen Pople, Unit 4.3 , Pg No.( 122 - 125 )

**Content:**

- 9.1 Principles of thermometry
- 9.2 Practical thermometers

**Learning Objectives:**

Students should be able to:

- (a) Explain how a physical property which varies with temperature may be used for the measurement of temperature and state examples of such properties.
- (b) Explain the need for fixed points and state what is meant by the ice point and steam point.
- (c) Discuss sensitivity, range and linearity of thermometers.
- (d) Describe the structure and action of liquid-in-glass thermometers (including clinical) and of a thermocouple thermometer, showing an appreciation of its use for measuring high temperatures and those which vary rapidly.

**10. Kinetic Model of Matter:**

GCE O Level Physics by Charles Chew, Unit 9, Pg No.(130-139)

Explaining Physics by Stephen Pople, Unit 4.1,4.2, 4.4-4.6 , Pg No.(116 – 121, 126 - 139 )

**Content:**

- 10.1 States of matter
- 10.2 Molecular model
- 10.3 Evaporation

**Learning Objectives:**

Students should be able to:

- (a) State the distinguishing properties of solids, liquids and gases.
- (b) Describe qualitatively the molecular structure of solids, liquids and gases, relating their properties to the forces and distances between molecules and to the motion of the molecules.
- (c) Describe the relationship between the motion of molecules and temperature.

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- (d) Explain the pressure of a gas in terms of the motion of its molecules.
- (e) Describe qualitatively the thermal expansion of solids, liquids and gases.
- (f) Describe the relative order of magnitude of the expansion of solids, liquids and gases.
- (g) List and explain some of the everyday applications and consequences of thermal expansion.
- (h) Describe qualitatively the effect of a change of temperature on the volume of a gas at constant pressure.

**ACTIVITY PLAN:**

TOPICS	ACTIVITY
• Measurement techniques	• Vernier Calipers and Micrometer Screw Gauge experiments.
• Simple Pendulum (Time period, length of pendulum)	• Simple Pendulum experiment
• Distance, Displacement, Speed, Velocity, Acceleration and Graphs.	• Presentation
• Free fall motion and terminal velocity	• Video
• Force, Balanced and unbalanced forces, Newton's Laws of motion	• Presentation
• Friction and its types	• Presentation
• Circular motion	• Video
• Mass, Volume, Density and Weight	• Experiment
• Moment, centre of mass and stability	• Experiment
• Elastic Deformation	• Experiment
• Energy sources and transfer of energy	• Presentation
• P.E, K.E, Work, Power and Efficiency	• Presentation
• Pressure, Gas Laws (Solid, Liquid, Gases)	• Presentation
• Temperature Principle of thermometry and practical thermometers	• Experiment and presentation

**Your Handy Checklist for the Practical:**

1. Repeat all readings and average. Show all readings. If timing measure the period of at least 5 oscillations each time. Try for 10 if time allows. Remember timing error is 0.1s with a handheld stopclock. When taking a set of readings make sure that they cover the whole range of the readings fairly evenly.
2. Try to arrange for a single table which

Shows all readings, even the first, and their averages has the correct units and quantities for each column has the same precision (ie no. of sig figs) for every reading in a particular column. Choose a sensible number of sig. figs. (Usually 2 or 3)

3. Your graph should

have each axis labelled with both quantity and unit occupy at least 5x7 squares (ie half the paper) with YOUR plotted points ask yourself whether the origin should be plotted not use an awkward scale, ie 1 square = 3, 7, 9 units have points plotted neatly, with NO large blobs, or crosses. Circle your points if you plot them as dots. Have a clear even thin line plotted

4. In measuring the slope

Use at least half of the drawn straight line show the coordinates that you use for the slope or the values of the sides of the triangle that you use. Give your answer to 1 or 2 sig. figs as appropriate. Don't forget units.

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5. Know the straight line formula for a graph,  $y = mx + c$ ,

If  $y^2 = kx^3$  then plot  $y^2$  against  $x^3$  and the slope is  $k$

If  $y = kx^n$  then plot  $\log_{10}(y)$  or  $\ln(y)$  against  $\log_{10}(x)$  or  $\ln(x)$  slope is  $n$ .

On tables and graphs the label is  $\log_{10}(y/m)$  or  $\ln(y/m)$  to show the unit of  $y$  as metres

Check that you know how to use logs.

### Checking Relationships:

In each case **state** what should be constant, perform the calculation and then say whether the constant was found and the relationship verified within the error.

- Y proportional to x      Y/x should be constant
- Y proportional to  $1/x$       Yx should be constant
- Y proportional to  $e^x$       Y decreases by same **factor** if x increases by equal amounts

### Error:

1. Causes of error in simple measurements **LEARN THESE**

- **Lengths**      Rulers have battered ends, or the zero is not actually at the end  
parallax error, you must view any reading from directly above.  
Likely error is  $\pm 1$  mm or perhaps  $\pm 0.3$  mm
- **Times**      Stopwatches measure to  $\pm 0.01$ s but you can't press them that accurately,  
Likely error is  $\pm 0.1$ s.
- **Meters (eg ammeter)** Error is the smallest scale reading, or notice any fluctuation.

2. Combining errors

- There are absolute errors and percentage errors
- Adding or subtracting quantities add absolute errors
- Multiplying or dividing quantities add percentage errors to get percentage error in answer

Work through this example then repeat it yourself on paper

If  $A = 2.34 \pm 0.02$  and  $B = 6.0 \pm 0.1$

(notice the values are quoted to the no. of decimal places justified by the error)

$$A+B = 8.34 \pm 0.12 = 8.3 \pm 0.1$$

$$B-A = 3.64 \pm 0.12 = 3.6 \pm 0.1$$

$$\begin{aligned} B/A &= 2.56 \quad \% \text{error} = \% \text{error in A} + \% \text{error in B} \\ &= 1 \quad + \quad 1.5 \\ &= 2.5\% \\ \text{actual error in B/A} &= 2.56 * 2.5/100 = 0.06 \end{aligned}$$

so  $B/A = 2.56 \pm 0.06$

$B.A = 14.04$ , again to 2.5%, which is  $2.5 * 14.04 / 100 = 0.4$

$B.A = 14.0 \pm 0.4$

### Describing and improving an experiment:

State every reading you will take. Do not say "Take the readings as before". Make clear what is kept constant and what is changed. Give sensible values for quantities, particularly those that are changed. Use your common sense. Have at least five sets of readings as a variable changes. Say that you will repeat and average each reading. Say what the axes will be for a straight line graph. Never just say "plot a graph". Set out your account clearly and logically; use their suggested format if you think it helps. Plan your account briefly before you start writing.

### Resource list:

Breithaupt, J Key Science – Physics (Stanley Thornes)

Dobson, K The Physical World (Nelson)

Duncan, T GCSE Physics (Third edition) (John Murray)

Nuffield Co-ordinated Sciences Physics (Longman)

[www.focuseducational.com](http://www.focuseducational.com)

[www.crocodile-clips.com](http://www.crocodile-clips.com)